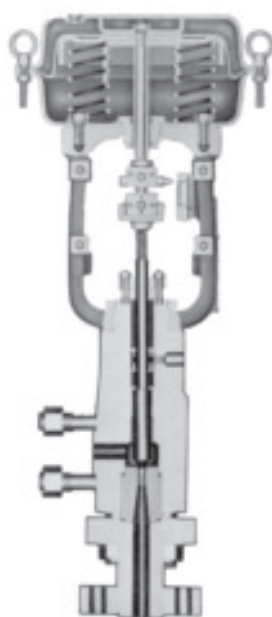


CV3000 Series Control Valve Model : HAL User's Manual



Azbil Corporation

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1. Outline

1-1 Introduction

This manual gives instructions for labyrinth trim type high pressure angle control valves.

For instructions on the pneumatic actuator and the positioner, refer to the publications OMI-8213-0500 (Multi-spring Diaphragm Motor Model HA and Model HL) and OMI-8313-0100 (HEP Electro-pneumatic Valve Positioner, Single Acting Type).

1-2 Construction

A control valve consists mainly of a valve body assembly and an actuator assembly. Control valves are available in various combinations of valve size, pressure rating, connection method, materials, and actuator size to meet a wide variety of applications. (For detailed specifications, refer to SSI-8119-2620.)

1-3 Structure

Figure 1-1 shows the structure of a control valve.

A HAL control valve is an angled single seated valve; its valve plug has a labyrinth groove. The labyrinth groove has the effect of prolonging the service life of the valve plug because cavitation near the seat is suppressed by the fluid resistance produced by the labyrinth effect.

A control valve of this type is most suitable for blow-down control of saturated water when the shut-off performance is hard to maintain because a high differential pressure tends to cause cavitation erosion.

This valve is easy to maintain because the body and the top cover are one piece construction.

The valve plug is guided by the guide bushing and kept in a suitable position by the actuator, which operates in response to control signals. The multi-spring type diaphragm actuator converts air pressure changes to positional changes through the diaphragm and the spring. Thus, it actuates the valve to the corresponding degree of opening.

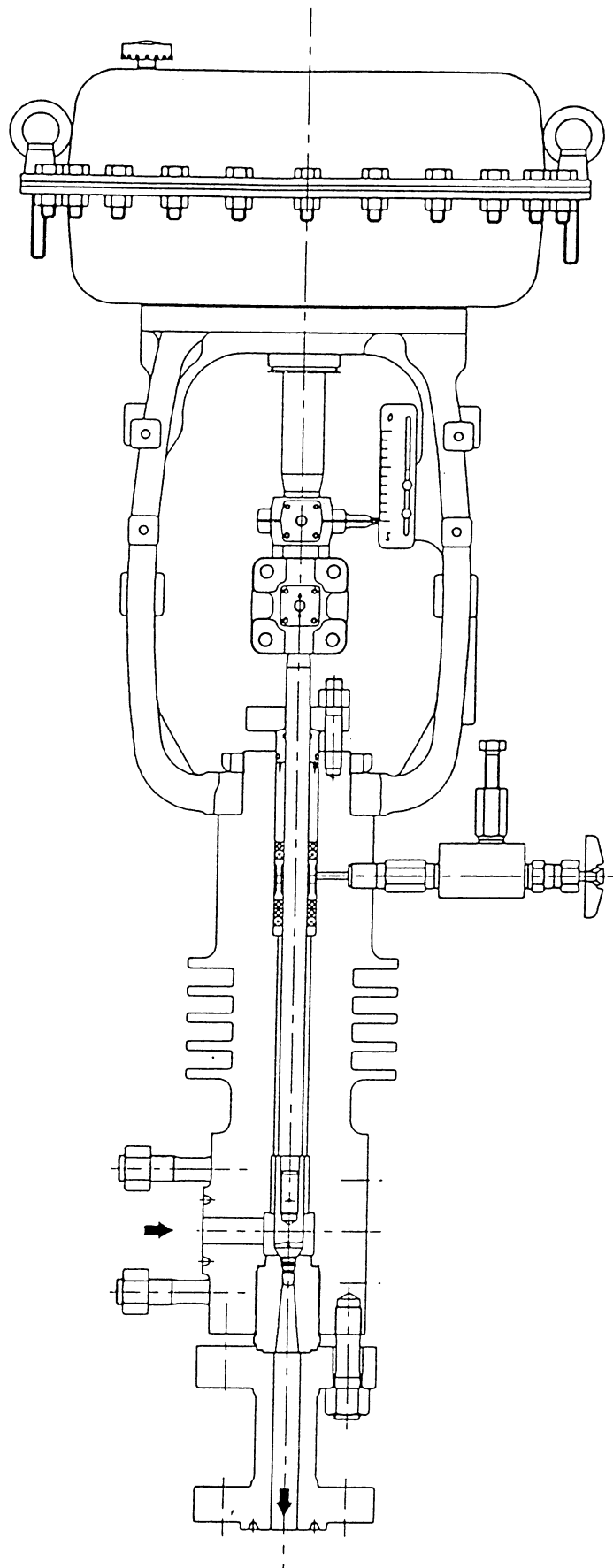


Figure 1-1 Labyrinth Trim Type High Pressure Angle Control Valve

1-4 Name Plate

A name plate (Figure 1-2) is attached to a control valve. It shows the principal specifications of a valve, including the model, size, rating, materials, and date of production. Check that the principal specifications on the name plate agree with your operating conditions. The production number (PROD. NO.) of a valve is also on its name plate. In inquiring about a specification change or ordering replacement parts, please tell us the production number of your valve.

CONTROL VALVE	
TAG. No.	
PROD. No.	
MODEL	ACT. <input type="text"/>
SIZE	LIFT <input type="text"/>
RATING	
BODY	
TRIM	
PLUG	
PACKING	
GASKET	
GREASE	
SPRING RANGE	<input type="text"/> kg/cm ²
POSITIONER SUPPLY	<input type="text"/> kg/cm ²
AIR TO	<input type="text"/> VALVE
DATE	<input type="text"/>
TOKYO JAPAN	
YN-23	

Figure 1-2 Name Plate

2. Installation

2-1 Suspension Load Limit of Eyebolts

Eyebolts* are mounted on the diaphragm case. In principle, the eyebolts are to be used for mounting or dismounting the actuator only. In using it for any other purpose, make sure that the total load, including the valve body and accessories, is within the following limits.

Table 2-1

Actuator model	Load limit	Actuator weight
HA1	160 kg	(8 kg)
HA2	160 kg	(16 kg)
HA3	160 kg	(32 kg)
HA4	220 kg	(68 kg)

* Eyebolts are a pair of bolts with a ring-shaped head that clamp the diaphragm case.

Note: The eyebolts of the actuator can suspend the whole valve body of a cast glove valve as long as its rating is not higher than 600. However, be sure to avoid any shock to it.

2-2 Installation on Pipe

- (1) Before installing a valve, remove scale and welding chips from the inner surface of the pipe across the valve position.
- (2) In installing the valve, make sure that fluid flows in the direction of the arrow shown on the valve body.
- (3) Make sure that the gasket used for connecting the pipe does not protrude into the inner diameter of the valve. Use a gasket of proper material for the operating conditions. A welded type valve has no gasket.
- (4) Do not apply excessive piping stress to the valve. Tighten the bolts of the connection flange uniformly. A high pressure valve must be connected by welding to a pipe, not with a flange.
- (5) Before connecting air pipes to the actuator and the positioner, remove dust and foreign substances from the pipes with pressurized air.
- (6) Do not insulate the top cover assembly.

2-3 Inspection after Installation and before Startup

- (1) Check that the air pipe of the hydraulics has no leakages.
- (2) Check that the bolts and nuts of the diaphragm case are not loose.
- (3) Tighten the packing flange nuts to prevent leakage from the gland packing.
The range of tightening torque is shown in Table 2-2.

Table 2-2 Packing Flange Nut Tightening Torque (kgf-cm)

Valve shaft size	Asbestos yarn packing
$\phi 13$	105 to 140
$\phi 16$	165 to 220
$\phi 20$	220 to 280

Note: (Tightening torque varies according to the packing type. The above figures are given as a guideline.)

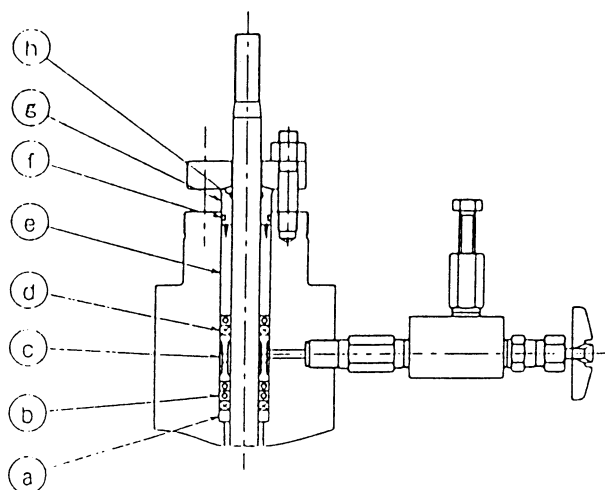


Figure 2-1 Gland Assembly

Symbol	Name
a	Packing ring
b	Graphite packing
c	Lantern ring
d	Yarn packing
e	Spacer
f	O-ring
g	Packing follower
h	O-ring

- (4) If a valve has a lubricator, check that it is filled with grease. (Figure 2-2)
 Loosen the lubricator handle and turn the push screw. If the push screw turns easily, supply more grease by the following procedure. (If the lubricator has enough grease, a high torque is required for turning the push screw.)

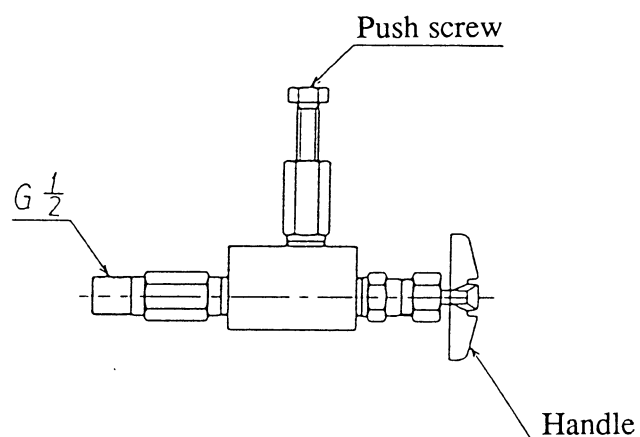


Figure 2-2 Lubricator

Grease feeding procedure

- Check the designated grease number on the name plate.
 - Tighten the lubricator handle firmly.
 - Remove the push screw, feed the grease, and mount the push screw back on.
 - Loosen the lubricator handle and push grease into the lubricator by turning the push screw.
 - Repeat steps b, c, and d. Tighten the lubricator handle last.
- (5) Apply pressure to the inside of the valve to confirm that neither the valve body nor the gasket at the pipe connection part has any leakage. When the fluid temperature is higher than 400°C, tighten the connection more firmly after the valve is heated in order to assure operation for a long period. Refer to Table 4-1 in Item 4 for the guidelines for tightening torque.
- (6) When heating a valve for high temperature use, apply heat gradually (at a rate not over approximately 100°C/hr). Do not actuate the valve during heating.

3. Maintenance and Inspection

Conduct the following maintenance and inspection whenever necessary, even during regular operation.

- (1) Tightening the gland packing
Tighten the gland packing about once every six months, following the instructions in 2-3-(3).
- (2) Feeding grease
Feed grease about once every six months, following the instructions in 2-3-(4).
- (3) Checking that opening degree is not hunting
Refer to “Troubleshooting”.
- (4) Checking for abnormal noise and vibrations
Refer to “Troubleshooting”.

4. Disassembly and Assembly

When a valve must be disassembled for inspection or for replacing parts due to a specifications change and so on, disassemble it by the following procedure.

4-1 Separation of Valve Body and Actuator

- (1) Apply air pressure to the actuator until the pointer rises by 10% to 20% from the complete closure position, and maintain this pressure.
- (2) Loosen the hexagon head bolt that fixes the stem connector, remove the stem connector, and separate the actuator stem from the valve stem.
- (3) Loosen and remove the yoke tightening nut.
- (4) Lift the actuator assembly. The body assembly and the actuator assembly have been separated.

Note: In separating the body assembly and the actuator assembly of a valve while it is still installed on a pipe, be sure to stop the pipe line flow initially and release the process pressure.

4-2 Disassembling and Assembling Body Assembly

Refer to Figure 4-1.

Disassembling procedure

- (1) Loosen the hexagon nut that fixes the packing flange.
- (2) Dismount the packing flange and the packing follower, and pull out the valve plug, gland packing, lantern ring, and packing ring together by pulling up the valve plug.
- (3) Separate the tail piece from the body by removing the nut that joins the two. Dismount the seat ring from the body using the screw of the seat ring or by pushing it lightly with the valve plug.

Inspection

Before reassembling the body, check the following items. If any damage is found, replace the damaged parts. In ordering parts, inform us of the production number (PROD. NO.) on the name plate.

- (1) Do not re-use used gland packing. Use new gland packing for reassembling the body.
- (2) Check whether the plug and the seat ring are damaged.
- (3) Check whether the gasket contacting parts of the body, the seat ring, and the tail piece are damaged. Do not re-use a used gasket. Use a new gasket for reassembling.
- (4) Check whether the inner surface parts of the plug guide part, stem, and guide bushing are damaged.

Assembling procedure

- (1) Mount the gasket, the seat ring, and the other gasket in the body in that order. Mount the tail piece and lock it by tightening the nuts uniformly. For the nut tightening torque, refer to Table 4-1.
(Apply Never Seize to the gasket unless the valve must be kept free of oil.)
 - (2) Insert the valve plug from the top gland part.
 - (3) Insert gland packing. Refer to Figure 2-1.
- Note: If you use yarn packing, make sure that each piece has alternating cuts.
- (4) Mount the packing follower and the packing flange and tighten the nut. For the nut tightening torque, refer to Table 2-2.

Table 4-1 Tail Piece Nut Tightening Torque (kgf-cm)

Body size	Screw size	Tightening torque
3/4 B	M20	1500 to 2000
1B	M22	2000 to 2500
1-1/2 B	M27	3500 to 4000

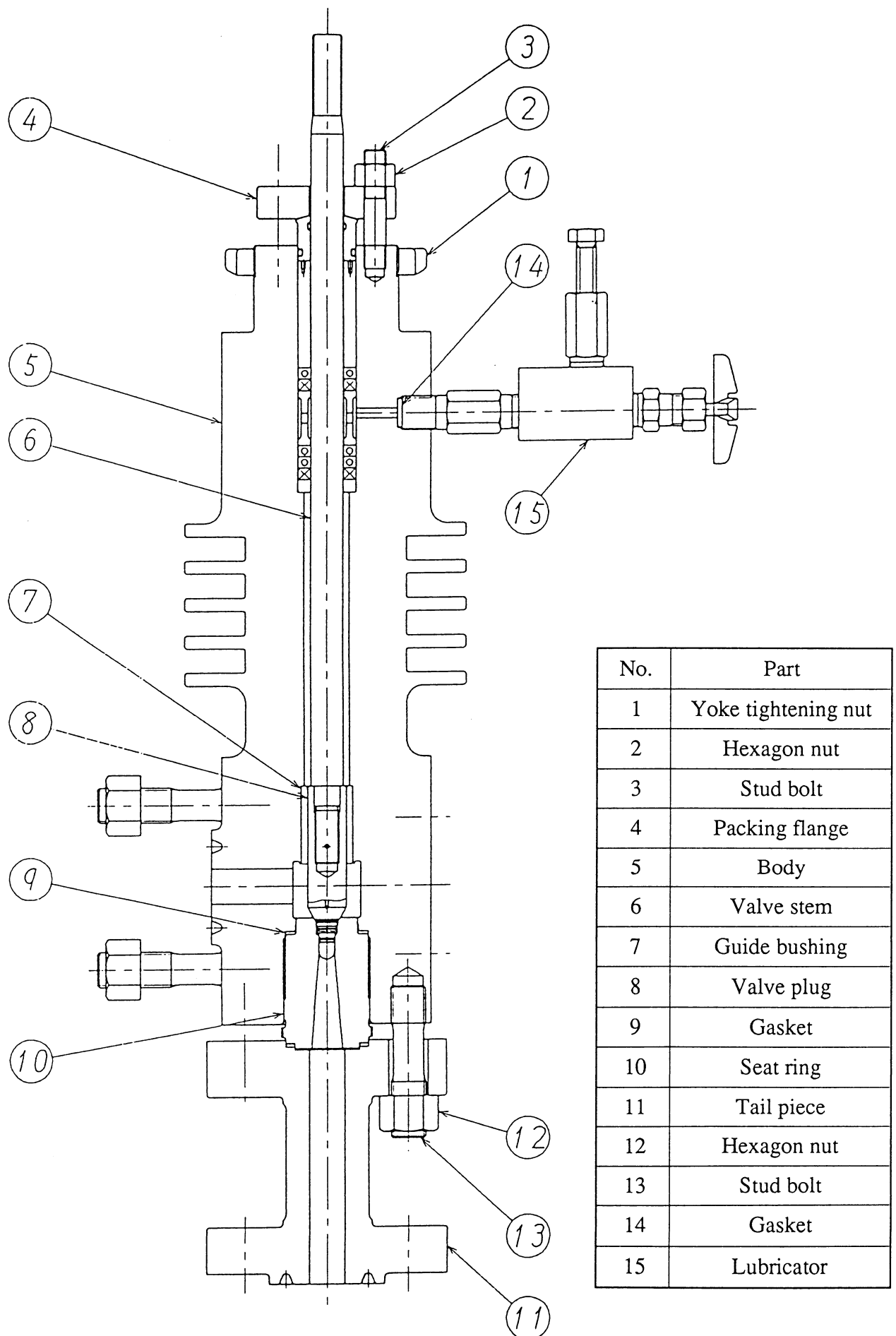


Figure 4-1 Cross Section View of Valve Body Assembly

5. Adjustment

In principle, a diaphragm type control valve requires no adjustment. However, the travel must be adjusted (to obtain the rated stroke) when the actuator is mounted on the body assembly after overhauling, etc. Use the following procedure. (Refer to Figure 5-1.)

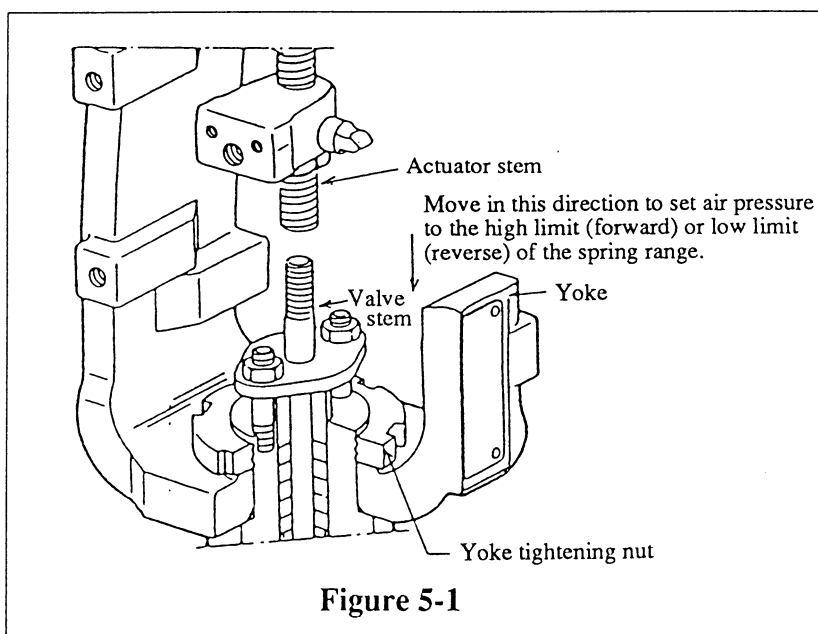
- (1) Mount the actuator on the body assembly of the valve and fix firmly with the yoke tightening nut. (Tighten the nut firmly by hitting it with a hammer, using a chisel.)
- (2) Connect an air pipe to the actuator, allowing free pressure changes with a pressure reducing valve. (In the case of a forward acting valve, connect an air pipe on the upper side of the diaphragm case. In the case of a reverse acting valve, connect it on the lower side of the diaphragm case.)
- (3) Push down the valve stem and make sure that it is on the seat.

Instructions for a forward acting valve:

- (4) Check the spring range on the name plate, and apply air pressure of the high limit value to the actuator.
- (5) Check that the actuator moves by 1 to 2 mm when the air pressure is increased further. (This is the stroke margin.)
- (6) Lower the air pressure once. Then set the air pressure to the high limit value of the spring range.
- (7) In this state, tighten the stem connector firmly with a hexagon head bolt, making sure that the threads of the actuator stem and the valve stem are engaged.

Instructions for a reverse acting valve:

- (4) Check the spring range on the name plate and apply air pressure of the low limit value to the actuator. At this time, check that the actuator moves by 1 to 2 mm.
- (5) Increase the air pressure once. Then set the air pressure to the low limit value of the spring range.
- (6) Take the same procedure as step (7) for a forward acting valve.



6. Troubleshooting

The kinds of trouble that can occur during operation are explained below.

Table 6-1

Phenomenon	Cause/Check/Action
Unstable valve operation <ul style="list-style-type: none"> Hunting occurs near the complete closure position. The supply air pressure changes. The signal pressure changes. Hunting occurs in spite of fixed signals. 	<ul style="list-style-type: none"> The valve capacity is too large. (Decrease the Cv value.) In the case of a single seated type valve, check whether the flow direction is opposite. Check whether too much air is being used in another line. (Related to pipe capacity, throttling, air pressure supply capacity, etc.) The pressure reducing valve is defective. The regulator is not tuned properly. (Change the setting of the proportional band, etc.) Check whether the regulator has abnormal output fluctuations. The positioner itself has hunting. (Check, repair, or replace the positioner.) The valve is influenced by fluid pressure fluctuation. (The actuator capacity is not large enough. Replace it with a larger actuator.)
Valve vibration <ul style="list-style-type: none"> Vibration occurs at any opening degree. (The valve makes abnormal noise.) Vibration occurs only at a specific opening degree. (The valve makes noise.) 	<ul style="list-style-type: none"> Check whether the pipe is vibrating. (Strengthen the support.) Check whether there is any other vibration source. The plug and guide have worn out. (Disassemble and check the parts.) The fluid conditions have changed. (The limit orifice or the Cv value was changed.) Change the plug shape. (Change the properties.)
Slow valve response Failure to operate	<ul style="list-style-type: none"> Leakage from the air pipe Air leakage from the actuator The plug guide is clogged with adhering substances. The gland packing has hardened. (The hysteresis has increased.) The positioner is defective. (Operate the positioner directly using a different air pressure source.)
Fluid leakage from gland	<ul style="list-style-type: none"> Check whether the packing flange has become loose. Check whether it is sufficiently greased. Check whether the valve shaft is damaged.
Fluid leakage from gasket	<ul style="list-style-type: none"> Check whether the nut of the top cover has become loose. The gasket is defective (damaged or deformed).
Fluid leaks heavily to the downstream side	<ul style="list-style-type: none"> Air leakage from the actuator Apply the supply air pressure or atmospheric pressure to the actuator. (Check the air source and the positioner.) Check whether the valve opening degree is indeed 0. (Check the lift.) Corrosion or erosion of the plug seat ring Seizure of the guide unit

Replace parts or take other necessary actions, according to the circumstances.

7. Main Replacement Parts

A control valve is made of durable parts that can be used for a long period of time. However, the following parts should be replaced as part of the maintenance work.

- Body assembly
 - Be sure to change the following parts at the time of disassembling:
 - Gland packing
 - Gasket

- Actuator
 - Diaphragm: Replace approximately every five years.
 - Bushing: "
 - Cap: "
 - Seal washer: " (Replace when disassembled.)
 - Dust seal: " ("
 - Rod seal: " ("

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products. You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product
(noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down.
You are required to provide your Equipment with safety design such as fool-proof design, *1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance, *3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.

*2. A design that is safe even if the device fails.

*3. Avoidance of device failure by using highly reliable components, etc.

*4. The use of redundancy.

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Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area).

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product.

However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

In addition,

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment

- * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
 - * Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
 - (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
 - (5) Machinery or equipment that may affect human lives, human bodies or properties
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Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.
 5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations. In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.
 6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.
 7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquiries or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.
 8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.
 9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

 - (1) Installation, adjustment, guidance, and attendance at a test run
 - (2) Maintenance, inspection, adjustment, and repair
 - (3) Technical guidance and technical education
 - (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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