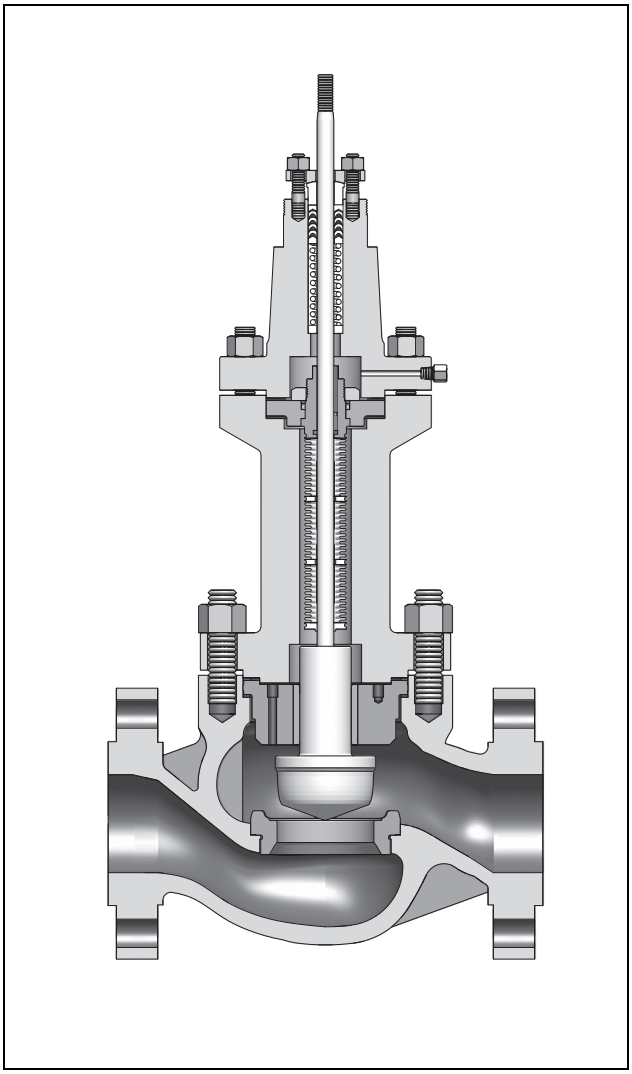
Bellows Seal Bonnet for CV3000 Control Valve

OVERVIEW

The bellows seal bonnet for CV3000 series control valves prevents fluid leakage from the control valve gland. It is ideal for applications where leakage must be prevented --- such as those involving toxic, flammable, or odiferous liquids --- and for applications requiring a high degree of vacuum.



FEATURES

- Three bellows options are available: Formed type I, Formed type II, and Welded type. This allows selection of the most suitable bellows, taking into consideration the temperature and pressure of the process fluid and the required lifespan and cost of the bellows.
- The 3 bellows options are interchangeable as long as the valve size is the same. By changing the bellows, it may be possible toachieve a longer product life or greater cost-effectiveness.
- The bonnet has a leakage detection hole. By connecting an appropriate pressure sensor or gas detector, damage to the bellows can be detected.
- For the formed bellows, buckling prevention during contraction and a uniform contraction volume are achieved by having the bellows guide integrated with the bellows ring. In addition, all 3 bellows types incorporate an anti-twist prevention measure in the form of a rotation prevention pin. These measures prevent damage to the bellows in the course of expansion and contraction, so that long-lasting seal performance is maintained.

SPECIFICATIONS

Target models

- CV3000 series single-seated control valves
  HLS (1/2 inch - 1 inch), HTS (1-1/2 inch - 6 inch)
- CV3000 series cage type control valves
  HCB, ACP, HCU (1-1/2 inch - 6 inch)

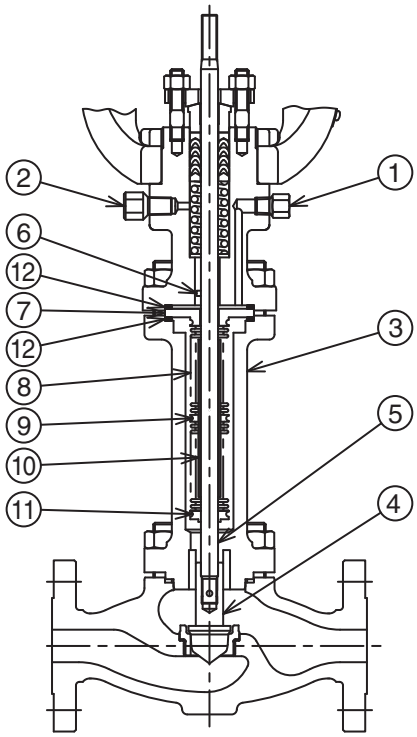
For the 8" of HTS, HCB, ACP and HCU, and as well as for the application of bellows seals with other models, special designed bonnets are necessary. Contact us for the specifications.
The specifications given in this document assume combination with a standard size actuator for each nominal size (see Table 1.). Contact us if you require an over-sized actuator.

Table 1 Standard Size Actuators by Nominal size

Nominal size	Standard size actuators
1/2 inch to 1 inch	PSA1, HA2
1-1/2 inch to 2 inch	HA2
2-1/2 inch to 4 inch	HA2, HA3
6 inch	HA3

Bellows Seal Types

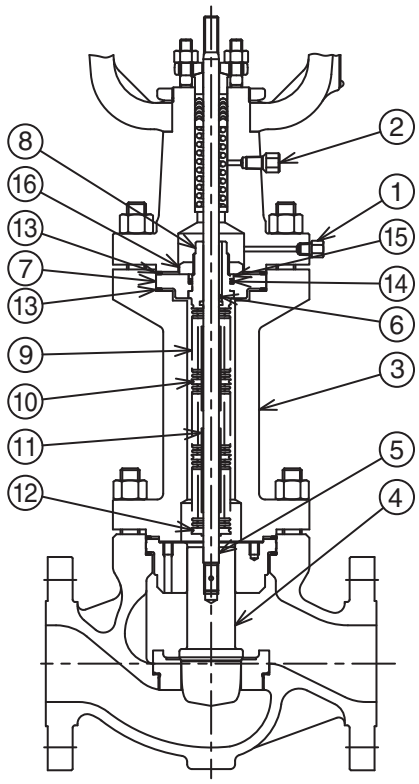
Formed Bellows Type I & II



No.	Part name	Material
1	Blind plug for leakage detection hole	SUS316
2	Blind plug (for V-PTFE packing)	SUS316
3	Bonnet extension	SUS316
4	Valve plug	SUS316
5	Valve stem	SUS316
6	Pin	SUS420J2
7	Bonnet flange	SUS316
8	Bellows	SUS316L
9	Bellows ring	SUS316
10	Bellows guide	SUS316
11	Bellows seat (B)	SUS316
12	Gasket	SUS316

Note: Valve body is SCS14A.

Figure 1 Formed Bellows for Model HLS

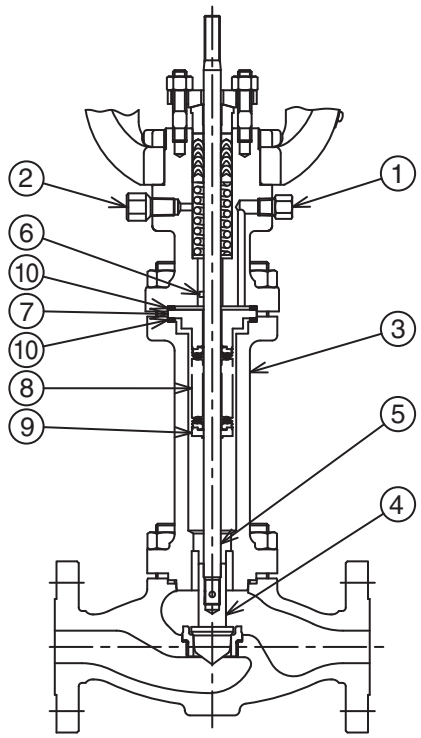


No.	Part name	Material
1	Blind plug for leakage detection hole	SUS316
2	Blind plug (for V-PTFE packing)	SUS316
3	Bonnet extension	SUS316
4	Valve plug	SUS316
5	Valve stem	SUS316
6	Pin	SUS420J2
7	Bonnet flange	SUS316
8	Bellows seat (A)	SUS316
9	Bellows	SUS316L
10	Bellows ring	SUS316
11	Bellows guide	SUS316
12	Bellows seat (B)	SUS316
13	Gasket	SUS316
14	Seal ring	Graphite-filled PTFE+ASTM B575 (Hastelloy C-276 equivalent)
15	Backup ring	SUS316
16	Bellows nut	SUS316

Note: Valve body is SCS14A.

Figure 2 Formed Bellows for Model HTS, HCB, ACP and HCU (Model HTS depicted)

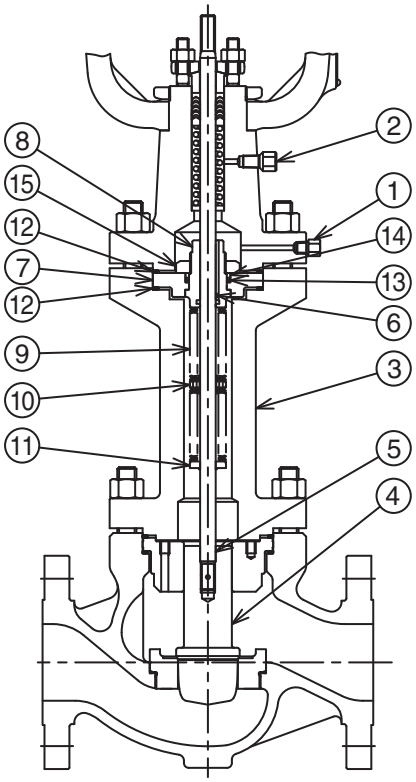
Welded Bellows



No.	Part name	Material
1	Blind plug for leakage detection hole	SUS316
2	Blind plug (for V-PTFE packing)	SUS316
3	Bonnet extension	SUS316
4	Valve plug	SUS316
5	Valve stem	SUS316
6	Pin	SUS420J2
7	Bonnet flange	SUS316
8	Bellows	Inconel718 equivalent
9	Bellows seat (B)	SUS316
10	Gasket	SUS316

Note: Valve body is SCS14A.

Figure 3 Welded Bellows for Model HLS



No.	Part name	Material
1	Blind plug for leakage detection hole	SUS316
2	Blind plug (for V-PTFE packing)	SUS316
3	Bonnet extension	SUS316
4	Valve plug	SUS316
5	Valve stem	SUS316
6	Pin	SUS420J2
7	Bonnet flange	SUS316
8	Bellows seat (A)	SUS316
9	Bellows	Inconel718 equivalent
10	Bellows ring	SUS316
11	Bellows seat (B)	SUS316
12	Gasket	SUS316
13	Seal ring	Graphite-filled PTFE+ASTM B575 (Hastelloy C-276 equivalent)
14	Backup ring	SUS316
15	Bellows nut	SUS316

Note: Valve body is SCS14A.

Figure 4 Welded Bellows for Model HTS, HCB, ACP and HCU (Model HTS depicted)

Note: Regarding the material of the parts shown here, the usual valve/trim combination of SCS14A/SUS316 is shown. If materials with greater corrosion resistance are desired, please contact the Azbil Group.

Selection of a Bellows Seal

Selection of a bellows seal involves the following 2 steps.

1. Select a Basic Type Based on Design Temperature and Pressure

Refer to Figure 5, "Bellows Type by Temperatures and Pressure Ranges" and select a basic type for the bellows seal that can be used in accordance with the design temperature and the design pressure of the fluid.

2. Check Whether Lifespan of Selected Bellows is Adequate

Determine the expected stroke length and refer to Figures 6, 7, and 8 to find the estimated life of the selected bellows seal (in number of cycles). If a Formed bellows type I or Formed bellows type II is selected as the basic type, and if the estimated lifespan does not meet requirements, upgrade to another type of bellows seal. (If the basic type is the Formed bellows type I, upgrade to Formed bellows type II or to the Welded bellows. If the basic type is Formed bellows type II, upgrade to the Welded bellows.)

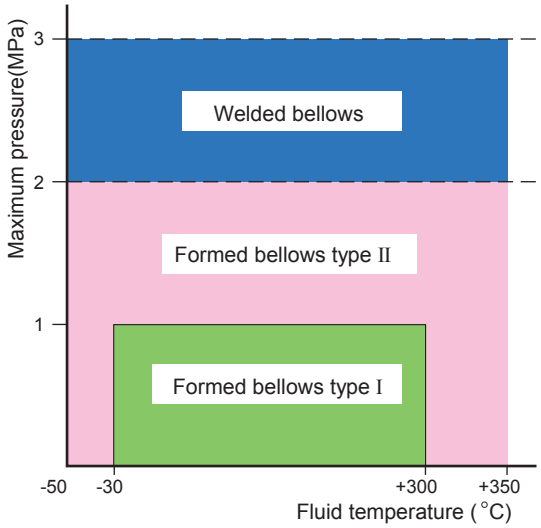


Figure 5 Bellows Type by Temperature and Pressure Ranges

.

PREDICTED BELLOWS LIFESPANS

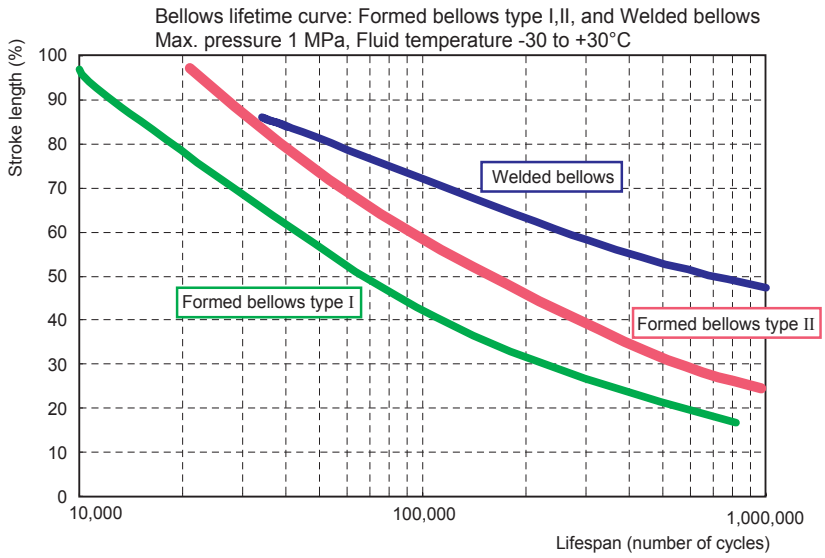


Figure 6 Bellows lifespan where basic type is Formed bellows type I

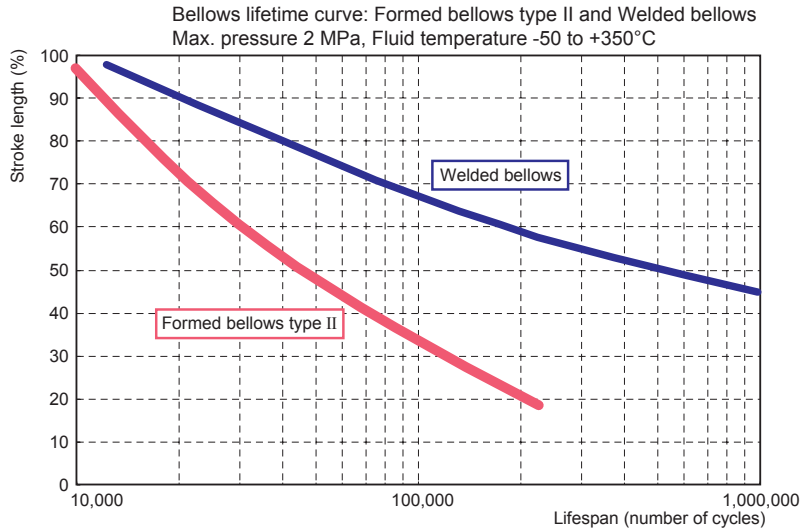


Figure 7 Bellows lifespan where basic type is Formed bellows type II

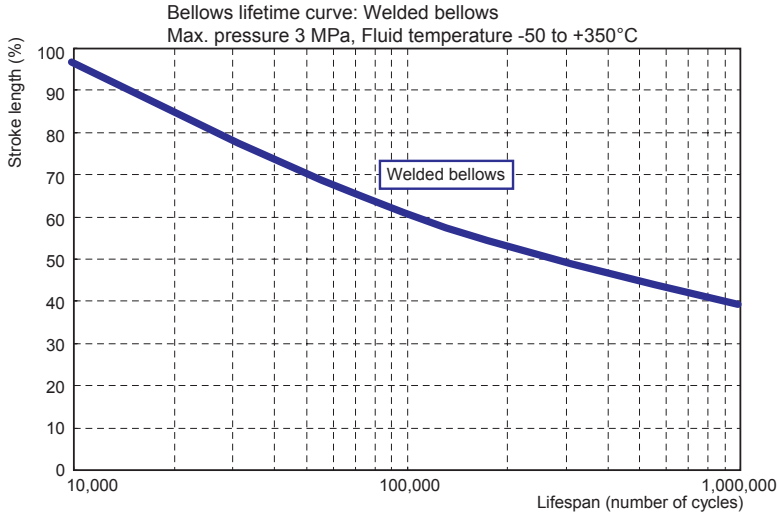


Figure 8 Bellows lifespan where basic type is Welded bellows

Note:

- Bellows seals have a limited service life. Replace them at the appropriate time.
- The estimated lifespans of bellows seals are not guaranteed.
- The lifespan of bellows seals is affected by the following factors in addition to the number of cycles.
  - Repetitive application of pressure due to pump pulsations, etc.
  - Temperature cycles
  - Vibration transmitted through pipes
  - Corrosion due to fluids
  - Shock due to water hammer
  - Excessive hunting because of improper adjustment of the positioner or controller, etc.

Therefore, the estimated lifespan calculations shown in this document should be used as reference data.

Handling Precautions

When using control valves with a bellows seal, there are some points regarding which caution needs to be taken that are different from those for general control valves.
Correct handling keeping the following points in mind is essential.

• NEVER turn the valve stem

Never rotate the valve stem with the bellows seal assembly. The bellows may become twisted resulting in damage.

• Pressure-resistant airtight test pressure

For the pressure-resistant airtight pressure test for control valves with a bellows seal, use the LOWEST pressure from out of the following conditions.

- Highest usable pressure for the selected bellows seal
- Test pressure determined by the pressure rating of the valve itself
- Test pressure stipulated by the High Pressure Gas Safety Law (in Japan)

If the test pressure based on the pressure rating of the valve or the test pressure stipulated by the High Pressure Gas Safety Law is higher than the highest usable pressure for the bellows seal, applying the test pressure to the bellows seal may damage the bellows.

Preventive maintenance for bellows seals

Bellows seals have a limited lifespan, and to use them properly the following measures are recommended.

• Leak and damage detection using the leak detection hole

By connecting a pressure sensor or a gas detector to the leak detection hole (Rc1/4), damage to the bellows and the resulting fluid leakage can be detected.

• Cycle number management using the control valve maintenance support system

The Valstaff control valve maintenance support system allows on-line tracking of the actual number of operation cycles of the control valve, for purposes of preventive maintenance. For details about Valstaff, refer to the following product specifications.

- SS2-VMS100-0100 (HART™ protocol support system)
- SS2-VMS103-0100 (FOUNDATION™ fieldbus support system)

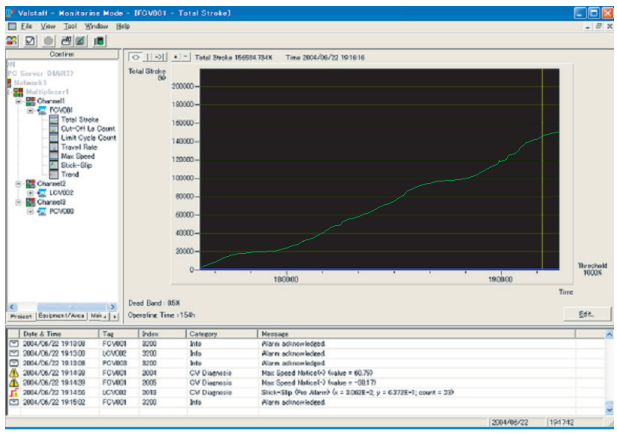


Figure 9. management of number of cycles using Valstaff

Every time the control valve operates, Valstaff tracks the distance the valve stem has moved and totalize this data. This figure is called “Total Stroke” diagnostics parameter of Valstaff. The number of cycles, an index of the bellows seal lifespan, is calculated by the following equation using the Total Stroke parameter.

Number of cycles (times) = Total Stroke (%) / 200 (%)

HART™ is a trademark of Hart Communication Foundation.
FOUNDATION™ is a trademark of Fieldbus Foundation.

Please read the "Terms and Conditions" from the following URL before ordering or use:

http://www.azbil.com/products/bi/order.html

Specifications are subject to change without notice.

Azbil Corporation

Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan
URL: http://www.azbil.com/

1st Edition: Issued in Aug. 2008
2nd Edition: Issued in June 2012