Product Manual

H100-010

Balanced Single-seat Cryogenic Control Valve

Chongqing Chuanyi Control Valve Co., Ltd.

Foreword

This manual applies to the use of the balanced cage cryogenic control valve assembled with HA or HV pneumatic actuators, electric actuators, and the H100-010 balanced single-seat cryogenic control valve body. If equipped with an electric actuator, please refer to the electric actuator manual for detailed instructions on the structure, working principle, use, installation, and commissioning of each type of electric actuator. The body components are exactly the same as those described in this manual. Do not use this manual for other valve models.

We kindly advise users (customers) to carefully read and fully understand this manual before use. Additionally, after the equipment has been started and is operating normally, operators and maintenance personnel must keep this manual properly for future reference.

The main contents of this manual include structure, operation principle, main technical parameters, dimensions and weight, maintenance and replacement of packing, acceptance, handling and storage, unpacking, installation, start-up preparation and start-up, daily and regular inspection, fault/abnormality identification methods and measures, disassembly and assembly.

As the research and improvement of control valves are ongoing, the contents of this manual may not be fully consistent with the specific product supplied. If you have any questions regarding the purchased product or this manual, please contact the following department:

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

Safety Precautions

To ensure the safe acceptance, handling, storage, installation, start-up preparation, start-up, and maintenance of this control valve, proper usage and regular maintenance are essential. Carefully read and fully understand the safety precautions outlined in this manual before operation.

This manual and safety precautions mainly introduce how to use the H100-010 balanced single-seat cryogenic control valve to regulate fluid flow, pressure, temperature, and level, as well as to control the on/off status of the fluid. Users who fail to use or operate the valve in the manner described in this manual will bear full responsibility for any safety-related consequences.

Essential safety precautions that must be observed in this manual are indicated below, including the titles "WARNING" and "CAUTION" and corresponding explanations.

⚠WARNING

Failure to observe the precautions may result in casualty accidents at any moment.

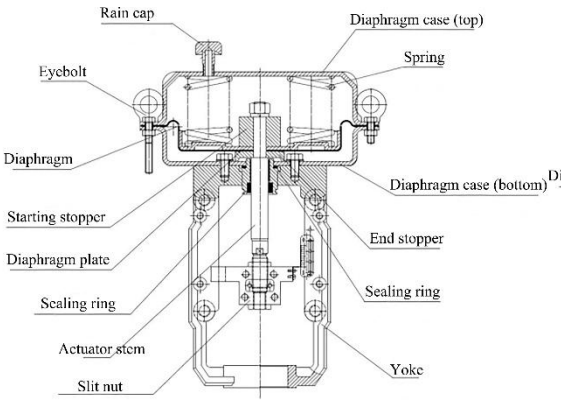
⚠CAUTION

Failure to observe the precautions may result in damage and fault of the control valve or other equipment at any moment.

1. Structure and Action Principle

1-1. HA1~4 Multi-spring Modular Actuator

Depending on the action mode, it is divided into direct acting (HA11~41D8) and reverse acting (HA11~41R8), as shown in Fig. 1-1(a) and Fig. 1-1(b).



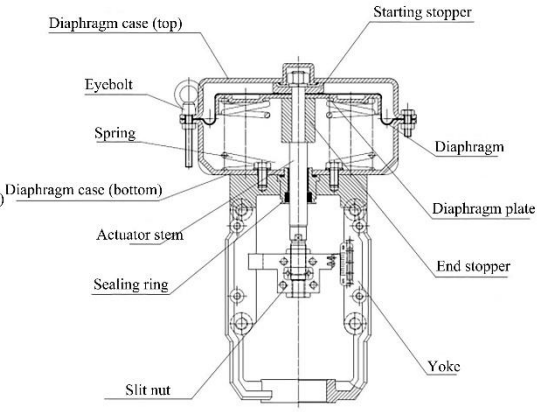


Fig. 1-1(a) Reverse Acting (HA11~41R) Fig. 1-1(b) Direct Acting (HA11~41D)

Structure: It mainly consists of diaphragm case (top), diaphragm case (bottom), diaphragm, actuator stem, spring, end stopper, starting stopper, yoke and other parts.

Principle: When the signal pressure is input into the diaphragm chamber, a thrust is generated on the diaphragm to move the actuator stem assembly. When the reverse action force generated by the compressed compression spring and the thrust generated by the signal pressure on the diaphragm are balanced at a certain position, the moving distance of the actuator stem is the stroke of the pneumatic diaphragm actuator.

Direct action: When the signal pressure of the air chamber is zero, the actuator stem assembly is located at the upper position; when the signal pressure is input into the air chamber, the actuator stem assembly moves downward. Reverse action: When the signal of the air chamber is zero, the actuator stem assembly is located at the lower position; when the signal pressure is input into the air chamber, the actuator stem assembly moves upward.

1-2. Handwheel Mechanism

A handwheel mechanism is provided to operate the control valve when there is no air supply.

1-2-1 Top-mounted handwheel mechanism (THM) installed on the actuator (See Fig. 1-2)

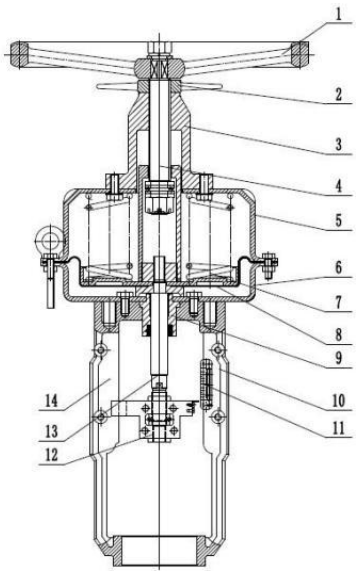


Fig. 1-2 Direct-acting Actuator with Top-mounted Handwheel Mechanism

No.	Part name	No.	Part name	No.	Part name

1	Handwheel	2	Lock nut	3	Handwheel body
4	Screw stem component	5	Diaphragm case (top)	6	Diaphragm case (bottom)
7	Spring	8	Diaphragm	9	Guide sleeve
10	Yoke	11	Travel indicator	12	Slit nut
13	Actuator stem	14	Yoke		

1-2-2 Side-mounted handwheel mechanism (SHM) installed on HA3~4 actuators (see Fig. 1-3).

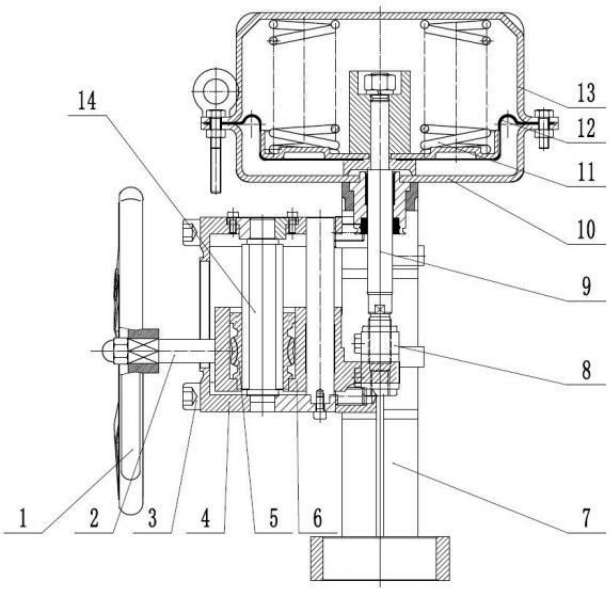


Fig. 1-3 Side-mounted Handwheel Mechanism Mounted on Actuator

No.	Part name	No.	Part name	No.	Part name
1	Handwheel	2	Worm	3	Support rod
4	Chassis	5	Worm gear	6	Worm gear box
7	Yoke	8	Slit nut component	9	Actuator stem
10	Diaphragm case (bottom)	11	Spring	12	Diaphragm
13	Diaphragm case (top)	14	Screw stem	15	

1-2-3 Structure of HA51 actuator, as shown in Fig. 1-4

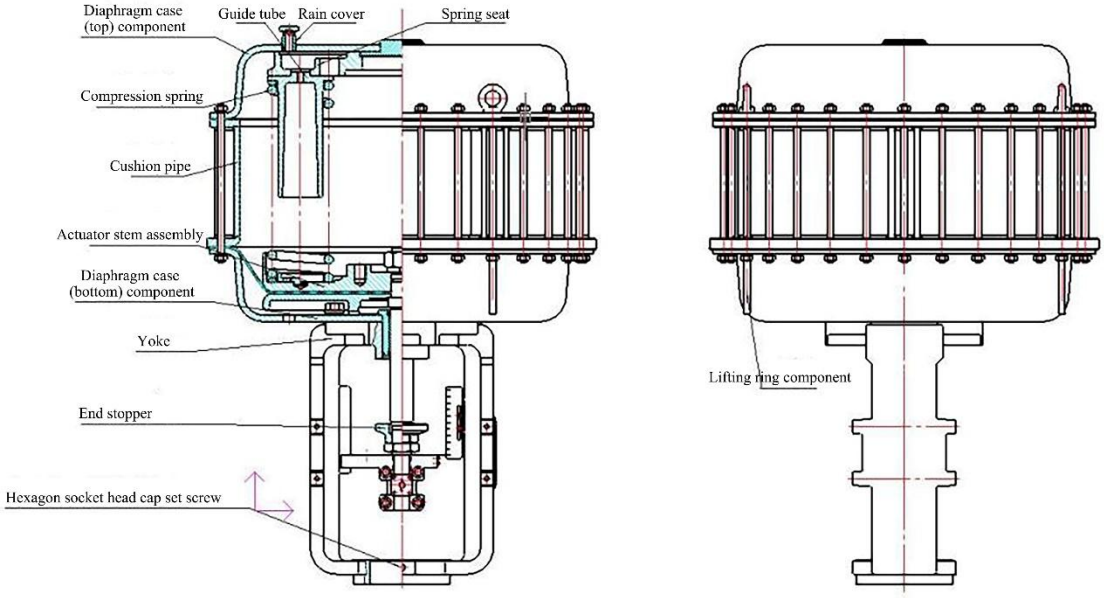


Fig. 1-4 Structure Diagram of HA51 Actuator (Reverse Acting)

1-3 Structure and Working Principle of HV Actuator

1. Structure and Working Principle of HV Single-acting Pneumatic Piston Actuator

Structure: The pneumatic piston actuator is mainly composed of the upper cylinder head, bottom cylinder head, cylinder, piston, actuator stem, spring, spring seat, yoke, slit nut, and other components. For the structure, see Fig. 2-1 and Fig. 2-2.

Working principle: For the pneumatic single-acting piston actuator, after the air source pressure from the air supply system is input into the cylinder chamber, thrust is generated on the piston to overcome the reaction force of the compression spring and move the actuator stem for a certain distance, which is the stroke of the actuator.

The pneumatic single-acting piston actuator is divided into direct action and reverse action. When the air source pressure is input into the cylinder chamber, it is direct action if the actuator stem moves downwards, and reverse action if the actuator stem moves upwards.

Manual operation:

(1) With side-mounted handwheel

① For direct action, disconnect the air supply to the cylinder first, turn the handwheel clockwise, and the screw stem moves downwards to drive the block and actuator stem to move downwards as a whole for manual operation. When switching to automatic operation, turn the Handwheel counterclockwise so that the screw stem is at the uppermost end (until the handwheel cannot be moved), and connect the air supply for automatic operation, as shown in Fig. 2-1.

② For reverse action, first disconnect the air supply to the cylinder, turn the handwheel clockwise to make the screw stem move downwards. When the through-hole on the actuator stem is aligned with that on the screw stem, insert the link pin into the hole; then turn the handwheel counterclockwise to make the screw stem and actuator stem move upwards for manual operation. When switching to automatic operation, the link pin must be pulled out first, and then the handwheel shall be turned counterclockwise so that the screw stem is at the highest position (until the handwheel cannot be moved), and connect the air supply for automatic operation, as shown in Fig. 2-2.

③ For double acting, disconnect the air supply to the cylinder first, turn the handwheel clockwise to make the screw stem move downwards, and insert the link pin into the hole when the through-hole on the actuator stem is aligned with that on the screw stem; for an air-to-open valve, turn the handwheel counterclockwise to make the screw stem and actuator stem move upwards to open the valve; for an air-to-close valve, turn the handwheel clockwise to make the screw stem and actuator stem move downwards to close the valve. When switching to automatic operation, the link pin must be pulled out first, and then the handwheel shall be turned counterclockwise so that the screw stem is at the highest position (until the handwheel cannot be moved), and connect the air supply for automatic operation, as shown in Fig. 1-2-1.

(2) With top-mounted handwheel

① For direct action, disconnect the air supply to the cylinder first, loosen the lock nut, and then turn the handwheel clockwise to make the screw stem move downward for manual operation. When switching to automatic operation, turn the handwheel counterclockwise so that the screw stem is at the top end (until the handwheel cannot be moved), tighten the lock nut, connect the air supply and carry out automatic operation, as shown in Fig. 2-3.

② For reverse action, first disconnect the air supply to the cylinder, loosen the lock nut, and then turn the handwheel counterclockwise to make the screw stem move upwards for manual operation. When switching to automatic operation, turn the handwheel clockwise, and the screw stem moves downwards so that both the handwheel and lock nut are flush with the handwheel body. Then tighten the lock nut, connect the air supply, and carry out automatic operation, as shown in Fig. 2-3.

(3) With hydraulic handwheel

First disconnect the air supply to the cylinder, inject anti-wear hydraulic oil of the specified grade and meeting ISO cleanliness below Grade 10 into the oil filling port, then completely tighten the pressure relief switch clockwise, and press it up and down with an extension bar for manual operation to realize valve opening and closing. When switching to automatic operation, fully open the pressure relief switch counterclockwise. When the pressure gauge pointer reads 0, connect the air supply to perform automatic operation, as shown in Fig. 2-4.

Precautions:

a. When manually operating the extension bar for pressurization, monitor whether there is any change in the pressure gauge and whether there is oil leakage at the high-pressure pipe joint to prevent natural aging of rubber seals from going unnoticed.

b. During manual-to-automatic operation, ensure that the handwheel is fully depressurized and the pressure gauge reads 0 before proceeding with automatic operation (factory default is automatic).

c. If the handwheel has not been used for an extended period, please drain the hydraulic oil promptly to prevent its deterioration, which may affect handwheel performance.

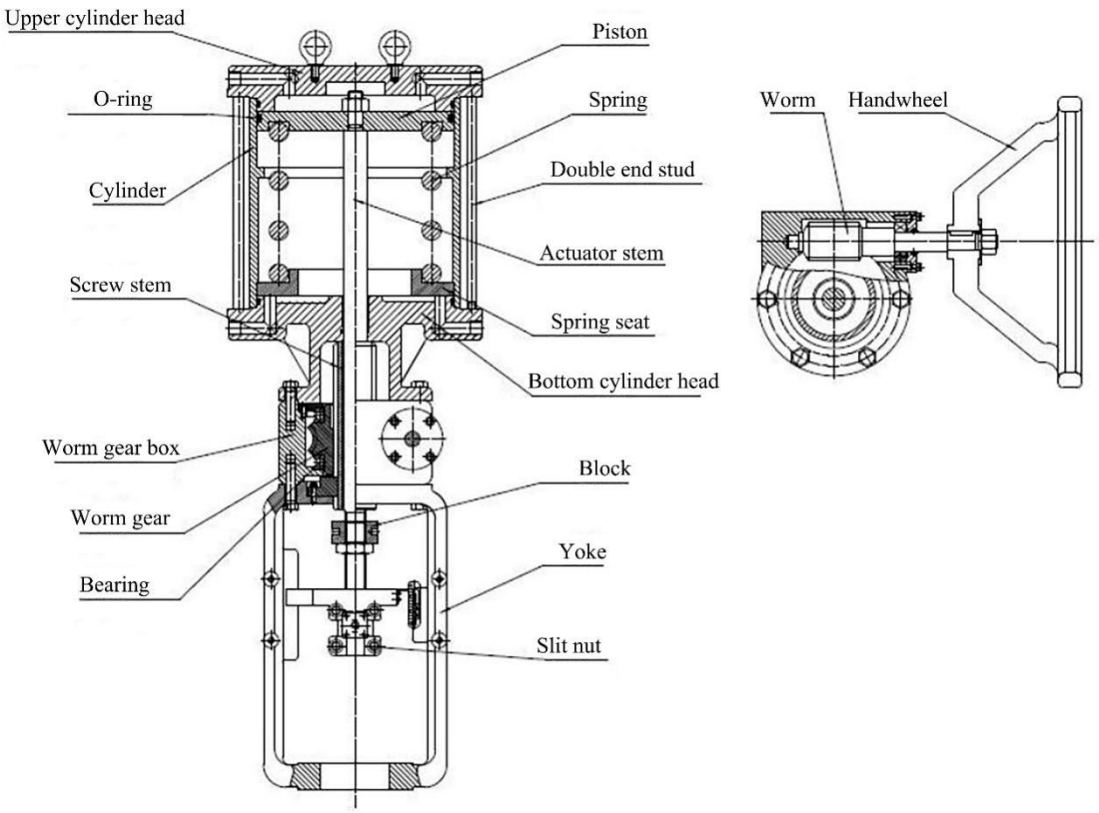


Fig. 2-1 HV Direct Action with Side-mounted Handwheel

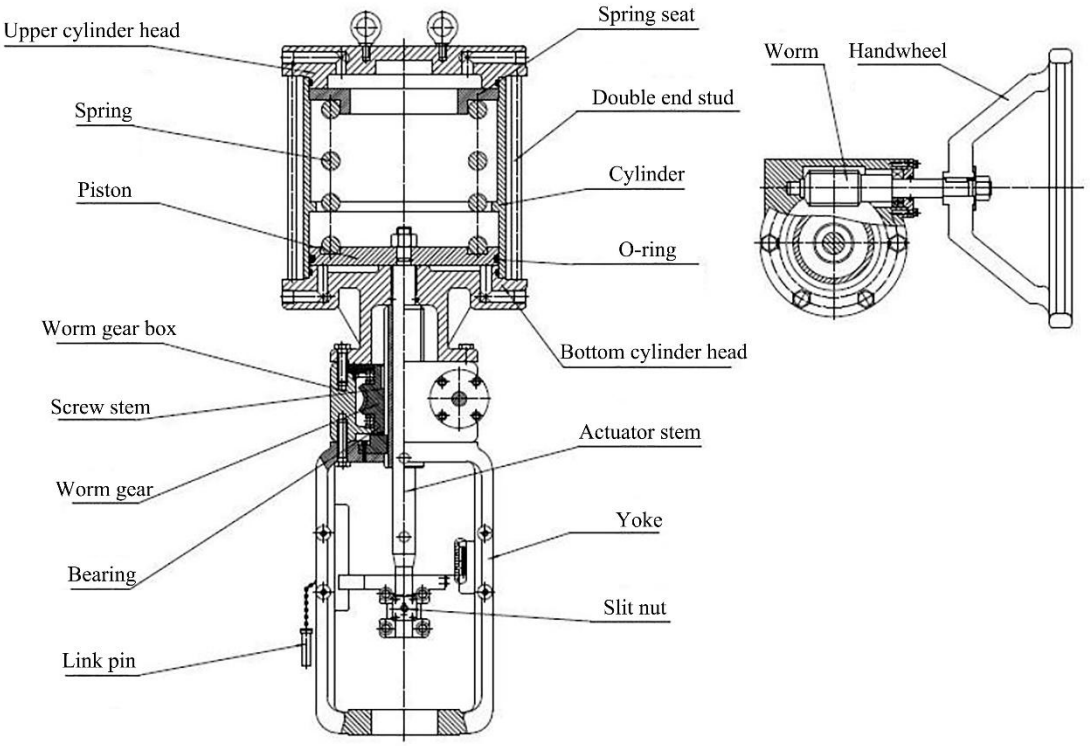


Fig. 2-2 HV Reverse Action with Side-mounted Handwheel

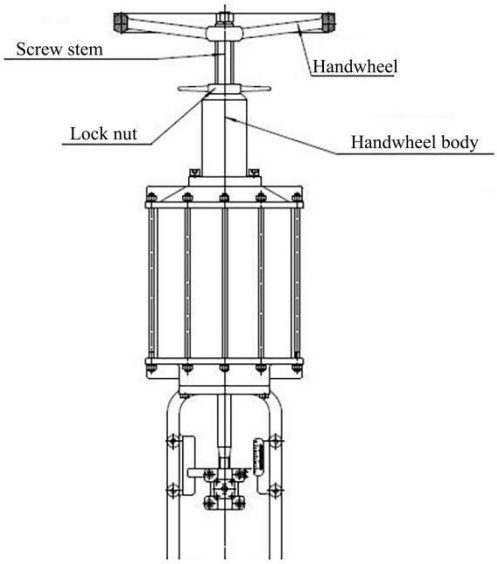


Fig. 2-3 HV Single-acting with Top-mounted Handwheel

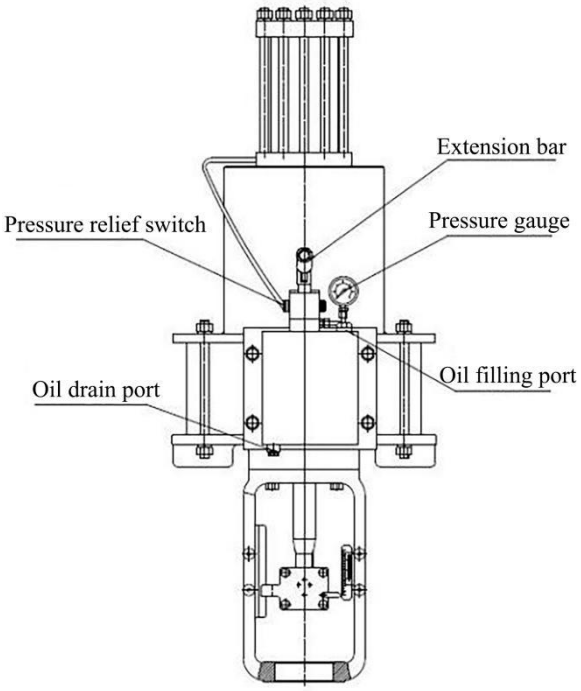


Fig. 2-4 HV Single-acting with Hydraulic Handwheel

2. Structure and Working Principle of HV Double-acting Pneumatic Piston Actuator

Structure: The double-acting cylinder piston actuator is mainly composed of upper cylinder head, bottom cylinder head, cylinder, piston, actuator stem, double end stud, slit nut and other parts, as shown in Fig. 3-1.

Working principle: For the pneumatic double-acting piston actuator, after the air source pressure from the air supply system is input into the cylinder chamber, thrust is generated on the piston to move the actuator stem for a certain distance, which is the stroke of the actuator.

Manual operation:

(1) With side-mounted handwheel

First disconnect the air supply to the cylinder, open the globe valve, turn the handwheel **clockwise** to make the screw stem move downwards, and insert the link pin into the hole when the through-hole on the actuator stem is aligned with that on the screw stem. For an air-to-close valve, turn the handwheel clockwise; for an air-to-open valve, turn the handwheel counterclockwise for manual operation. When switching to automatic operation, the link pin must be pulled out first, and then the handwheel shall be turned counterclockwise so that the screw stem is at the highest position (until the handwheel cannot be moved), close the globe valve, and connect the air supply for automatic operation, as shown in Fig. 3-1.

(2) With top-mounted handwheel

First disconnect the air supply to the cylinder, open the globe valve and loosen the lock nut. For an air-to-close valve, turn the handwheel clockwise; for an air-to-open valve, turn the handwheel counterclockwise for manual operation. When switching to automatic operation, measure the length of the screw stem between the handwheel and the handwheel body with a handwheel position scale to ensure that they are roughly equal. Then tighten the lock nut, close the globe valve, connect the air supply, and carry out automatic operation, as shown in Fig. 3-2.

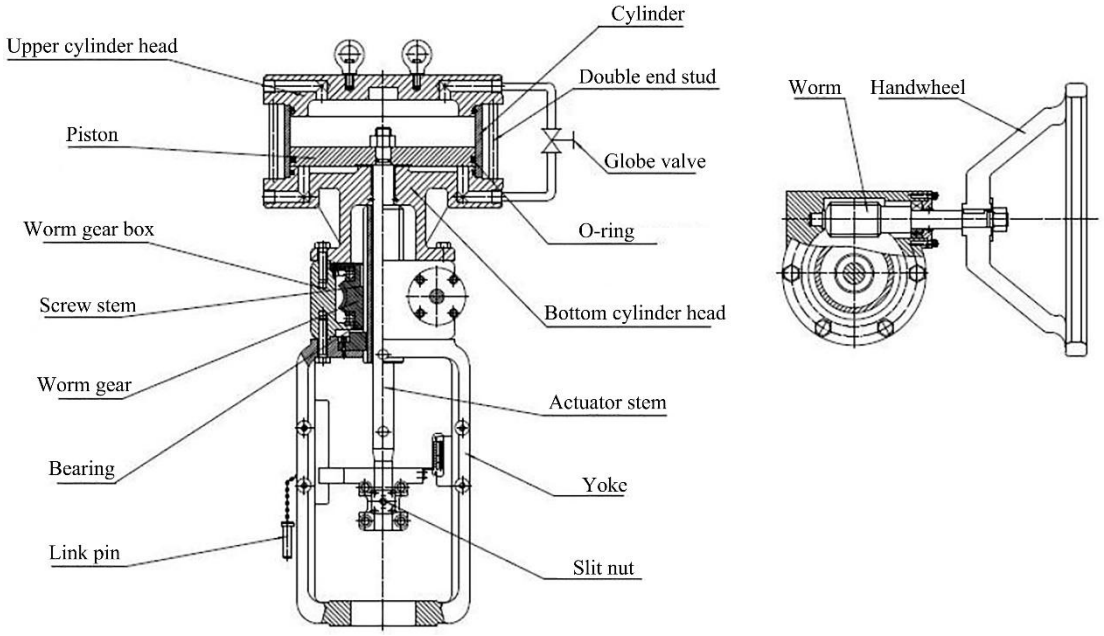


Fig. 3-1 HV Double-acting with Side-mounted Handwheel

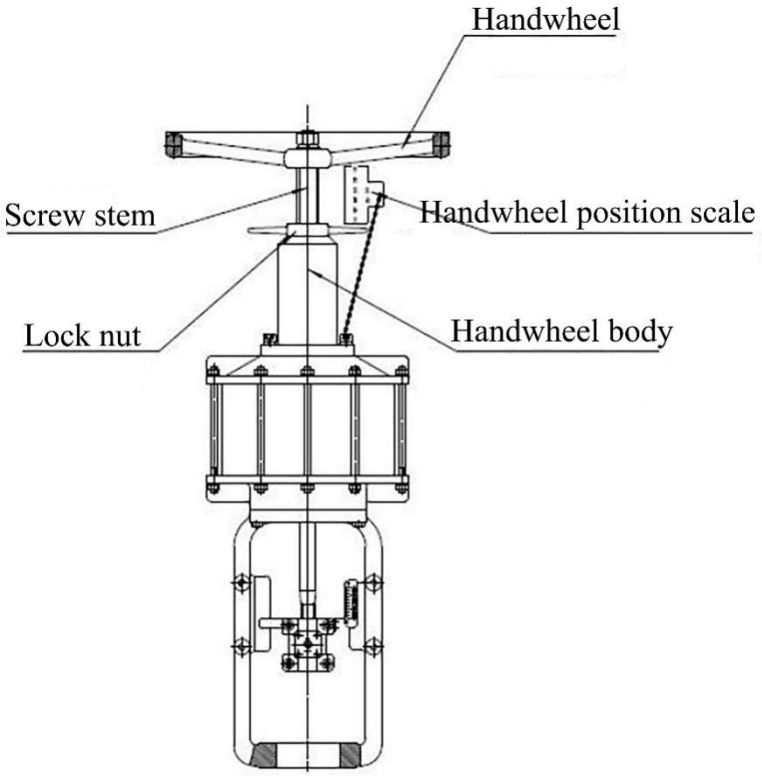


Fig. 3-2 HV Double-acting with Top-mounted Handwheel

1-4 H100-010 Valve Body Assembly

Structure: It is mainly composed of bonnet, body, valve seat, plug assembly, packing, gland flange, guide ring and other parts. The plug assembly consists of a plug and a valve stem, fixed with a cylindrical pin. The bonnet features a packing chamber containing PTFE V-type packing or graphite packing, as shown in Fig. 4.

Principle: The control valve is in direct contact with the regulated medium. As the upward and downward movement of the plug changes the flow area between the plug and the valve seat, it alters the resistance coefficient of the valve and achieves the regulation effect on the medium flow.

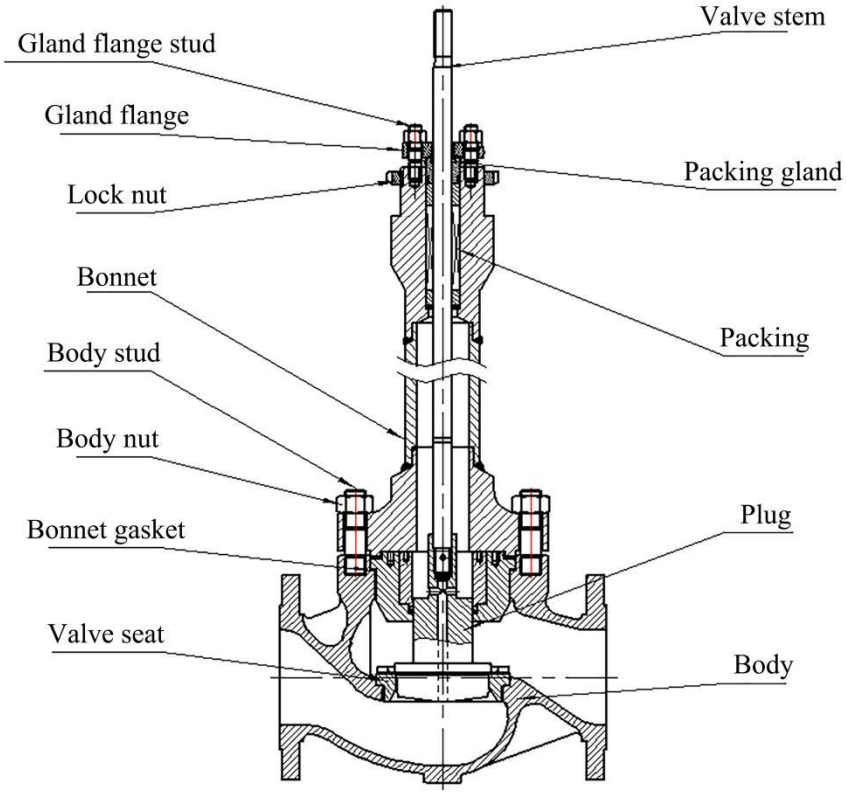


Fig. 4 Structure Diagram of H100-010 Valve Body Assembly

2. Main Technical Parameters

● Valve body

Type	Balanced single-seat cast globe valve
Nominal diameter	40、50、65、80、100、125、150、200mm
Nominal pressure	Class 150, 300, 600, 900, 1500:
Connection type	Flange type: FF, RF, RJ, TG, MFM Welded type: BW (65–250 mm) Flange standards: JIS B2201, JB/T79.1-94 (PN1.6 MPa), JB/T79.2-94 (PN4.0, 6.4 MPa), ANSI B16.5-2009, HG20592-2009, HG20615-2009
Dimension	See Table 5
Material of body and bonnet	CF3、CF3M、CF8、CF8M
Bonnet type	Extended III Type (EIII): -196~+200°C
Gland type	Bolt compression type
Packing	V-type PTFE packing, graphite packing. See Fig. 2
Gasket	Serrated (316, 316L)
Surface coating	Dark gray (epoxy). However, when the body is made of stainless steel, no coating will be applied to the body.

● **Trim**

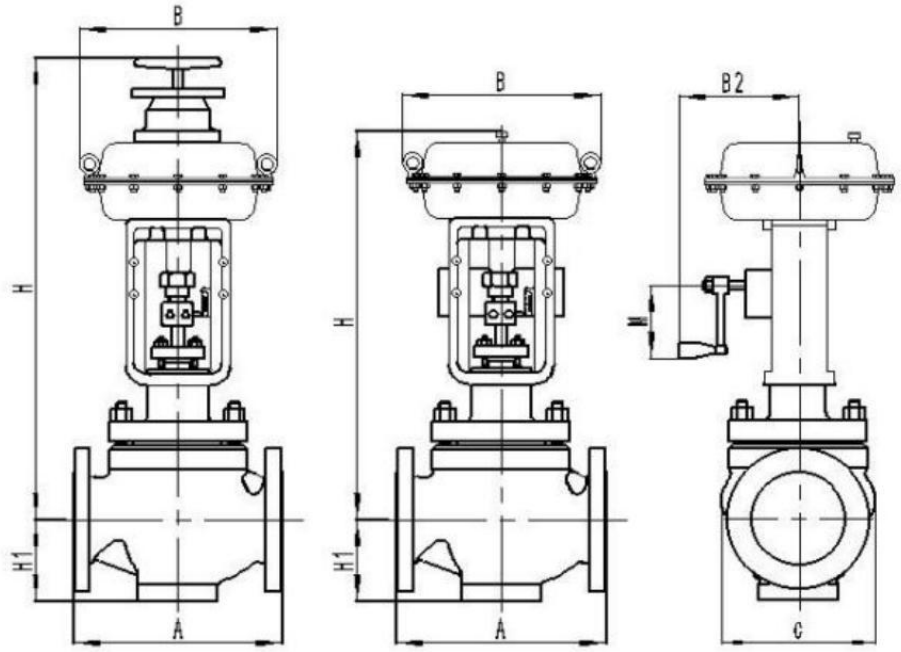
Plug type	Single-seat plunger type
Flow characteristics	High volume flow characteristics Equal percentage characteristic (%F) and linear characteristic (LF) High-precision flow characteristics Equal percentage characteristics (%) and linear characteristics (L)

● **Actuator**

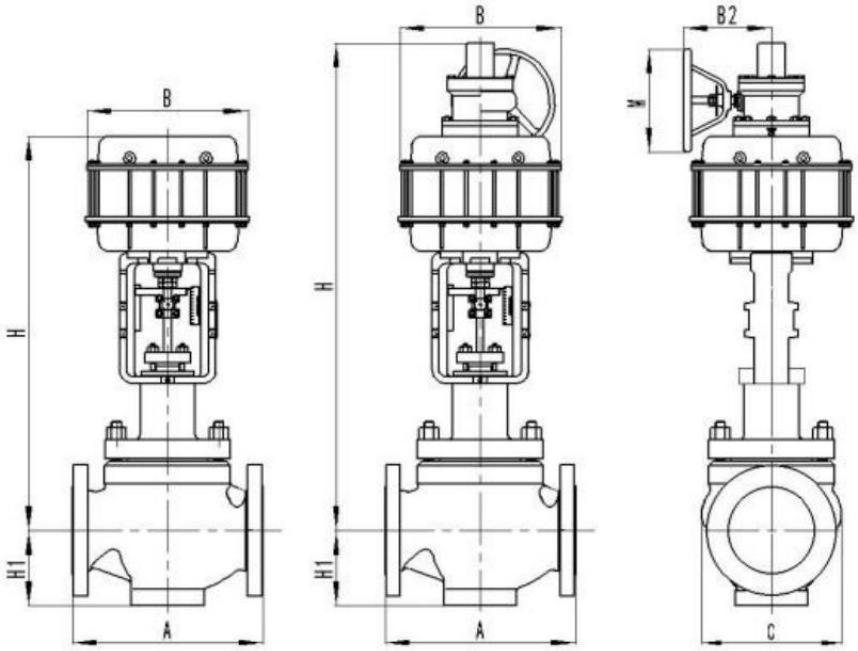
Model / **Specification**	**Pneumatic diaphragm type**	**Cylinder piston type**	**Electronic**	**Intelligent type**
	HA	HV	EIL	M8 series
	Multiple spring type	Single/double acting piston type		
Application	Adjustment	Adjustment	Adjustment	
Air supply pressure or voltage	Air supply pressure (spring range) 500kPa	Air supply pressure 500kPa	Voltage: 220 /380V 50HZ Input signal: 4~20mA DC	Voltage: 220 /380V 50HZ Input signal: 4~20mA DC
Interface	Air piping: NPT 1/4（HA11~HA41）; NPT 1/2（HA51）	Air piping: NPT 1/4（HV21~31）; NPT 3/8（HV41~51）; NPT 1/2（HV61~71）; NPT 3/4（HV81）	Wiring: 2-PF3/4	Wiring: PG13.5
Direct action	As air pressure increases, the valve closes	As air pressure increases, the valve closes	As input signal increases, the valve closes	As input signal increases, the valve closes
Reverse action	As air pressure increases, the valve opens	As air pressure increases, the valve opens	As input signal increases, the valve opens	As input signal increases, the valve opens
Hysteresis	≤1% FS (with positioner) ≤3%FS (without positioner) ≤5% FS (with HA1 type)	≤1% FS (with positioner) ≤3%FS (without positioner)	≤1%FS	≤1%FS
Basic error	≤±1% FS (with positioner) ≤±5%FS (without positioner) ≤±2% FS (with HA1 type)	≤±1% FS (with positioner) ≤±5%FS (without positioner)	≤±1%FS	≤±1%FS
Ambient temperature	Standard type: -30 ~ +70°C High temperature type: -15 ~ +120°C	Standard type: -20 ~ +80°C High temperature type: -	－20 ~ ＋70℃	－25 ~ ＋70℃

	Low temperature type: -40 ~ +70°C	15 ~ +120°C Low temperature type: -40 ~ +80°C		
Paint color	Water blue (color code RAL5021)	Water blue (color code RAL5021)	-	-
Accessories	Positioner, air filtering and pressure reducing valve, lock-up valve, valve transmitter, handwheel mechanism, etc.	Positioner, air filtering and pressure reducing valve, lock-up valve, valve transmitter, handwheel mechanism, etc.	EIL actuator handwheel	M8 actuator handwheel

● **Dimensions**



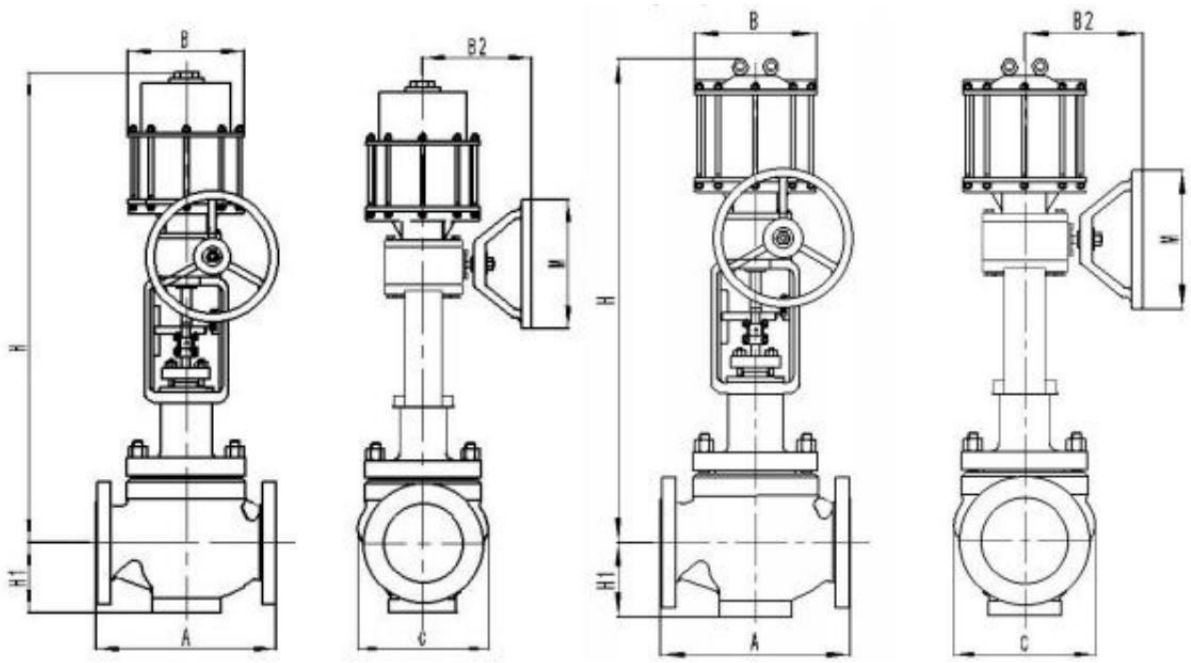
With HA11~HA41 actuator



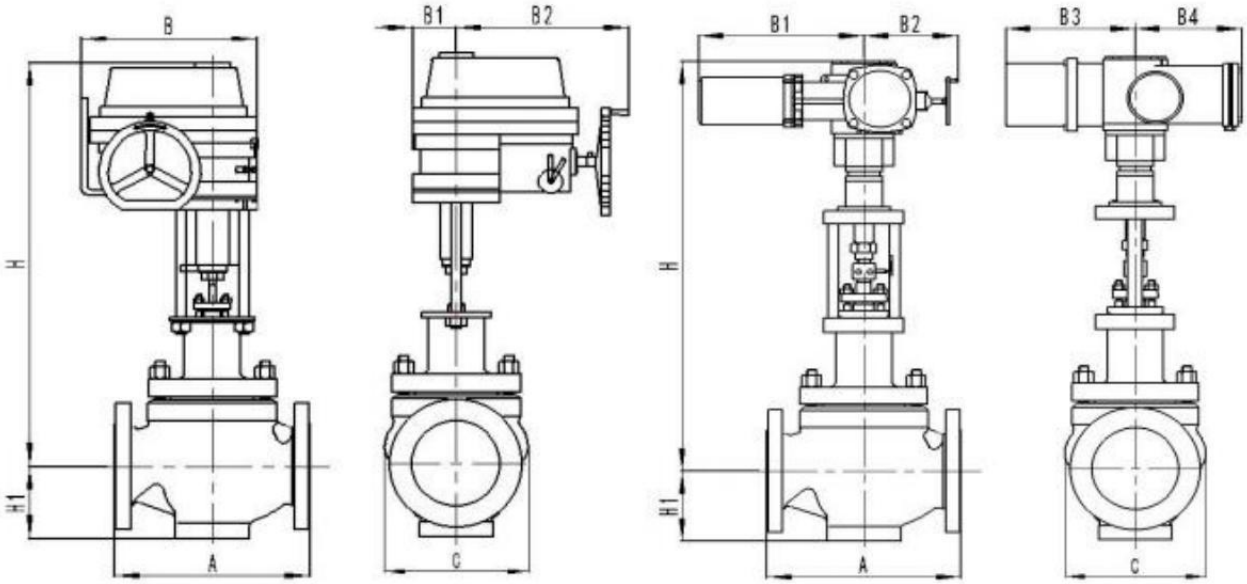
With HA51 actuator

Nominal diameter	Actuator	H (Extended III Type EⅢ)	B	B1	B2	B3	B4	M	H1
40	HA21	1095	281	—	273.5	—	—	¢175	70
	HA31	1245	363	—	278.5	—	—	¢175	
	EIL04	1310	172	—	258	—	—	—	
50	HA21	1100	281	—	273.5	—	—	¢175	80
	HA31	1250	363	—	278.5	—	—	¢175	
	EIL04	1315	172	—	258	—	—	—	
65	HA31	1290	363	—	278.5	—	—	¢175	88
	HA41	1550	520	—	303	—	—	¢320	
	EIL08	1475	229	—	338	—	—	—	
	M8610+L8210	1530	—	285	346	253	350	—	
80	HA31	1295	363	—	278.5	—	—	¢175	98
	HA41	1560	520	—	303	—	—	¢320	

	EIL08	1485	229	—	338	—	—	—	
	M8610+L8210	1535	—	285	346	253	350	—	
100	HA31	1315	363	—	278.5	—	—	¢175	113
	HA41	1575	520	—	303	—	—	¢320	
	HV61SR5	2115	475	—	384	—	—	¢380	
	HV51D00	1825	382	—	324	—	—	¢380	
	EIL08	1515	229	—	338	—	—	—	
	M8610+L8210	1555	—	285	346	253	350	—	
125	HA31	1450	363	—	278.5	—	—	¢175	146
	HA41	1630	520	—	303	—	—	¢320	
	HV61SR5	2175	480	—	384	—	—	¢380	
	HV51D00	1880	382	—	324	—	—	¢380	
	HV61D00	1995	480	—	384	—	—	¢380	
	HV71D00	1995	580	—	384	—	—	¢380	
	EIL08	1670	229	—	338	—	—	—	
	M8610+L8210	1795	—	313	350	253	350	—	
150	HA31	1450	363	—	278.5	—	—	¢175	170
	HA41	1630	520	—	303	—	—	¢320	
	HV61SR5	2175	480	—	384	—	—	¢380	
	HV51D00	1880	382	—	324	—	—	¢380	
	HV61D00	1995	480	—	384	—	—	¢380	
	HV71D00	1995	580	—	384	—	—	¢380	
	EIL08	1660	229	—	338	—	—	—	
	M8610+L8210	1795	—	313	350	253	350	—	
200	HA41	1780	520	—	303	—	—	¢320	220
	HV51D00	2050	382	—	324	—	—	¢380	
	HV61D00	2165	480	—	384	—	—	¢380	
	HV71D00	2165	580	—	384	—	—	¢380	
	M8620+L8220	2205	—	313	350	253	350	—	
250	HA51	—	605	—	380	—	—	¢325	305
	HV61D00	—	480	—	384	—	—	¢380	
	HV71D00	—	580	—	384	—	—	¢380	
	EIL25	—	258	—	356	—	—	—	
	M8620+L8230	—	—	313	350	253	350	—	



With HV single/double-acting actuator



With EIL/M8 actuator

Fig. 5 Outline Dimension Drawing

Table 1-1 Flange Face-to-Face Dimensions mm

Nominal diameter	A							
	Class 150 RF PN16 RF	JIS 16K RF	Class 300 RF PN40MFM	Class 600 RF PN63MFM	JIS 16K TG	JIS 20K TG	JIS30K TG	JIS 40K TG
32	190	I	205	210	I	I	I	I
40	222	231	235	251	235	236	248	251
50	254	263	267	286	265	267	276	286
65	276	288	292	311	290	292	303	311
80	298	313	317	337	310	317	326	337
100	352	364	368	394	360	368	379	394
125	403	I	425	457	I	425	I	457
150	451	465	473	508	475	473	486	508
200	543	560	568	610	570	568	580	610
250	673	I	708	752	I	I	I	I
300	737	I	775	819	I	I	I	I

Nominal diameter	A						
	Class 150 RJ	Class 300 RJ	Class 600 RJ	Class 300 TG	Class 600 TG	Class 150 SW、BW	Class 150, 600 SW、BW
32	235	248	251	244	248	251	251
40	235	248	251	244	248	251	251
50	267	283	289	276	283	286	286
65	289	308	314	302	308	311	311
80	311	333	340	327	333	337	337
100	365	384	397	378	391	394	394
150	464	489	511	483	505	473	508
200	556	584	613	578	606	568	610

Nominal diameter	A						
	JIS63K	Class 900		Class 1500		Class 2500	
	RF	RF(SW,BW)	RJ	RF(SW,BW)	RJ	RF(Sw,BW)	RJ
40	323	333	333	333	333	358	361
50	354	375	378	375	378	400	403
80	431	440	443	460	463	498	504
100	496	510	513	530	533	575	585
150	699	715	718	770	776	820	833
200	895	915	918	972	982	1020	1036
250	—	1137	1140	1327	1336	I	I
300	I	1311	1314	1400	1416	I	I

Note: Face-to-face dimension complies with IEC60534-3 standard.

Table 1-2 Maximum Side Dimensions mm

Nominal diameter	C					
	PN16	PN40	PN64	Class150	Class300	Class600
32	147	149	152	147	149	152
40	150	150	170	150	150	170
50	177	180	184	177	180	184
65	198	202	206	198	202	206
80	209	214	218	209	214	218
100	249	256	262	249	256	275
125	301	306	316	301	312	330
150	351	358	370	351	358	370
200	434	450	458	434	450	468
250	560	568	574	560	568	580
300	575	583	589	575	583	597

Nominal diameter	C		
	Class900	Class1500	Class2500
40	180	180	205
50	215	215	235
80	240	265	305
100	290	310	355
150	380	395	485
200	470	498	550

Table 2-1 Outline Dimensions mm

Nominal diameter	Actuator	H (Extended III Type EIII)	B	B1	B2	B3	B4	M	H1
40	HA21	1095	281		273.5			175	70
	HA31	1245	363	I	278.5		I	175	
	EIL04	1310	172		258			I	
50	HA21	1100	281		273.5			175	80
	HA31	1250	363	I	278.5			175	
	EIL04	1315	172		258			I	
65	HA31	1290	363		278.5			175	88
	HA41	1550	520	I	303		I	320	
	EIL08	1475	229		338			I	
	M8610+L8210	1530	I	285	346	253	350	I	
80	HA31	1295	363		278.5			175	98
	HA41	1560	520	II	303			320	
	EIL08	1485	229		338			I	
	M8610+L8210	1535	I	285	346	253	350	I	
100	HA31	1315	363		278.5			175	113
	HA41	1575	520		303			320	
	HV61SR5	2115	475		384			380	
	HV51D00	1825	382		324			380	
	EIL08	1515	229		338			I	
	M8610+L8210	1555	I	285	346	253	350	I	
125	HA31	1450	363	I	278.5			175	146
	HA41	1630	520		303			320	
	HV61SR5	2175	480		384			380	
	HV51D00	1880	382		324	—		380	
	HV61D00	1995	480		384	—		380	
	HV71D00	1995	580		384			380	
	EIL08	1670	229		338			I	
	M8610+L8210	1795	II	313	350	253	350	I	

150	HA31	1450	363		278.5			175	170
	HA41	1630	520		303		II	320	
	HV61SR5	2175	480		384		—	380	
	HV51D00	1880	382		324			380	
	HV61D00	1995	480		384		II	380	
	HV71D00	1995	580		384		II	380	
	EIL08	1660	229		338			I	
	M8610+L8210	1795	I	313	350	253	350	I	
200	HA41	1780	520	—	303	—	—	320	220
	HV51D00	2050	382		324			380	
	HV61D00	2165	480		384	—	—	380	
	HV71D00	2165	580	—	384			380	
	M8620+L8220	2205	—	313	350	253	350	—	
250	HA51	II	605		380	—		325	305
	HV61D00	I	480		384			380	
	HV71D00	II	580		384			380	
	EIL25	II	258		356			I	
	M8620+L8230	I	—	313	350	253	350	I	

3. Installation

3-1 Valve Installation

WARNING

As the control valve is heavy, the following precautions must be observed to avoid major personal injury caused by improper operation.

- When connecting the control valve to the process pipeline, please use suitable hoisting machinery that complies with applicable occupational safety and health regulations. Never stand or operate hoisting machinery under a suspended load.
- Personnel carrying out any installation adjustments must use the equipment and protective clothing normally required for valve installation.
- Lines must be depressurized, drained and vented before valves are installed.
- Handling and installation of all valves and actuators must be carried out by personnel trained in all aspects of erection and manual/mechanical handling techniques.
- Packing leakage may cause personal injury. The packing has been tightened at the factory; however, it may be necessary to re-adjust the packing to meet specific application conditions.
- Please clean the inside of the piping thoroughly to remove sundries, welding slag, and rust before installing this control valve. Any residual foreign matter will cause leakage between the plug and the valve seat. In addition, if the foreign matter enters the guide section of the plug, it will cause malfunction.
- When installing the control valve on the process piping, do not subject it to severe impacts such as bumping or dropping. Otherwise, malfunctions may occur, necessitating re-commissioning.
- Please ensure sufficient space is reserved for the maintenance and disassembly of the control valve.
- Do not install the control valve in a place where there is severe vibration or where excessive load is applied to the control valve.
- The installation direction of the control valve must enable the medium to flow in the direction indicated by the arrow on the valve body.

3-2 Installation Position

The standard mounting arrangement for a control valve assembly is to mount the actuator vertically above the valve. Other positions may cause uneven wear of the valve trim, affecting the performance of the valve. Installation within the range shown in Fig. 6 is permitted only when unavoidable. If the control valve may be subject to vibration and external forces, the attached yoke or piping support should be used.

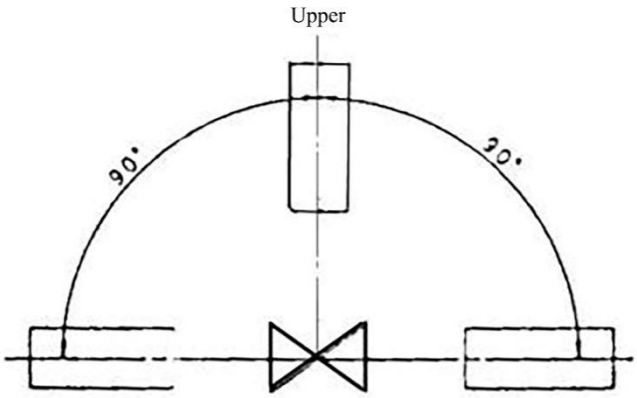


Fig. 6

3-3 Installation Direction and Support Requirements of Actuator on Pipeline

The control valve assembly is normally mounted with the actuator vertically above the valve. Other locations may result in uneven wear of the valve trim, affecting the performance of the valve. For some valves, when the actuator is not vertical, it may also require additional supports.

Suggestions for pipeline installation direction of various actuators:

(1) HA Series: Vertical installation is recommended. Field data indicates that no issues have occurred with horizontal installation of some HA2~4 units. However, theoretical analysis suggests a higher probability of issues when HA4X2 or HA5Y actuators are installed horizontally.

● When the HA4X2 or HA5Y actuator is placed horizontally, the diaphragm assembly has no support in the inner cavity and is entirely supported at the actuator stem guide sleeve. This position is mainly used for guiding. If it bears the support load, the gravity of the diaphragm assembly (including the diaphragm plate, etc.) will be completely applied to the edge of the actuator stem guide, resulting in large friction. In addition, the 304 material of the actuator stem is not wear-resistant, which easily causes scratches to the actuator stem, abnormal sound, seizing, and scratching of seals leading to air leakage. ;

● The HA actuator features a multi-spring structure with guide on only one side; the guide is short and has low strength. When placed horizontally, it easily causes the spring to topple over, which may lead to failure of the whole machine.

(2) HV Series: Any orientation

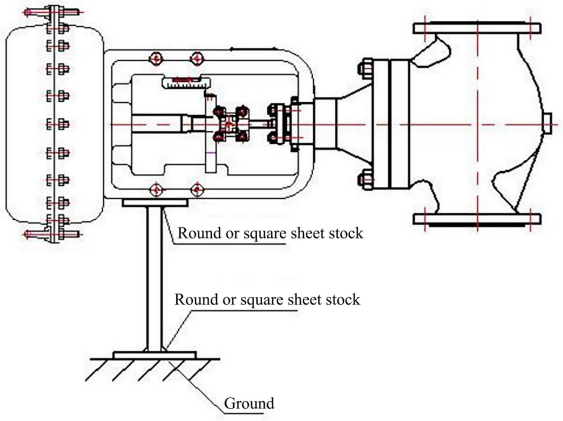
(3) AT Series: Any orientation

(4) AW Series: Any orientation

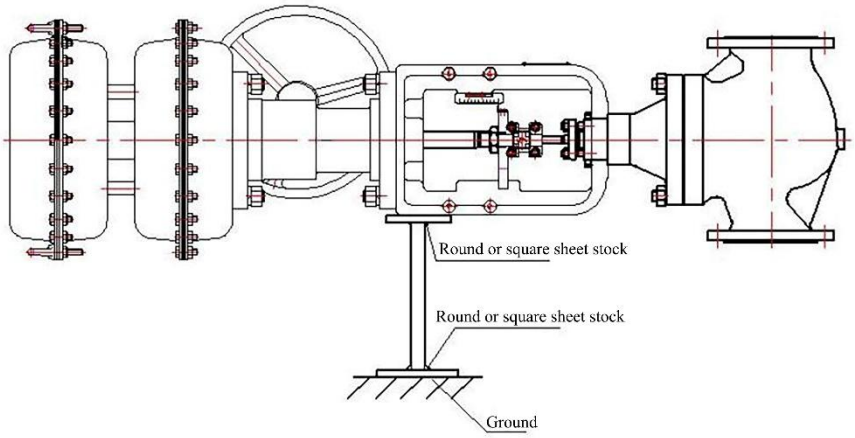
(5) VR series: The actuator must be installed vertically; horizontal installation is prohibited.

The reason is similar to that of the HA pneumatic diaphragm actuator mentioned above; due to the linear and quarter-turn strokes, there is a large rotational eccentricity, which easily leads to internal friction and jamming inside the cylinder.

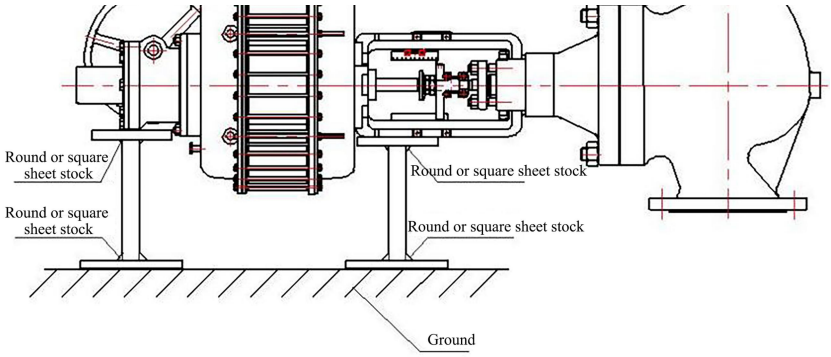
● Schematic Diagram of supporting the actuator when it is installed horizontally:

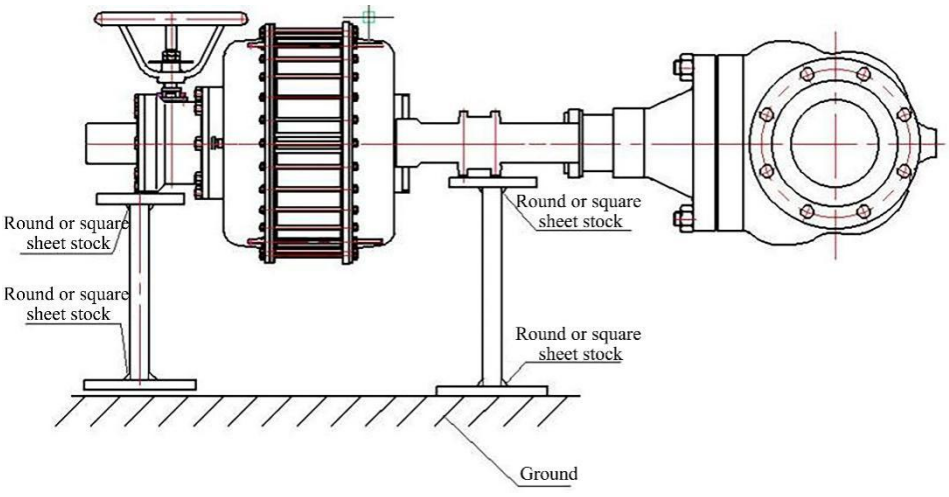


Schematic Diagram of Horizontal Installation Support for HA1~4



Schematic Diagram of Horizontal Installation Support for HA4X2





Schematic Diagram of Horizontal Installation Support for HA5

Fig. 7 Schematic Diagram of Horizontal Installation Support for HA Series Actuators

3-4 Precautions for Connecting Actuator with Valve

3-4-1 Connection to pneumatic actuator

(1) For HA reverse-acting actuator

Introduce an air supply pressure of 40 kPa into the diaphragm chamber, place a transition block between the actuator stem and the valve stem, then release the air supply to make the plug contact the valve seat; at this time, adjust the precision pressure reducing valve, introduce an air supply pressure of 20 kPa into the diaphragm chamber of the actuator, remove the transition block, and connect the slit nut.

(2) For HA direct-acting actuator

Place a transition block between the actuator stem and the valve stem, introduce a certain air supply pressure into the diaphragm chamber of the actuator to make the plug contact the valve seat, adjust the input value of the air supply pressure to 20 kPa, remove the transition block, and connect the slit nut.

(3) For HA pneumatic diaphragm actuator and HV single-acting cylinder piston actuator

Check the spring range according to the nameplate. According to the starting position, adjust the precision pressure reducing valve, introduce the maximum air supply pressure within the spring range into the actuator diaphragm chamber, and observe whether the product can complete the full stroke.

(4) For double-acting actuator

Input an air supply pressure of 500 kPa from the upper end. When the actuator stem reaches the lower end, adjust the precision pressure reducing valve to input a certain air supply pressure from the lower end to move the actuator stem upward by 2 mm, and connect the slit nut (or other connecting pieces). According to the starting position, install and fix the travel indicator, input an air supply pressure of 500 kPa from the lower end, and observe whether the product can complete the full stroke.

3-4-2 Connection to electric actuator

(1) Connect the actuator and valve body components, remove the actuator housing, and loosen the mechanical limit mechanism and limit switch.

(2) Turn the handwheel to bring the actuator stem into contact with the valve stem, then turn the handwheel two turns in the opposite direction. Connect the actuator stem and the valve stem, install the travel indicator, and secure the lower limit switch and mechanical limit mechanism. Connect the power lines and control lines according to the actuator manual. Apply a control signal to make the valve complete the full stroke, and fix the upper limit switch and mechanical limit mechanism. Note that the starting and ending limit switches of the actuator must act before the mechanical limit mechanism. Check whether the electric-to-open or electric-to-close action mode is correct.

(3) Cut off the power supply and signal, remove the connecting wires, and reinstall the housing.

3-5 Stroke Adjustment

All control valves produced by our factory have been debugged before leaving the factory. However, if they have been disassembled for inspection, when assembling the actuator and valve body components, it is necessary to adjust the stroke of the actuator stem (to obtain the rated stroke). At this time, please proceed in the following sequence (this stroke adjustment only applies to the HA actuator produced by Chuanyi Control Valve; for actuators from other manufacturers, please refer to the corresponding manufacturer's manual):

(1) Mount the actuator onto the valve body assembly and tighten the lock nut (it can be tapped and tightened with a chisel hammer).

(2) Install the air pipe on the actuator so that the pressure can be changed freely through the pressure reducing valve (install it on the diaphragm case (top) for the direct action type and on the diaphragm case (bottom) for the reverse action type).

(3) Press down the valve stem to bring the plug into contact with the valve seat.

Direct-acting actuator

(4) Confirm the spring range marked on the nameplate, and apply an air supply pressure to the actuator corresponding to the upper limit of this range.

(5) When the air supply pressure is further increased to the required level, the actuator stem should still be able to move 1~2 mm (this is the actuator stem travel margin).

(6) Decrease the air pressure, and then increase it again up to the upper limit of the spring range.

(7) In this state, when the threads of the slit nut match those on the actuator stem and valve stem, tighten them with hex bolts. See Fig. 10.

Reverse-acting Actuator

(8) Confirm the spring range marked on the nameplate, and apply air pressure of its lower limit to the actuator. At this time, the actuator stem can move 1~2 mm.

(9) Increase the air pressure and then decrease it to the lower limit of the spring range.

(10) Follow the procedure outlined in step 7 for the direct-acting actuator.

Note: Since unfavorable conditions such as bumping and dropping are inevitable during transportation and installation, if disassembly has not been performed, the direct and reverse-acting actuators only need to be calibrated according to steps (4) to (7) or (4) to (6) above after installation.

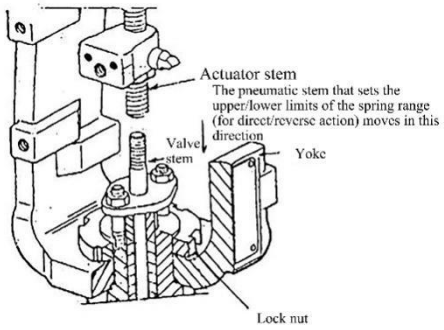

Actuator stem
The pneumatic stem that sets the upper/lower limits of the spring range (for direct/reverse action) moves in this direction
Valve stem
Yoke
Lock nut

Fig. 8

4. Maintenance

Valve parts are subject to normal wear and must therefore be inspected and replaced as required. The frequency of inspection and maintenance depends on the severity of the process conditions. Maintenance and replacement of the packing can be carried out while the valve is still installed in the pipeline. The contents of regular observation and maintenance are as follows:

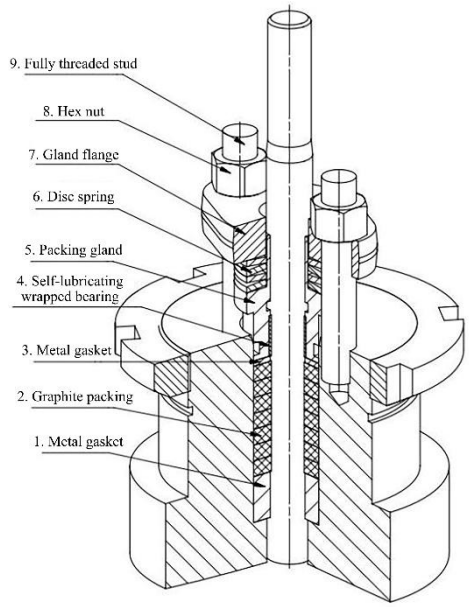
1. Check the actuator for air leakage;
2. Check whether the control accessories operate normally;
3. Check the packing area for external leakage;
4. Check whether the valve operates smoothly;
5. Check whether the system flow is normal.

⚠WARNING

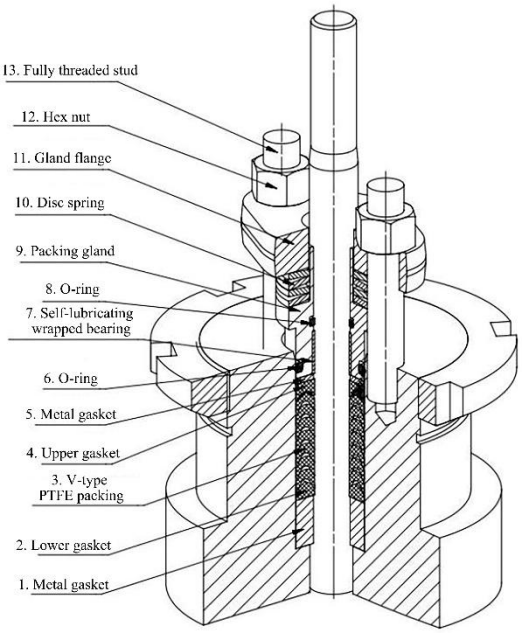
Avoid personal injury or property damage caused by a sudden release of process pressure or bursting of parts. Before carrying out any maintenance operation, you should:

- Always wear protective gloves, clothing, and goggles during any maintenance operation to avoid personal injury.
- Disconnect all operating lines that supply air pressure, power, or control signals to the actuator. Ensure that the actuator does not suddenly open or close the valve.
- Isolate the process pressure from the valve by bypassing or completely shutting down the process. Completely relieve the process pressure on both sides of the valve. Drain the process medium on both sides of the valve.
- Vent the pneumatic actuator loading pressure and release any actuator spring pre-compression force.
- Use lockout methods to ensure that the above measures remain effective while you work on the equipment.
- Even if the valve has been removed from the pipeline, the packing box of the valve may still contain pressurized process fluid. Therefore, when removing the packing hardware or packing rings, the process fluid may spray out under pressure.

4-1 Packing Maintenance



Graphite Packing system



PTFE Packing system

If non-spring-loaded packing leaks unexpectedly, first attempt to limit the leakage by adding a little PTFE or graphite packing, and then strengthen the valve stem seal by tightening the packing flange nuts.

If the packing is relatively new and seats snugly on the valve stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or scored, making it impossible to form a seal. The surface finish of a new valve stem is critical to forming an excellent packing seal. If the leakage originates from the outside diameter of the packing, it may be caused by nicks or scratches on the packing box wall.

When the control valve is used in high-temperature medium conditions (such as steam), it is recommended to add lubricating oil to the graphite packing every six months. Filling method: fully open the valve body, slightly loosen the nuts of the control valve gland flange, drop non-freezing lubricating oil into the gap between the valve stem and the packing, and let the valve stem reciprocate several times to achieve lubrication.

4-2 Packing Replacement

(1) Isolate the control valve from the pipeline pressure, relieve the pressure on both sides of the valve body, and discharge the process medium from both sides of the valve. Use lockout methods to ensure that these measures remain effective while you work on the equipment.

(2) Input a certain air pressure to the actuator so that the pointer indicates 80% to 90% of the fully closed position.

(3) Loosen the hex bolts on the slit nut connecting the valve stem and actuator stem, remove the slit nut, and separate the actuator stem from the valve stem.

(4) Loosen the yoke lock nut and hoist it down.

(5) Lift the actuator to separate it from the valve body.

(6) Loosen the gland flange nuts so that the packing does not press tightly against the valve stem. Remove all travel indicator parts and the slit nut from the valve stem threads.

> **⚠ WARNING**
>
> To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet according to the instructions given in the next step. Do not forcibly pull or remove a stuck bonnet with tools that can stretch or store energy in any way. The sudden release of stored energy will cause uncontrolled movement of the bonnet.

> **⚠ CAUTION**
>
> Avoid damaging the seating surface caused by the plug and valve stem assembly falling from the bonnet after partially lifting the bonnet.

(7) The bonnet is fixed to the valve body with hex nuts. Loosen these nuts by about 3 mm, and then rock the bonnet or pry between the bonnet and the valve to loosen the joint surface between the valve body and the bonnet gasket. Use a pry bar to pry up the bonnet along its periphery until the bonnet is loosened. If no fluid leaks from the joint surface, completely remove the nuts or hex-head screws, and carefully lift the bonnet off the valve body.

(8) Remove the lock nut, separate the plug and valve stem from the bonnet, and place the components on a protective material surface to prevent damage to the sealing ring or seating surfaces.

(9) Remove the bonnet gasket and cover the valve opening to protect the sealing ring surface and prevent foreign matter from entering the inner cavity of the valve body.

(10) Remove the packing flange nuts, gland flange, and packing gland. Use a round bar or other tool that will not scratch the packing box wall to carefully push out all remaining packing parts from the valve side of the bonnet, and clean the packing box and metal packing parts.

(11) Check the valve stem threads and packing box surface for sharp edges that could cut the packing. Scratches or burrs can cause packing box leakage or damage the new packing. If gently sanding with abrasive paper cannot improve the surface condition, the damaged parts must be replaced.

(12) Remove the cover protecting the valve body inner cavity and install a new bonnet serrated gasket. Ensure that the gasket seating surface is clean and smooth, then slide the bonnet along the valve stem and onto the double end studs.

> **⚠ CAUTION**
>
> Properly executing the bolt-tightening method will compress the serrated gasket, thereby fully sealing the joint surface between the valve body and the bonnet.
>
> Proper bolt tightening methods include, but are not limited to, ensuring that the bolt threads are clean and evenly tightening the nuts on the hex-head screws or double end studs in a crisscross pattern. Tightening one hex-head screw or nut may loosen an adjacent hex-head screw or nut. Repeat the crisscross tightening pattern several times until every hex-head screw or nut is tight and the valve body is sealed against the bonnet. Once the operating temperature is reached, perform this torque tightening method again.

(13) Install the bolts, and install the new packing or metal packing box parts according to the specific structure. When the packing is PTFE, place a smooth-edged pipe over the valve stem, gently tap each soft packing part into the packing box, slide the packing gland and gland flange into place, and install the gland flange nuts. When the packing is V-type graphite packing, first place it into the packing box, then install the packing gland, gland flange, packing bolts, and nuts. Compress the packing by tightening the packing nuts.

4-3 Maintenance and Disassembly of Valve Trim

4-3-1 Rust prevention

For the H100-010 balanced single-seat cryogenic control valve produced by our company, under non-oil-free working conditions, we have applied anti-rust oil to the non-painted surfaces of carbon steel products to achieve rust prevention. The applied areas include, but are not limited to, the valve body flow passages and flange sealing surfaces.

Note: Anti-rust oil is a rust prevention product based on mineral oil. If cleaning is required, organic solvents or high-temperature steam can be used. After cleaning, the product will no longer have anti-rust capabilities. 4-3-2 Lapping of plug and valve seat

For metal valve seat structures, the seating surfaces of the plug, valve seat ring, or inner lining can be lapped to improve shut-off performance. (Deep cuts should be removed by machining rather than lapping).

> ⚠CAUTION
>
> To avoid damaging the bellows seal bonnet assembly, do not attempt to lap the metal seating surfaces. Any forced lapping rotation will damage the internal components of the bellows seal bonnet.

Lapping Method:

(1) Wipe the plug and valve seat clean.

(2) Apply an even and appropriate layer of high-quality lapping compound (grit size 280 to 600) to the seating line of the plug;

(3) Install the bonnet and secure it to the valve body;

(4) Install a slit nut or other clamping device to clamp the valve stem, then rotate the plug against the valve seat for lapping;

(5) During lapping, apply light, steady, and even force;

(6) After lapping for a period of time, remove the slit nut, other clamping devices, and the bonnet. Check whether the contact area of the seating lines between the plug and the valve seat is above 90%; if so, proceed with assembly; otherwise, repeat steps 1) to 6).

5. Acceptance, Handling, and Storage

5-1. Acceptance and Handling

> ⚠WARNING
>
> As the control valve is heavy, the following precautions must be observed during handling. Failure to observe these precautions may result in serious personal injury.
>
> ● Use hoisting machinery that complies with occupational safety and health laws for loading, unloading, and handling. Never stand or operate hoisting machinery under a suspended load.
>
> ● For small-sized products packaged in corrugated cartons, the carton strength may decrease if it gets wet from water. Handle with extra care in such conditions.

5-2. Storage

(1) It must be kept in its packaged state until it is installed on the pipeline.

(2) Storage in the following locations is prohibited:

(a) Places exposed to rain.

(b) High-temperature locations exceeding 60°C.

(c) Dusty places.

(d) Places exceeding the permissible humidity.

(3) If the packaging was opened for performance inspection during acceptance, it must be repackaged properly until installation begins.

(4) Do not remove the plugs and covers from the air piping interfaces and electrical wiring interfaces before starting the air piping and electrical wiring work.

(5) If the storage period exceeds one year, the packing often hardens and ages. Therefore, please open the packaging, loosen the hex nut tightening the packing by 2 turns, and store it in this state. Before use, tighten the hex nut, apply air or water pressure equivalent to the operating fluid pressure from the piping connection flange, and check whether the packing area leaks. If there is any leakage, please replace with new packing. For the replacement procedure, please follow the instructions in the disassembly and assembly section.

(6) When storing the valve after use, please handle it as follows:

(a) Carefully wash the interior of the control valve with water and then dry it thoroughly.

(b) Do not damage the sealing surfaces of the piping connection flanges shown in Fig. 9-1.

(c) Please apply rust-proof treatment to areas prone to rusting.

Apply waterproof treatment to the air piping interfaces and electrical wiring interfaces.

6. Unpacking

⚠WARNING

● When taking the control valve out of the packing box and lifting it, please use a standardized sling suitable for the weight of the control valve to avoid damaging it. At this time, please use the eyebolts on both sides of the actuator (the eyebolts are also a pair of ring-headed bolts used to clamp the diaphragm case) and ensure the load is evenly distributed. Please refer to Fig. 12-2. However, if the weight marked on the surface of the packing box exceeds the limited weight range specified below, do not use the eyebolts installed on the diaphragm case. Instead, follow the procedure shown in Fig. 12-3. Otherwise, personal injury or death may occur due to unsafe hoisting.

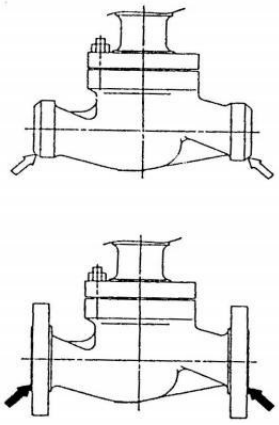
Actuator model	Maximum load (kg)	Weight of a single actuator (kg)
HA1	160	8
HA2	160	16
HA3	160	32
HA4	220	68
HA5	500	123

⚠CAUTION

After unpacking, the following precautions must be observed to prevent damage to the control valve.

● Do not damage the sealing surface of the piping connection flange or the welding bevel as shown in Fig. 9-1, to prevent leakage at the sealing surface.

● When accessories such as a positioner, volume booster, solenoid valve, and handwheel mechanism are installed on the actuator of the control valve, do not let them touch the ground to avoid them being crushed by the control valve.



Do not damage the surface indicated by the arrow

Fig. 9-1

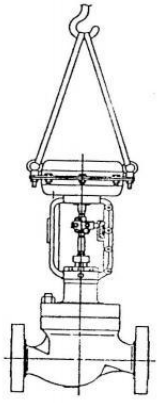


Fig. 9-2

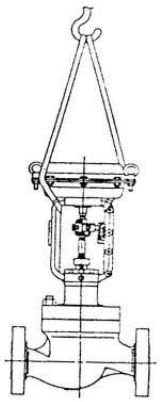


Fig. 9-3

7. Routine Inspection and Regular Inspection

7-1 Routine Inspection

For control valves that play a critical role in the production process, perform routine inspections according to the following items.

● To prevent malfunctions, check for air leaks at the air supply port.

● Check for any leakage at the packing and gasket areas. If fluid leakage occurs, inspect the valve stem for damage, seizing, or other issues. If no abnormality is found, check the operating status while tightening the packing.

● Check for any abnormal noise during operation, and inspect for vibrations in the control valve and piping.

7-2 Regular Inspection

All the above routine inspection items must be carried out for all control valves once every six months.

If any abnormality is found during routine or regular inspections that cannot be resolved, you may perform disassembly and repair during a shutdown, or contact the Sales Department of Chongqing Chuanyi Control Valve Co., Ltd.

8. Fault Symptoms, Causes, and Solutions

Fault Symptom	Main Cause	Troubleshooting
The valve does not operate or operates slowly	1) Low air supply pressure 2) Blockage or leakage in air piping 3) Actuator failure, such as diaphragm rupture causing air leakage 4) Deposits on the guide part of the plug, or bent/broken valve stem 5) Accessory abnormalities: positioner, solenoid valve, etc.	1) Supply the specified air pressure 2) Clean and tighten the connecting parts, then reconnect the piping 3) Replace the diaphragm 4) Clean or replace the parts 5) Apply the specified air pressure to the actuator air supply port without connecting accessories. If there is no abnormality, readjust the positioner or check and replace other accessories.
Unstable operation	1) The actuator stiffness is too low, resulting in insufficient thrust due to changes in medium pressure. 2) Fluctuation in positioner signal 3) Fluctuation in air supply pressure 4) Failure of the pressure reducing valve	1) Replace with an actuator having higher stiffness. 2) Adjust various settings of the positioner and check the signal system. 3) Check or replace the air supply piping diameter 4) Repair or replace the pressure reducing valve.
Excessive valve leakage	1) Corrosion or damage to the sealing surfaces between the plug and valve seat, or between the valve seat and body. 2) Excessive medium pressure differential, resulting in insufficient actuator output force 3) Foreign matters in the valve body 4) Insufficient full stroke	1) Repair or replace the parts 2) Install a positioner or replace the actuator 3) Remove foreign matters 4) Adjust the full stroke
Packing	1) The Packing gland is not tightened 2) Aging, deterioration, or deformation of PTFE packing 3) Wear on the sealing surface of the valve stem	1) Tighten the packing 2) Replace the packing 3) Replace the valve stem
Leakage at connections	1) Loose nut 2) The gasket is damaged 3) Corrosion or damage on the sealing surfaces of other parts in contact with the gasket	1) Tighten the nut 2) Replace the gasket 3) Repair or replace the relevant parts

9. Suggestions on Disposal of Decommissioned Valves

⚠CAUTION

● The term "decommissioned valves" below refers to valves that have been scrapped as fixed assets in accordance with relevant regulations and withdrawn from production.

● After product decommissioning, components contaminated by the medium must be handled by qualified professional organizations.

1. After a scheduled shutdown, decommissioned valves should undergo the identification and assessment of safety and environmental risks, and corresponding response measures should be formulated. They should receive thorough process treatment until sample analysis confirms that no residual materials remain, achieving a safely inoperative and pollution-controlled state.

2. During the process treatment of decommissioned valves, venting, depressurizing, displacement, and purging operations should be carried out strictly in accordance with the emptying and displacement procedure. The discharged "three wastes" (wastewater, waste gas, and waste residue) must be disposed of in accordance with relevant regulations to ensure that wastewater and waste gas meet emission standards. It is strictly prohibited to discharge any wastewater or waste into open

ditches or rainwater drainage systems; waste residue must be sent to locations designated by environmental authorities for disposal; during purging operations, noise reduction and sound insulation facilities must be used so that the generated noise does not disturb residents (or cause pollution to the surrounding environment).

3. During the cleaning operations of decommissioned valves, a detailed cleaning plan must be developed, specifying the types, toxicity, hazards, and control measures for all substances emitted during the cleaning process. Cleaning wastewater must be properly treated and, after analysis confirms it meets discharge requirements, may then be discharged or further handled.

4. Valves for which asset retirement has been applied must be sealed, dismantled, or disposed of as scrap. They must not be put back into production service, nor may they be leased or transferred.

10. Ordering Information

When placing an order, please specify:

1. Product model	2. Nominal diameter × valve seat diameter	3. Nominal pressure and flange connection type
4. Materials of valve body and trim components	5. Bonnet type	6. Flow characteristics
7. Actuator model and air supply pressure	8. Valve action type	9. Accessories (positioner, handwheel mechanism, pressure reducing valve)
10. Special requirements such as oil-free and copper-free treatments	11. Medium name, temperature and specific gravity	12. Fluid viscosity and presence of suspended solids
13. Spare parts		

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Version No.: CY11-2025B-01