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Automation Instrument

▶ Forward

To further meet user requirements for different service conditions, the 100 Series linear motion control valves are new generation high performance products independently developed by reowo Company on the basis of many years of experience in design, production and field use after incorporating internationally advanced design concept.

With its quality, performance, life, maintenance, appearance and cost being included into the core of design, the product is featured by precise control, fast response, tight shut–off, compact structure, simple maintenance, long service life, low cost, etc.

• Easy disassembly structural design

The seat is fixed by the axial pressure of the bonnet and fixing cage, with such features as automatic alignment during installation, good concentricity, high precision, tight shut–off, low leakage, compact structure, simple maintenance, low use cost, etc.

• Top guided structural design

The friction and blocking between the cage and plug can be effectively avoided so that the valve service life is long with good stability and reliability.

• Innovative packing design

Good sealing performance, low friction, high control precision, fast response, small dead band

• Standard part design

Good interchangeability of parts lowers inventory of users and reduces use cost.

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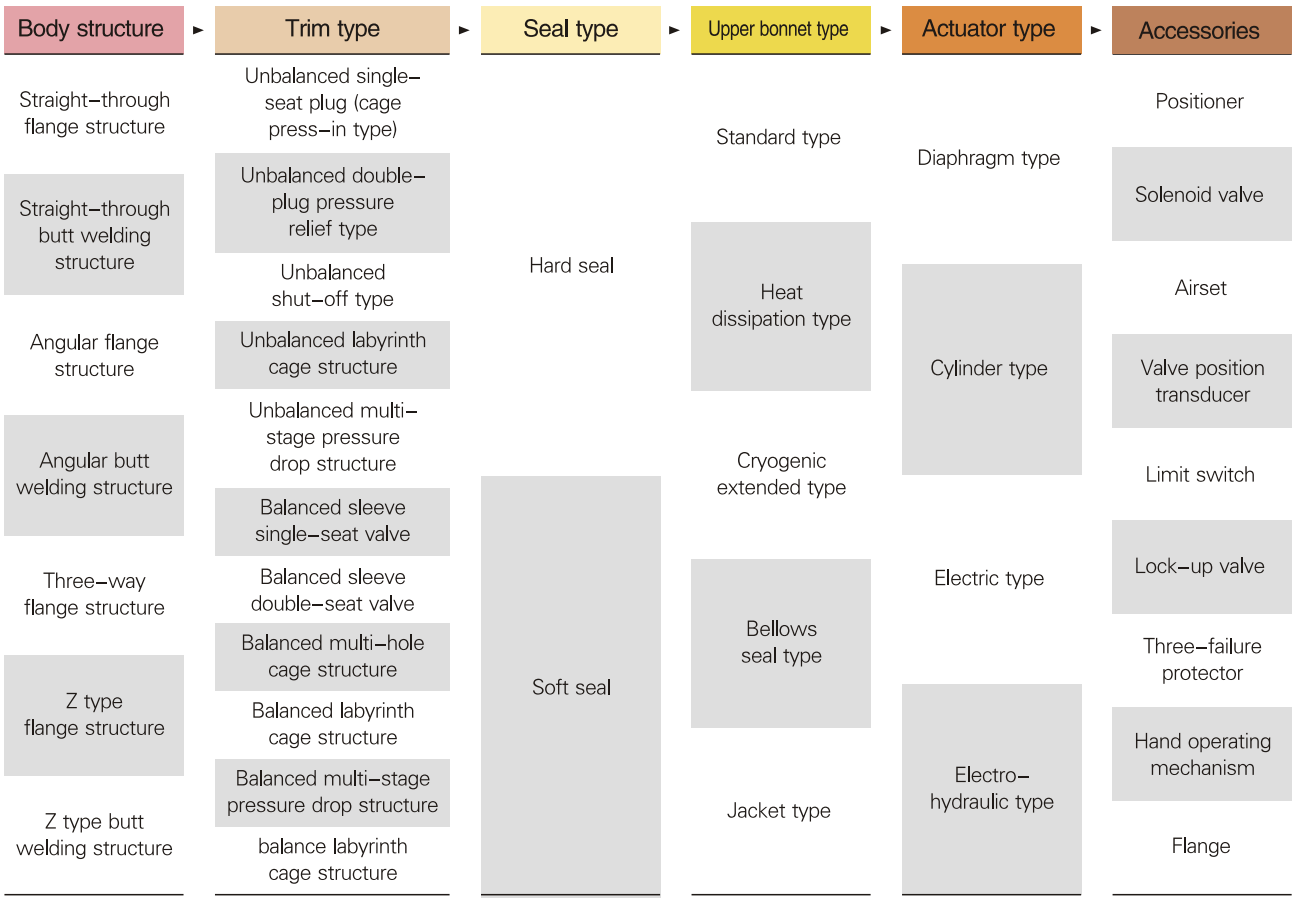
Automation Instrument ▶ **control valve**

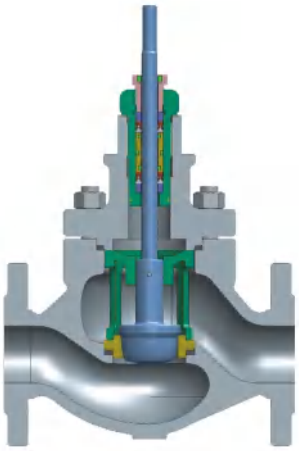
Control valve configuration



Note:

- The above diagram is the configuration guide diagram for linear motion control valves. Please select the most suitable structure for control valves according to the options indicated by the arrow so as to meet the requirements of technological parameters.
- The catalog only covers some important contents in the above configuration guide diagram.
- Please check the relevant contents you are concerned with according to page P.
- If you need any detailed parameters for the electric actuator, electro–hydraulic actuator and relevant accessories that are not elaborated in the catalog, please consult reowo engineers.
- The allowable maximum differential pressure when the control valve is equipped with the actuator, the CV value corresponding to the valve opening and other detailed control valve performance parameters are not listed in the catalog. If you need to know them, please consult reowo engineers or select the most suitable control valve after calculating technological parameters according to the model selection software of reowo Company.

▶ Body type



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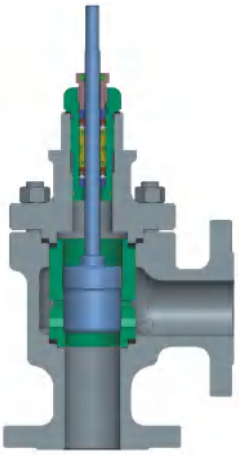

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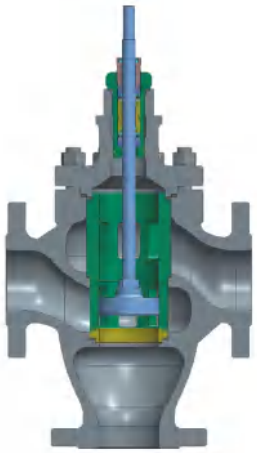

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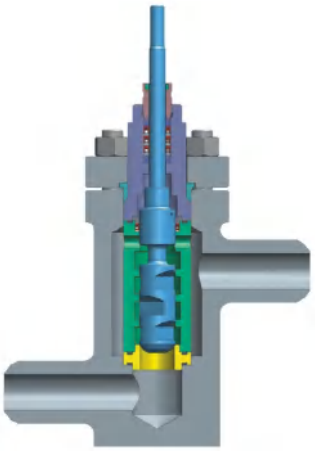


❹

❶ Straight–through body

The straight–through body has an S streamlined flow channel and the inner wall is smooth with equal cross–sectional area. It has such features as low pressure loss, high flow rate, stable flow, etc.

❷ Angular body

Except that its appearance is rectangular, the angular body is similar to the straight–through body in other aspects. It has such features as compact structure, simple flow channel, low resistance, etc. It is especially suitable for media that may easily be coked, blocked, media of high viscosity and other service conditions.

❸ Three–way body

The three–way body includes converging type and diverging type. It is mainly used for proportional control or bypass control with small floor space and low cost.

❹ Z type body

The Z type body is mainly used for high pressure service conditions. It is integrally forged. It has high pressure withstanding performance. The flow channel is simple and whirlpool or backflow does not easily occur. The possibility of flash evaporation and cavitation under high differential pressure service conditions is reduced.

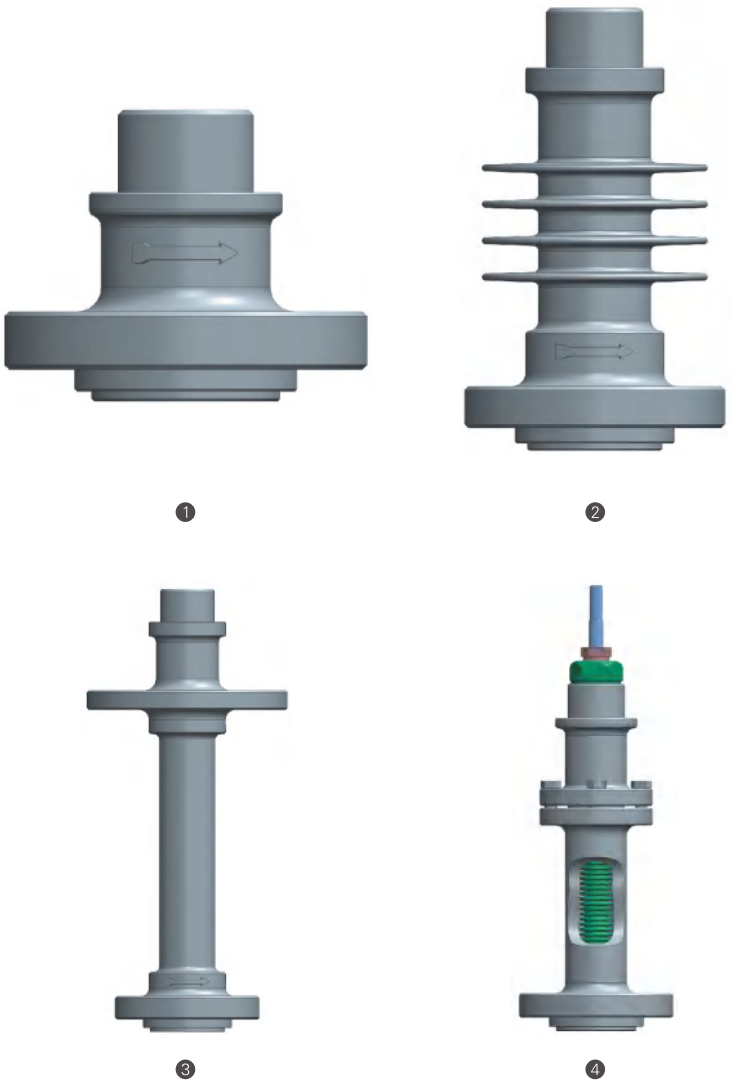
▶ Bonnet type

❶ Standard bonnet

The standard bonnet is normal temperature upper bonnet. The bonnet material is the same as that of the body, playing the function of sealing the body and linking the actuator.
Working temperature: –30℃ – 230℃

❷ High temperature bonnet

The high temperature bonnet is specially designed for high temperature service conditions. The heat sink enhances the contact area between the bonnet and the surrounding air so as to play the function of heat dissipation. It can effectively protect the packing and actuator.
Working temperature: +230℃ – 530℃
–45℃ – –5℃



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❸ Cryogenic extended bonnet

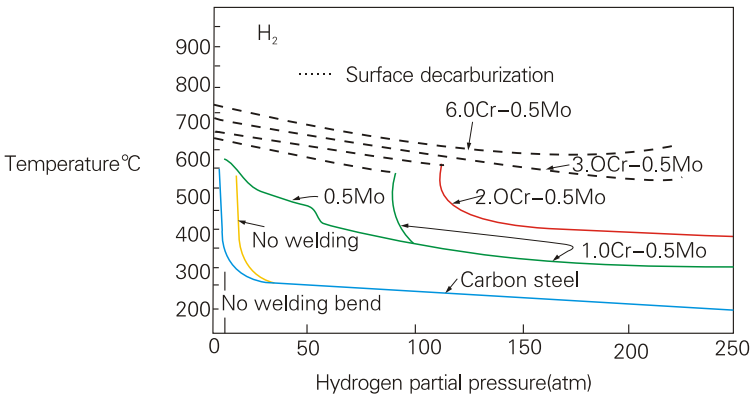
The cryogenic extended bonnet is suitable for media under low temperature status (such as liquid oxygen, liquid nitrogen). This kind of upper bonnet can effectively protect the packing and actuator. The standard material adopted is 304 or 316. Materials of different expansion coefficients can also be adopted according to different service conditions.
Working temperature: –196℃ – 45℃

❹ Metal bellows seal bonnet

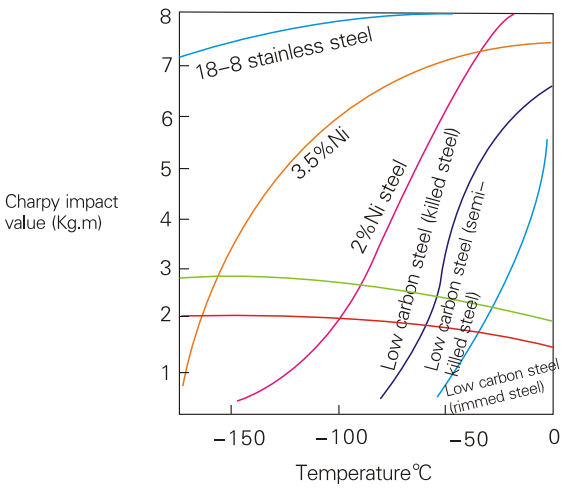
The metal bellows seal bonnet is installed with the stainless steel bellows assembly to isolate the media from the outside and ensure the stem will make upward and downward movement. In addition, the upper bonnet is also provided with the standard packing box to ensure the media will not leak and cause waste or produce pollution to the environment.
Working temperature: –60℃ – 530℃

Body materials

Basic principles of selecting the materials



Range of application of carbon steel and alloy steel under high temperature and high pressure hydrogen



Cryogenic impact value of various materials (5mm U notch)

▲ Anti–corrosion materials

The corrosion of metal materials include general corrosion, crevice corrosion, intergranular corrosion, pitting corrosion, stress corrosion, etc. There is no material that can resist all the above corrosion. Actually, the corrosion of materials is related to the fluid type, concentration, temperature, flow velocity, and also depends on if the fluid contains oxidant. Thus, the selection of materials becomes more complex.
The anti–corrosion materials commonly used in control valves mainly include PTFE, F46 and other lining materials or high–cost austenitic stainless steel, 20# alloy steel, Hastelloy B, Hastelloy C, titanium and other special metals.

▲ High temperature materials

The issues such as high temperature strength, change of metallurgical structure under high temperature and anticorrosion must be taken into full consideration during the selection of high temperature materials. Generally, the alloy steel shall contain chrome, nickel, molybdenum, etc.
In addition, under high temperature and high pressure, the steel will be eroded by hydrogen, which will cause decarburization and embrittlement. After being added into the steel, the elements such as chrome, nickel, molybdenum, etc. can enhance the hydrogen corrosion resistance of steel in combination with the element carbon.

▲ Cryogenic materials

The cryogenic impact value of materials and the problem of embrittlement of materials under low temperature must be taken into full consideration during the selection of cryogenic materials. Therefore, the materials that are used in cryogenic service conditions must have sufficient toughness under low temperature. The valve will be safe and reliable only when the steel used in the valve meets the impact energy stipulated in relevant standards under the applicable temperature.
The austenitic stainless steel is often adopted as its cryogenic mechanical property is relatively stable.

▲ Anti–cavitation materials

When the fluid is liquid, especially when the occurrence of flash evaporation and cavitation appears, the issue of anti–cavitation must be taken into full consideration. The anti–cavitation materials mainly include:
a) Materials of high hardness (the hardness is enhanced through heat treatment)
b) Materials with solid oxide layer and high toughness and fatigue strength (the hardness on the surface of the material is enhanced through surface heat treatment)b) Materials with solid oxide layer and high toughness and fatigue strength (the hardness on the surface of the material is enhanced through surface heat treatment)
c) Materials of partial hardening treatment (overlay welding treatment)

▶ Trim materials

The commonly used trim materials include SUS 304, SUS316, SUS316L, SUS410, SUS420, etc. According to different fluids, the corresponding treatment is carried out. When the valve is used for controlling cavitation fluids and fluids containing solid granules or used in high temperature and high pressure applications, hardening treatment must be carried out to prolong the service life of the valve.

The main methods of hardening treatment include:

1. Heat treatment

a. 304/316 solid solution treatment

The series of materials is austenitic stainless steel which is mainly used in service conditions with corrosive media or low temperature applications. Solid solution treatment must be carried out when the media corrosion is relatively strong. The purpose of solid solution treatment is to enhance material hardness and anti–corrosion performance.Working temperature range –196 – 530℃

b. 410/420 thermal refining treatment (quenching + tempering)

The series of materials is martensitic stainless steel which is an excellent anti–cavitation material. It shall be subjected to thermal refining treatment when used in high temperature and high pressure applications. The purpose of thermal refining treatment is to enhance

c. 17–4PH precipitation hardening treatment

Different types and quantities of reinforcing elements are added on the basis of the chemical components of stainless steel, and different types and quantities of carbides, nitrides, carbonitrides, intermetallic compounds are deposited through precipitation heat treatment. The process that forms high strength stainless steel with the steel strength being enhanced and sufficient toughness being maintained is called precipitation hardening.

Working temperature range –45 – 425℃ material hardness and prolong the service life under severe service conditions.

Working temperature range –45 – 425℃

2. Surface hardening treatment

Surface heat treatment includes two types: surface hardening, surface chemical heat treatment.

a. surface hardening by flame heating, surface hardening by contact heating, induced surface hardening, etc.

b. carburizing, nitriding, carbonitriding, boronizing, chromizing, copperizing, etc.

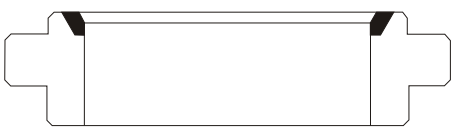
3. Overlay welding treatment

Stellite overlay welding (main elements Co, Cr, W) is the commonly used hardening treatment and excellent anticorrosive performance can be achieved.

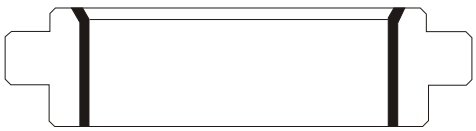
Stellite overlay welding includes two modes such as full overlay welding and partial overlay welding. The selection of the overlay welding modes is not specially stipulated in a standard. The mode shall be selected according to different pressures and temperatures of the fluids and depends on if the fluids contain granules.

The types of overlay welding include:

Plug overlay welding treatment (Stellite overlay welding)

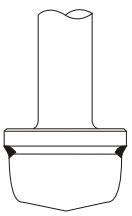


Sealing face overlay welding

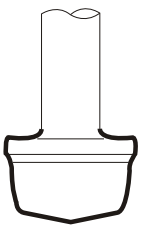


Full profile overlay welding

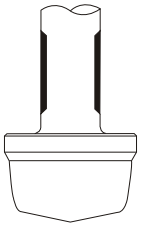
Seat overlay welding types (Stellite overlay welding)



Sealing face overlay welding



Full profile overlay welding



Guide face overlay welding

▶ Trim materials

Materials for main parts	
Part name	**Material**
Body、 bonnet	WCB、WC6、WC9、CF8、CF8M、CF3、CF3M
Plug, seat	304、316、316L、410、420、17–4PH、蒙乃尔合金、哈氏合金 Monel, Hastelloy
Cage	CF8、CF8M
Stem	304、316、316L、420、17–4PH

Note: Special materials can be offered according to customer requirements.

As the main pressure parts, the body and bonnet will release the media contained to the air once they fail. Therefore, thematerials used in the bod and bonnet must be able to meet the corresponding mechanical properties under thestipulated medium temperature and pressure.

ANSIWorking temperature and pressure range of body materialsANSI — UNIT:MPa G

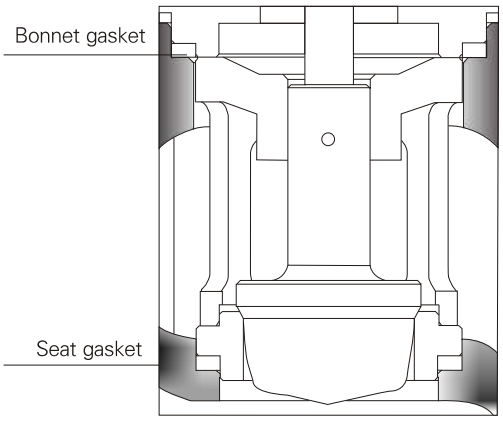
℃ Temperature	150#			300#			600#		
	WCB	Cf8	CF8M	WCB	Cf8	CF8M	WCB	Cf8	CF8M
–196~38	––	1.90	1.90	––	4.95	4.95	––	9.91	9.92
–45~38	––	1.90	1.90	––	4.95	4.95	––	9.91	9.92
–5~38	1.96	1.90	1.90	5.10	4.95	4.95	10.20	9.91	9.92
50	1.92	1.84	1.84	5.00	4.77	4.80	10.01	9.56	9.62
100	1.76	1.61	1.61	4.63	4.08	4.21	9.27	8.17	8.43
150	1.57	1.47	1.47	4.51	3.62	3.85	9.04	7.26	7.69
200	1.40	1.37	1.37	4.38	3.27	3.56	8.75	6.54	7.12
250	1.20	1.20	1.20	4.16	3.04	3.34	8.33	6.10	6.67
300	1.01	1.01	1.01	3.87	2.91	3.15	7.74	5.80	6.32
350	0.84	0.84	0.84	3.69	2.81	3.03	7.38	5.60	6.07
375	0.73	0.73	0.73	3.64	2.77	2.96	7.28	5.54	5.93
400	0.64	0.64	0.64	3.44	2.74	2.91	6.89	5.48	5.81
425	0.55	0.55	0.55	2.88	2.71	2.87	5.74	5.42	5.72
450	0.47	0.47	0.47	1.99	2.68	2.81	4.00	5.37	5.61
475	0.37	0.37	0.37	1.35	2.65	2.73	2.70	5.30	5.46
500	0.28	0.28	0.28	0.88	2.60	2.67	1.75	5.20	5.37
525	0.18	0.18	0.18	0.51	2.19	2.57	1.03	4.77	5.15
538	0.13	0.15	0.15	0.34	2.18	2.53	0.72	4.55	5.06

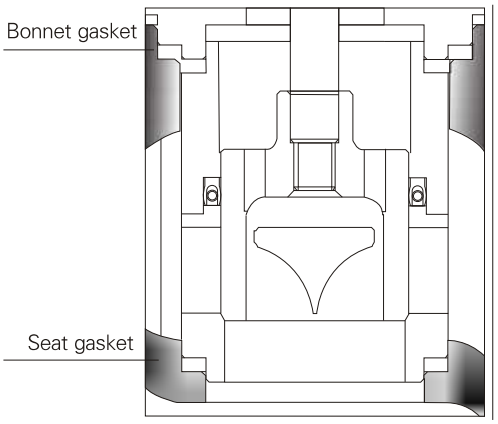
JB/T79–94 — UNIT:MPa G

℃ Temperature	PN1.6	PN4.0	PN6.3	PN10	℃ Temperature	PN1.6	PN4.0	PN6.3	PN10
	ZG230–450					ZGOVr18Ni9			
–5~200	1.60	4.00	6.30	10.00	–45~200	1.60	4.00	6.30	10.00
~250	1.40	3.50	5.40	9.00	~300	1.40	3.50	5.40	9.00
~300	1.20	3.00	4.00	7.50	~400	1.20	3.00	4.00	7.50
~350	1.10	2.60	4.00	6.60	~480	1.10	2.60	4.00	6.60
~400	0.90	2.30	3.70	5.80	~520	0.90	2.30	3.70	5.80
~425	0.80	2.00	3.20	5.00	~560	0.80	2.00	3.20	5.00
~435	0.70	1.80	2.80	4.50					
~445	0.62	1.60	2.50	4.20					
~455	0.57	1.40	2.30	3.60					

▶ Gasket

The 100 Series is a new generation high performance control valve. It adopts self aligning insertion type threadless seat, which is fixed axially by the bonnet and cage. Metal–to–metal contact between the bonnet and body and between the seat and body is realized. The gap between them is filled by the packing gasket and sealing is realized. The compression degree of the bonnet sealing gasket is determined by the bolt pre–tightening force on the bonnet. Only after the concentricity between the bonnet and body is ensured, will it be ensured that the plug and seat are vertically aligned so as to meet the strict sealing requirement.
When the bonnet is completely installed, its force is transferred to the seat through the cage or sleeve. Only when the height tolerance of seat, cage or sleeve is very close, will the sealing gasket of the seat achieve proper compression, so that sealing is ensured and no leakage is caused due to over pressure on the sealing gasket of the seat. If the valve is correctly assembled, the self aligning seat with the top guided structure will fit well with the plug without the need of grinding.



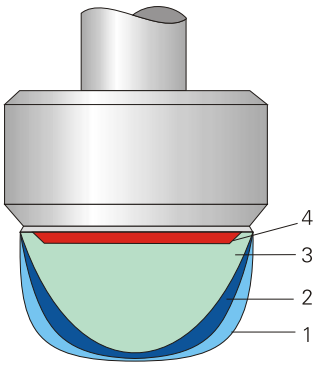


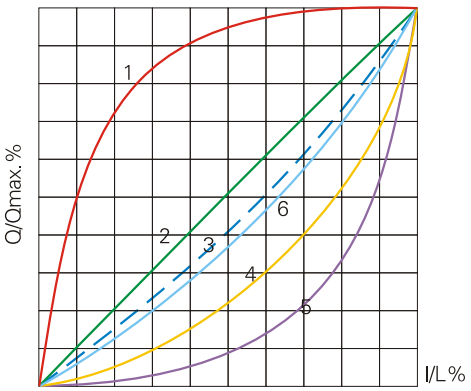
Various gasket materials and working temperature range

Type	Material	Temperature range
Flat gasket(for general purpose)	PTFE	–130℃ ~ 150℃
Serrated gasket (for high temperature and high pressure)	304/316	–196℃ ~ 500℃
Spiral wound gasket (for high temperature and corrosion)	304/316+flexible graphite	–196℃ ~ 500℃

The sealing gaskets made of special materials can be used under higher temperature.

▶ Flow characteristic





Equal percentage characteristic

Linear characteristic

Quick open characteristic

▲ Flow characteristic

The flow characteristic of the control valve is the relationship between the flow of the incompressible fluid that passes through the control valve and the opening of the control valve when the differential pressure at the two ends of the valve is invariable. This flow characteristic is called inherent flow characteristic.
The typical inherent characteristics include linear characteristic and equal percentage characteristic. Actually, when the control valve controls the process media, the differential pressure on the valve will change according to the change of the opening. In this case, the characteristic curve between the opening of the control valve and the flow will deviates from the inherent flow characteristic curve . We call this kind of flow characteristic as actual flow characteristic.

▲ Linear flow characteristic:

It indicates that the flow and opening of the control valve are in the linear relationship. It is usually used for applications with small change of differential pressure, which is almost invariable. When the pressure drop on the valve becomes the main pressure drop in the system, the linear flow characteristic is often used.

▲ Equal percentage flow characteristic:

It indicates the flow change rate caused due to the change of travel is in direct proportion to the original flow at the point. It is usually used in applications that require relatively wide adjusting range, or when the system pressure loss is much higher than that of the valve, or when the opening change and differential pressure change on the valve is relatively high.

▲ Quick open:

It is mainly used for on–off control system. It is required that the flow should be high when the opening is small, and with the increase of the opening, the flow will reach the highest value very soon. After that, if the opening increases again, the change of flow is very little.

▶ Packing structure

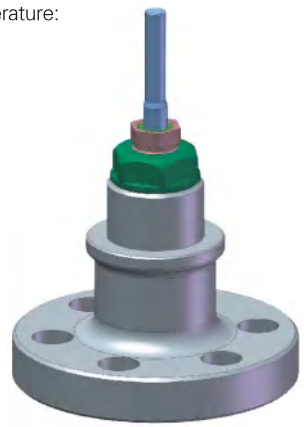
▲ Packing

As a seal at the stem, the packing plays the sealing function for the upward and downward movement at the stem. The traditional solution is the pressing board type packing box structure. Although this structure can play the sealing function, the problem that high friction at the stem will cause big dead band, no response and small signal still exists. To solve the above problem, the 100 Series control valve is designed with the new type packing box structure based on the principle of ensuring effective sealing at the stem, improving the structure and reducing stem friction. The structure has such features as: The integral packing box is easy to replace and repair. Many U type seal rings with sealing compensation function replace the traditional PTFE V type packing.

Standard packing box structure

Standard packing
The integral packing box is the standard packing structure. It is easy to replace and repair with the modular design.
Working temperature:
–30℃ – 260℃

The packing is composed of many U type seal rings with sealing compensation function.

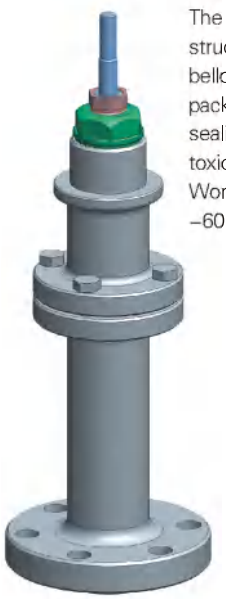


High temperature packing box structure

High temperature packing
The V type flexible graphite serves as the high temperature packing.
Working temperature:
–45℃ – 530℃

The high temperature packing is composed of three V type graphites of different tapers.

▶ Bellows packing box structure



The bellows stem sealing structure often adopts the bellows. The standard packing box with dual sealing will absolutely seal toxic and cryogenic media. Working temperature: –60℃ – 530℃

The metal bellows isolates the media from the outside, and ensures the stem makes upward and downward movement.

Working pressure and temperature range of sealing materials

Type	Material	
Standard	PPL PTFE	–30℃ – 260℃ –30℃ – 230℃
High temperature	V type flexible graphite RTFE	–30℃ – 540℃ –50℃ – 250℃
Bellows seal	304/316 Hastelloy C/MOENEL	–196℃ – 400℃ –250℃ – 530℃

Flg2–1 R.TEE V–RLNG

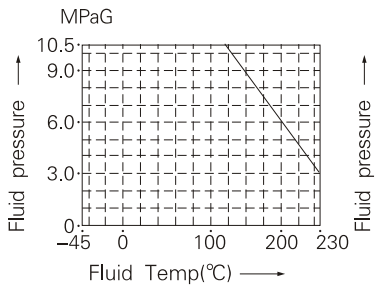


Fig 2–3 Grafoil

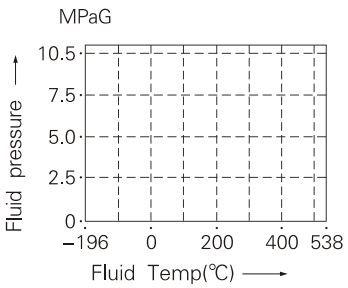


Fig.1–3 Sus316 pressed bellows

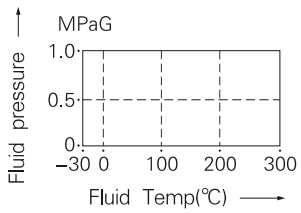
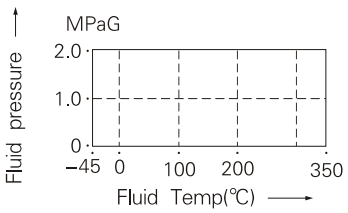


Fig.1–4 SUS WELDED BELLOWS

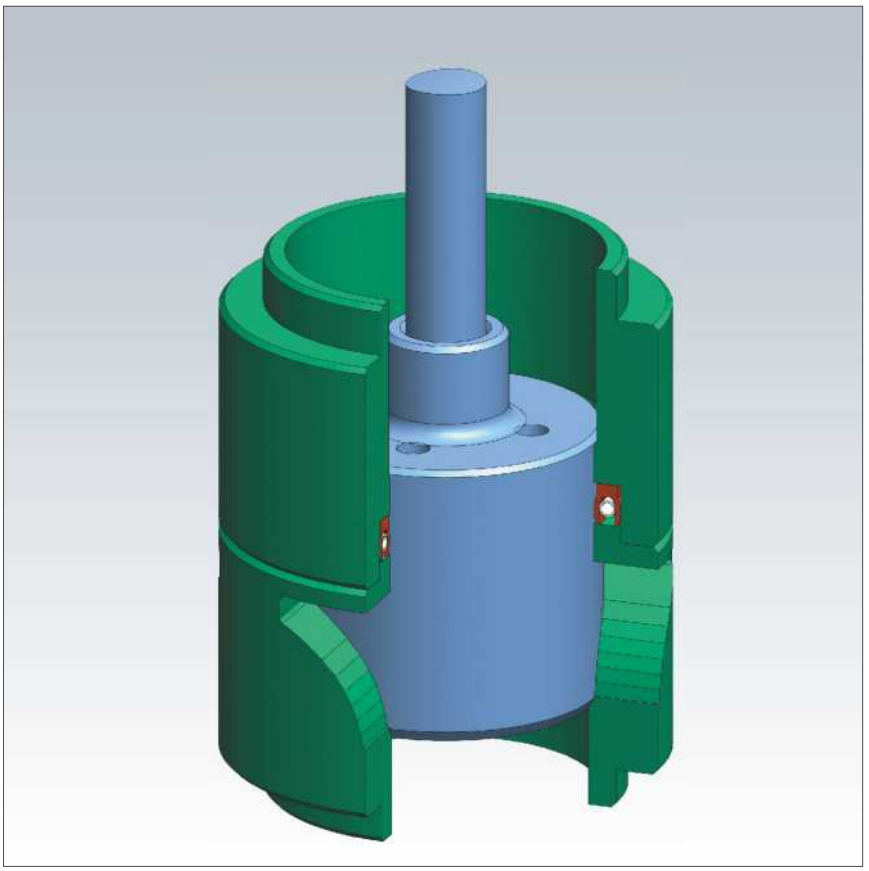


Automation Instrument

▶ Seal ring solutions in the balanced trim

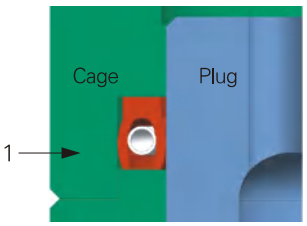
▲ Seal ring solutions in the balanced trim

The balanced seal ring is mainly used in the balanced trim to play the sealing function. It is a core technological part in the sleeve type control valve. The balanced trim type control valve produced by our company provides three kinds of seal rings for users.



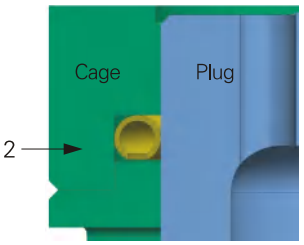
▲ Balanced seal ring

Sealing type: pressure self–sealing
Shut–off class: ASME B16.104 Class V
Temperature range: –30℃ – 260℃



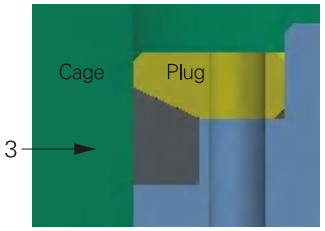
▲ Metal C ring

Sealing type: extruding sealing/pressure self–sealing
Shut–off class: ASME B16.104 Class IV
Temperature range: –196℃ – 650℃



▲ Compound graphite seal ring

Sealing type: extruding sealing
Shut–off class: ASME B16.104 Class V
Temperature range: –196℃ – 560℃



▶ Introduction to the balanced seal ring

▲ Introduction to the balanced seal ring

- The spring actuated PTFE seal is a high performance seal that is assembled with special spring in the U PTFE.
- The proper spring force and the fluid pressure in the system will eject the seal lip and slightly press the sealed face so as to achieve excellent sealing effect.
- The seal lip is short and thick, which is the best feature, so as to reduce friction and prolong the service life.

▲ Features of the balanced seal ring

- Used for reciprocating and rotating movements
- Suitable for most fluids and chemical products
- Low friction coefficient
- Without the occurrence of crawling during precision control, the dead band of the valve is reduced.
- Good anti–wear performance and size stability
- Adapting to sharp temperature change
- No pollution

Selection of sealing materials

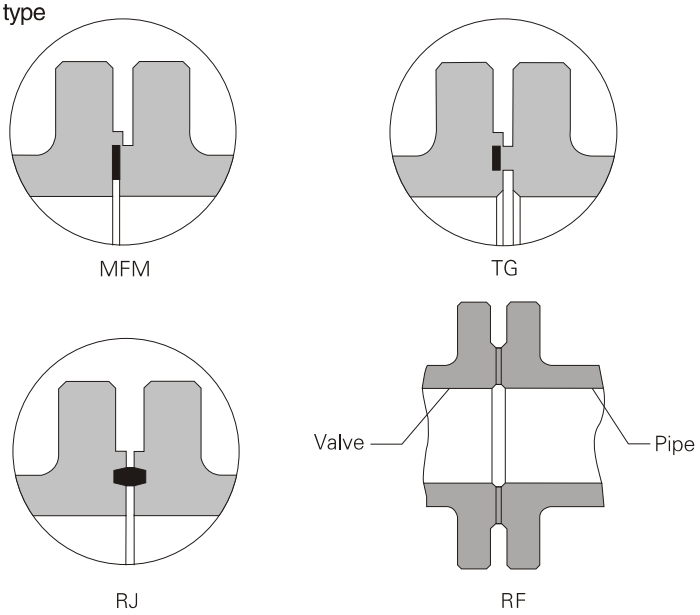
Temperature range	–196℃	–30℃	260℃	450℃	560℃
Number Seal ring type	Material				
1 Balanced seal ring		PPL			
2 Graphite seal ring	Flexible graphite				
3 Metal seal ring	INCONEL 718				

▶ Connection type

The end connection types of the control valves produced by our company mainly include flange connection and butt welding connection, and socket welding connection and thread connection are also available for valves of small sizes. Designs can also be made according to customer requirements.

Flange connection end

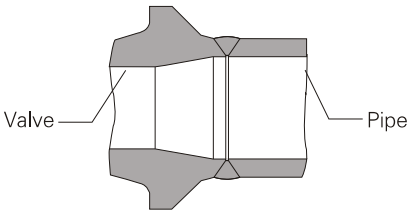
Sealing face type



Note: When used on valves with PN≥4.0MPa, the integral flanges generally have female face, and the pipe flanges generally have raised face.

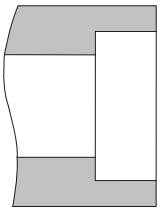
Butt welding connection end

Unless otherwise specified by customers, the butt welding end of the control valves produced by our company is machined according to the slope size stipulated in GB/T12224, ASME B16.25.

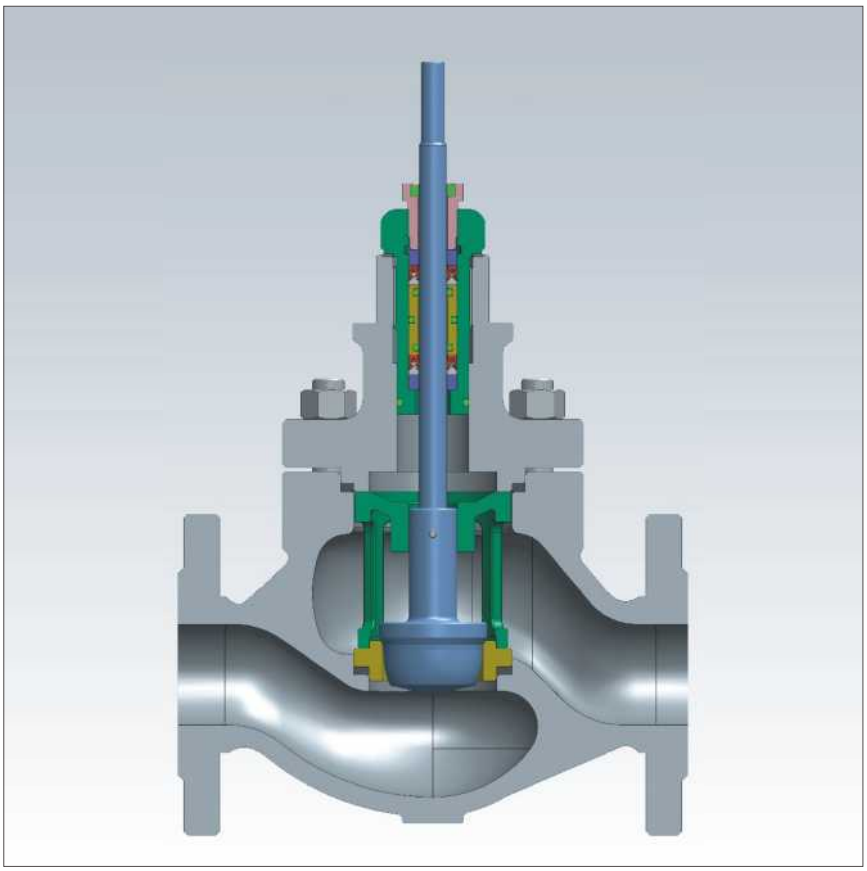


Socket welding connection end

Unless otherwise specified by customers, the socked welding end of the control valves produced by our company is machined according to the size stipulated in JB/T1751, ASME B16.11.



▶ 10P Series control valve



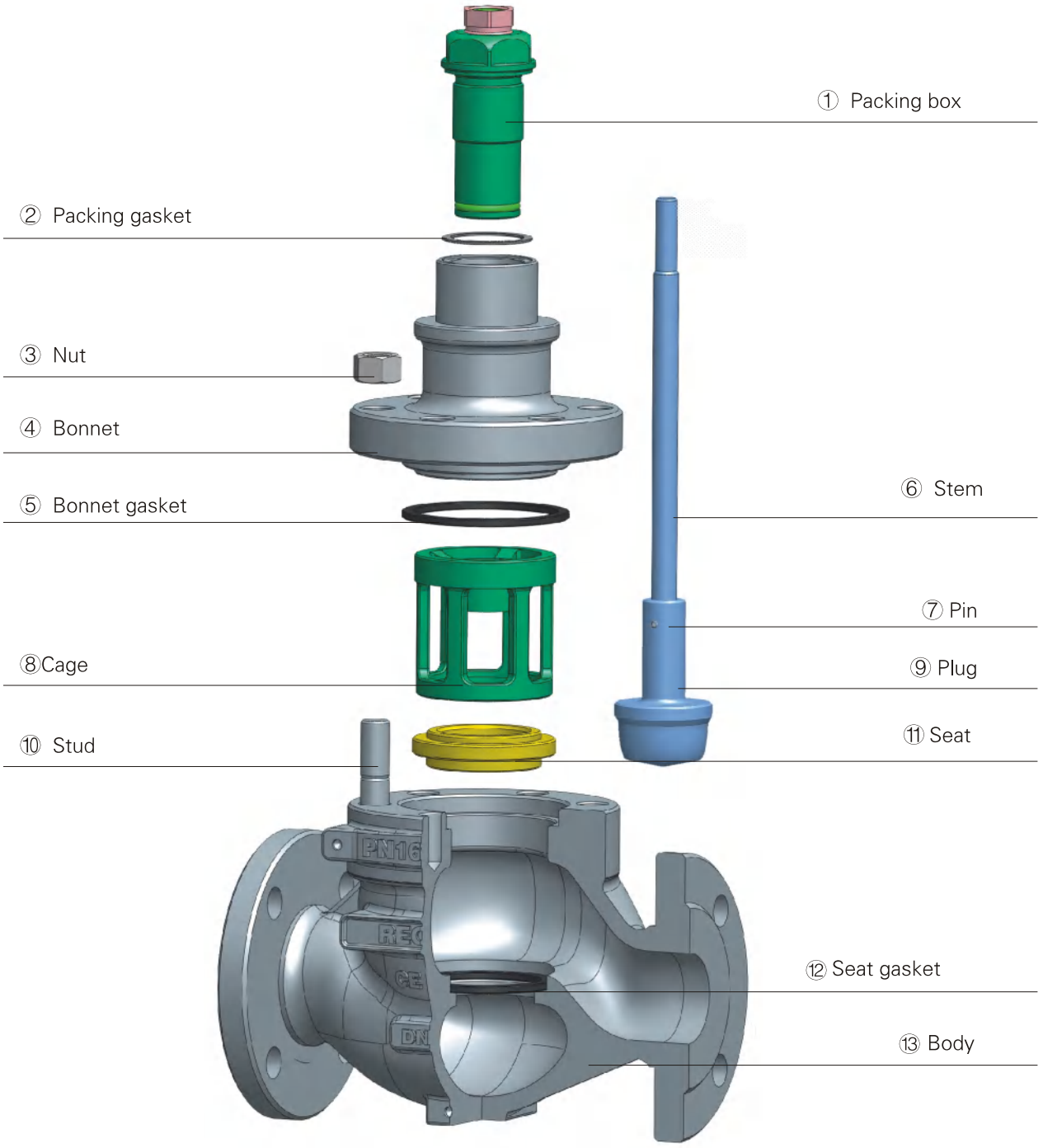
▲ Outline

The 10P Series single–seat control valve adopts the top guided unbalanced structure, featured by high strength, heavy load, S type flow channel, low pressure drop loss, high flow coefficient, wide adjustable range, high flow characteristic precision, etc.
This kind of control valve is suitable for applications with relatively low differential pressure with tight shut–off. It is suitable for controlling medium flow or pressure. The cage adopts the press–in type seat design, which solves the problems of difficult disassembly and high leakage of the traditional thread screw–in type seat and prolongs the service life. The flow to open design is adopted, and the medium flow direction tends to the opening direction of the valve with good controllability of small opening and low flow characteristic distortion. Special cages with noise reduction and anti–cavitation functions can be offered according to the requirements in different service conditions.

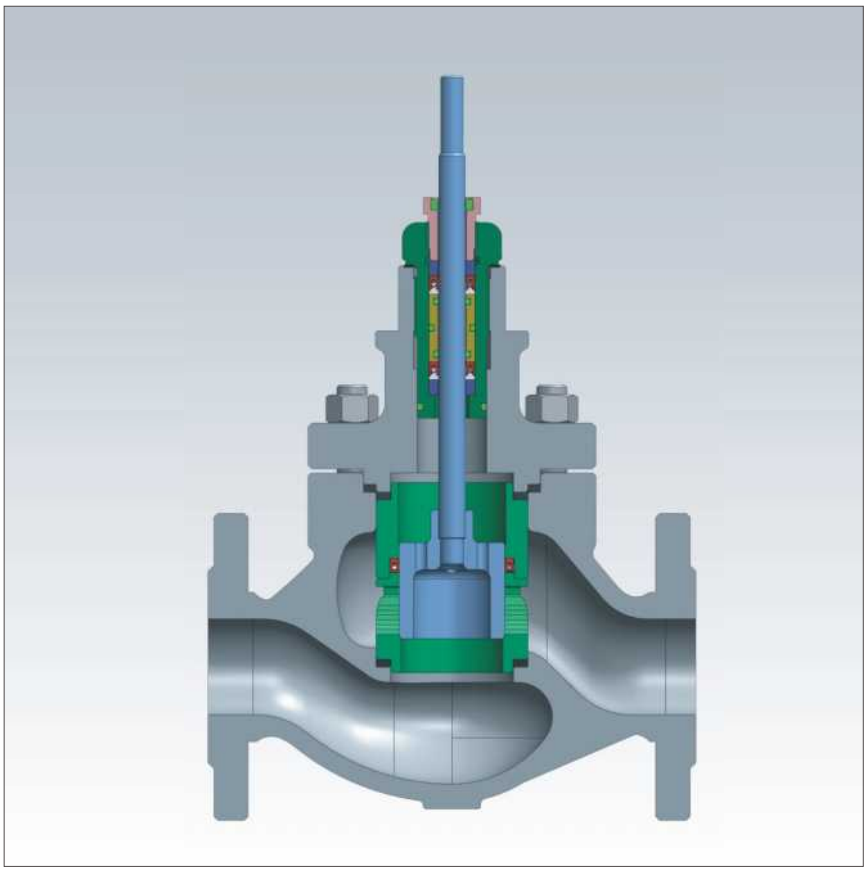
▲ Parameters of control valves:

Trim features:	Top guided, unbalanced trim, quick disassembly cage structure
Body type:	straight–through type, angle type.
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–196℃ – 570℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶Exploded view of 10P Series



▶10T Series control valve



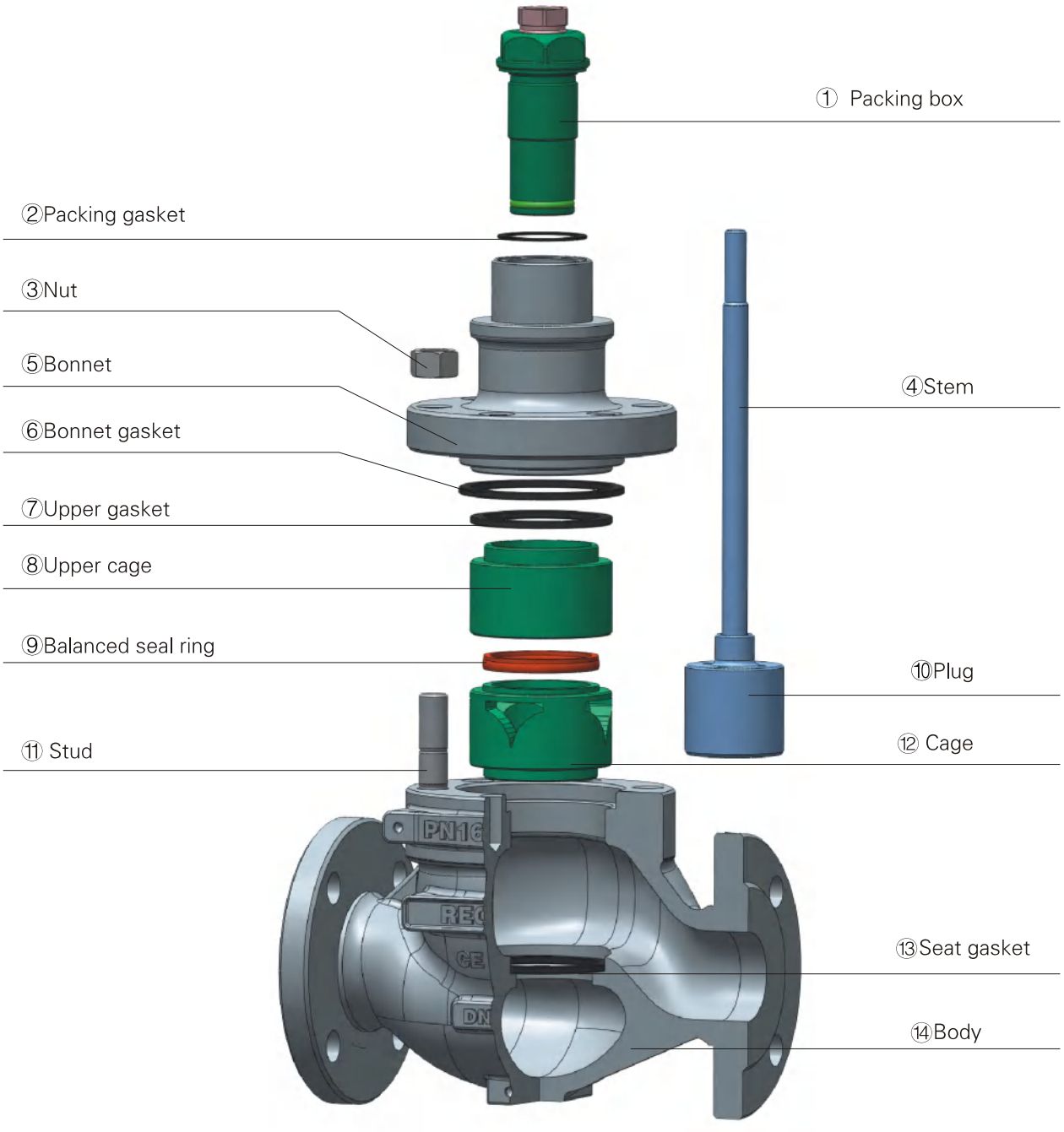
▲ Outline

The 10T Series cage single–seat control valve adopts the cage guided structure and pressure balanced plug. It is suitable for applications with relatively high differential pressure. The balanced seal ring replaces the upper seat to change the traditional cage double–seat valve structure into the cage single–seat structure. This improvement has greatly enhanced the shut–off class of the cage valve. The plug makes use of the pressure balanced structure, the opening and closing force is low and the media under service conditions with high differential pressure can be controlled through relatively low actuator thrust. It is widely used for fluid control on pipelines of middle and low temperature and middle and low pressure that require good dynamic stability. With such features as good sealing performance, high allowable differential pressure, cage guiding, large guiding area, good stability and compact structure, it can realize fast replacement of trims on the line with high maintenance efficiency, saving manpower and time. The balanced plug structure makes sure that the actuator thrust required is the lowest.

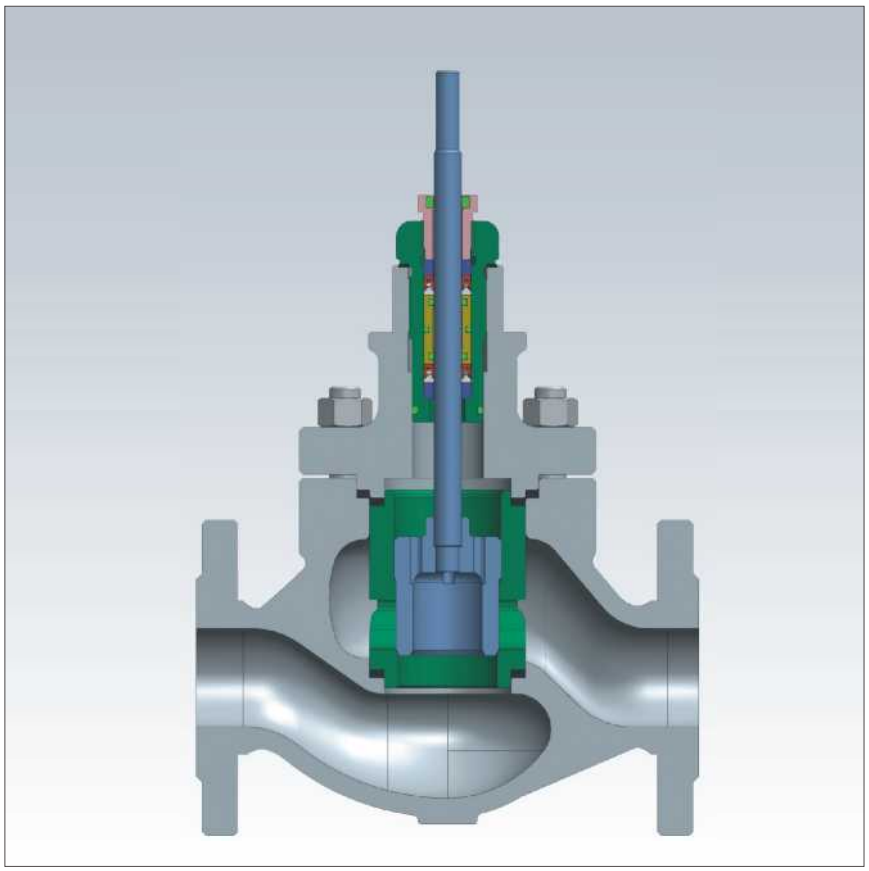
▲ Parameters of control valves:

Trim features:	cage guided type, balanced trim structure, with balanced seal ring structure
Body type:	straight–through type, angle type.
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–30℃ – 260℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶ Exploded view of 10TSeries



▶ 10G Series control valve



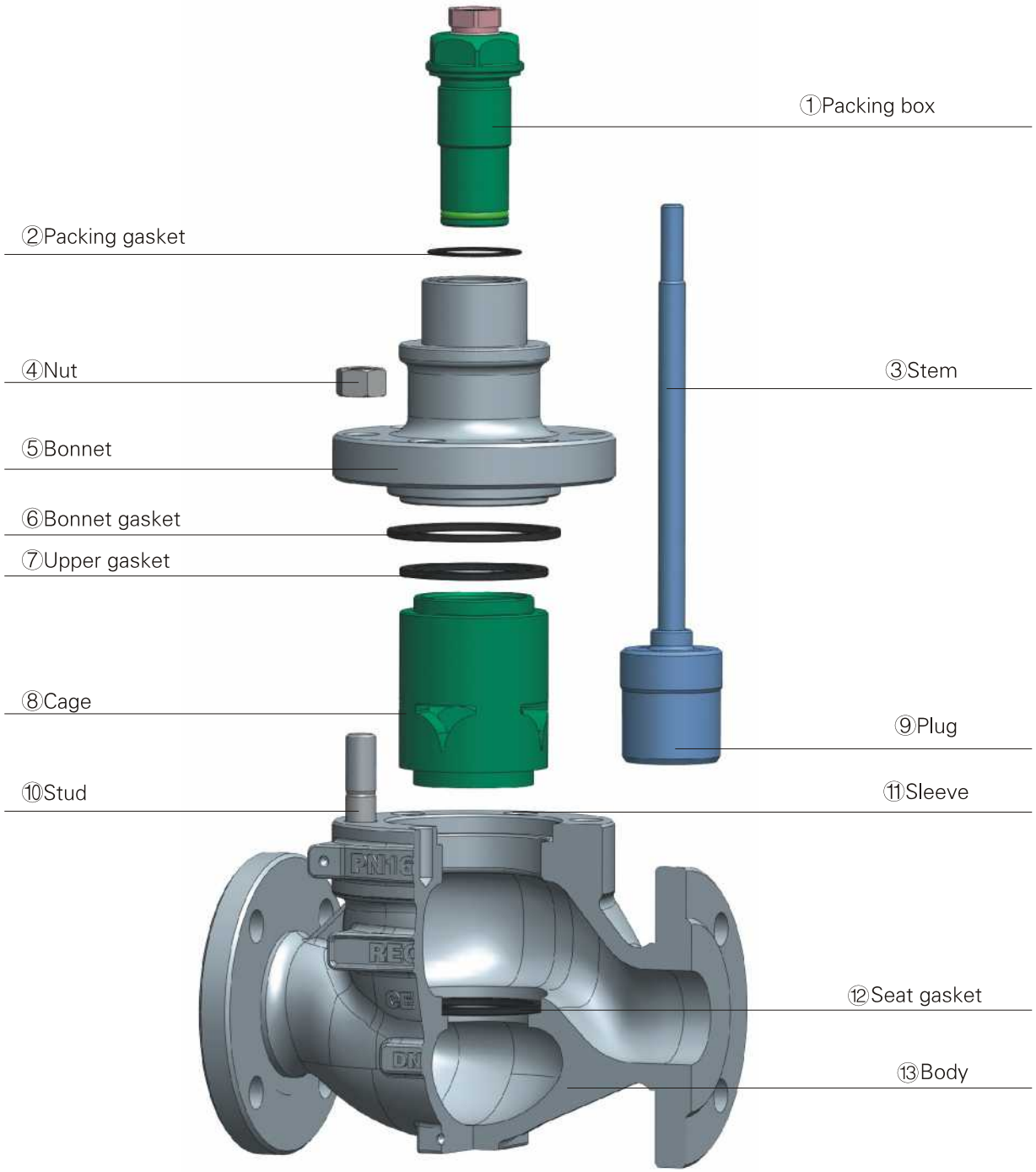
▲ Outline

The 10G Series cage double–seat control valve adopts thecageguided structure and pressure balanced plug. Different from the 10T Series, this kind of control valve adopts the cagedouble–seat structure and is mainly used in applications that do not have high requirements for shut–off class. As it adopts the double–seat structure, and the two sealing faces are metal seals, the temperature range is wider. The plug makes use of the pressure balanced structure, the opening and closing force is low and the media under service conditions with high differential pressure can be controlled through relatively low actuator thrust. It is widely used for fluid control on pipelines of middle and low temperature and middle and low pressure that require good dynamic stability. With such features as good sealing performance, high allowable differential pressure, cage guiding, large guiding area, good stability and compact structure, it can realize fast replacement of trims on the line with high maintenance efficiency, saving manpower and time. The balanced plug structure makes sure that the actuator thrust required is the lowest.

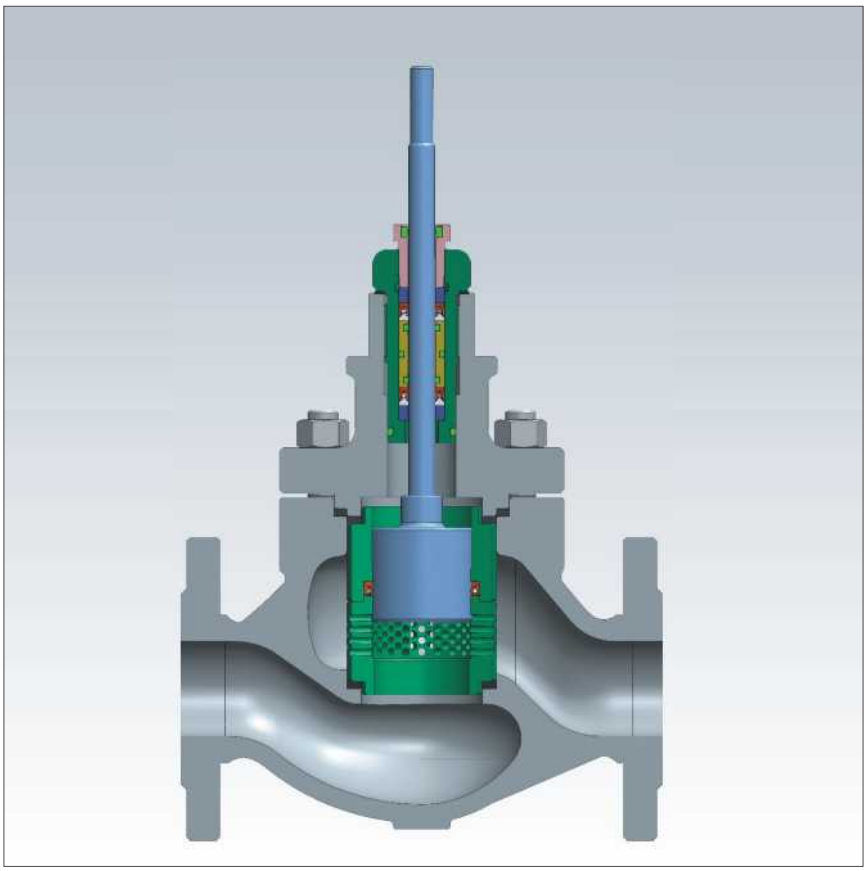
▲ Parameters of control valves:

Trim features:	cage guided type, balanced trim structure, with balanced seal ring structure
Body type:	straight–through type, angle type.
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–196℃ – 570℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶Exploded view of 10G Series

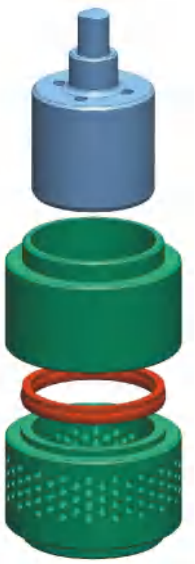


▶10D Series control valve



▲ Outline

The 10D Series multi–hole low noise control valve adopts the sleeve guided structure and pressure balanced plug. It is a high performance control valve with good dynamic stability that is suitable for severe service conditions. As the differential pressure in the service conditions is relatively high and the flow velocity of media is high, the trims will be severely eroded and damaged and high noise will be produced. Therefore, we change the standard window–type sleeve into the multi–hole sleeve. For liquids, the flow direction is generally high–in and low–out, and multi–hole throttling makes the media carry out collision inside the sleeve, so as to consume internal energy and reduce flow velocity. For gas media, the flow direction is generally low–in and high–out, so that the gas media achieve volume expansion at the back of the seat after throttling by the multi–hole sleeve and the pressure of media is reduced to lower the flow velocity. The parts of the 101D Series are interchangeable with those of the 101T Series control valve except that the sleeve is changed into the multi–hole type.

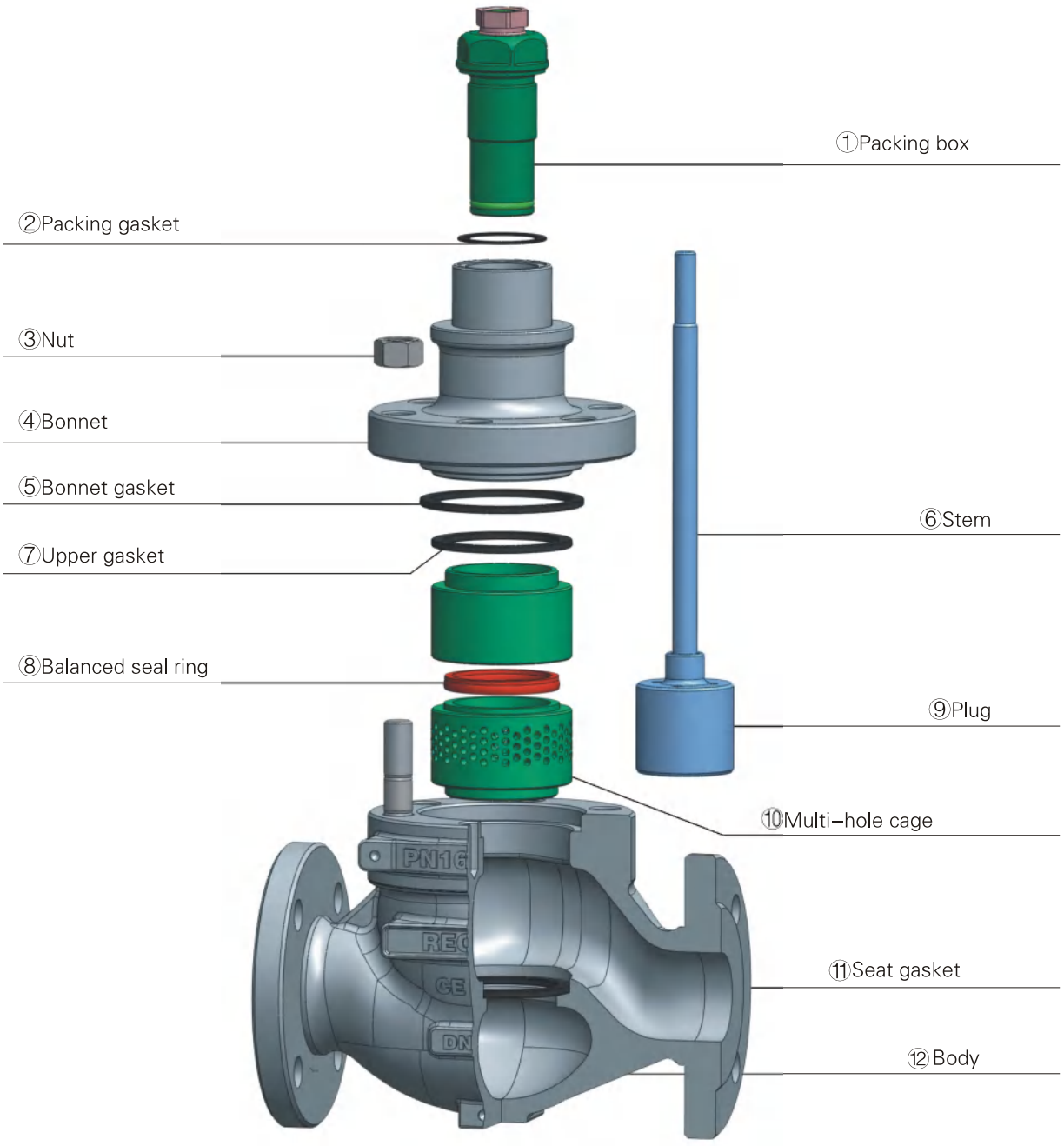


▲ Parameters of control valves:

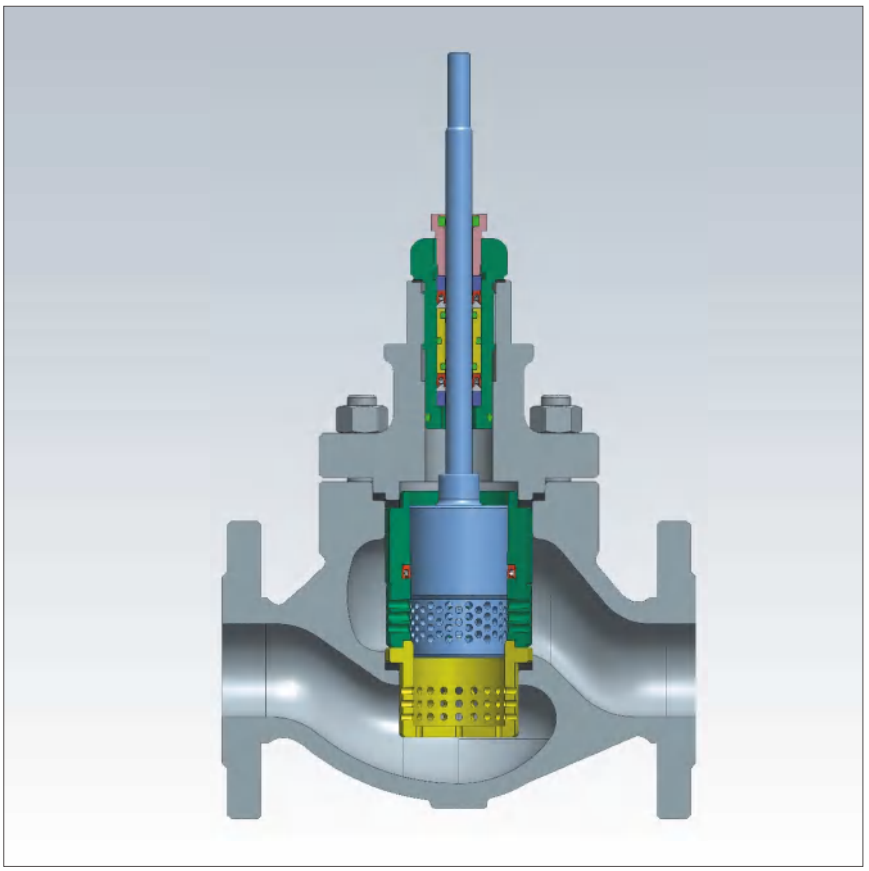
Trim features:	sleeve guided type, balanced trim structure, with balanced seal ring structure
Body type:	straight–through type, angle type.
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–30℃ – 260℃ (single–seat structure) –196℃ – 570℃ (double–seat structure)
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

Automation Instrument

▶ Exploded view of 10D Series



▶ 10S Series control valve



▲ Outline

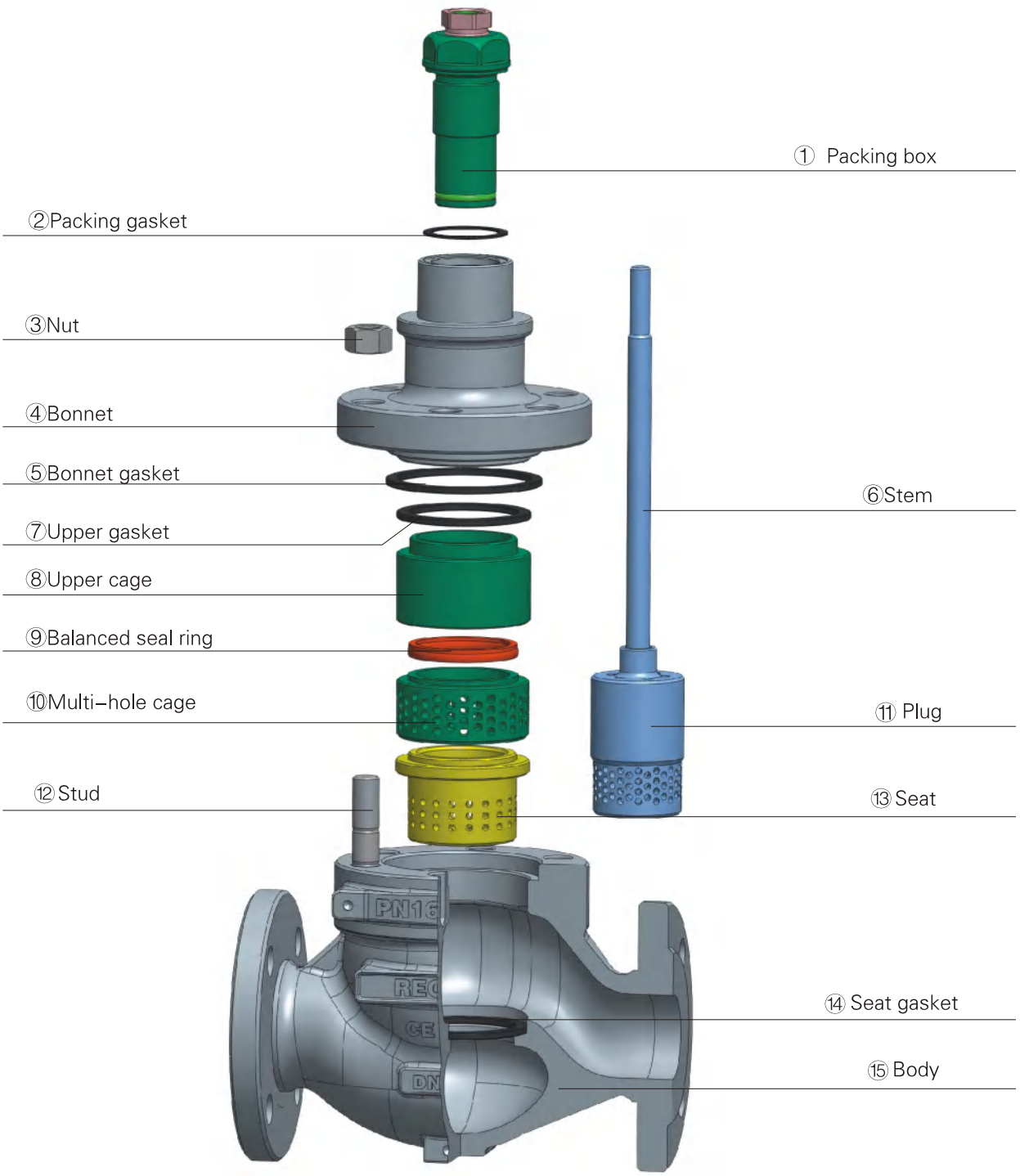
The 10S Series multi–stage pressure drop control valve adopts the sleeve guided structure and pressure balanced plug. It is mainly used in service conditions with high differential pressure and applications that produce flash evaporation and cavitation. According to different parameters, it is designed with different pressure drop cages that form a multi–stage pressure drop trim. The cages designed according to different service conditions ensure the occurrence of flash evaporation and cavitation in the valve is eliminated. Throttling is carried out from the time when the media contact the first cage, and the high differential pressure at the inlet is gradually reduced after several times of throttling. Thus it is effectively ensured that the pressure is always above the saturated vapor pressure when the media flow in the valve, and the occurrence of flash evaporation and cavitation is eliminated, so that the service life of the control valve is prolonged under severe service conditions.

▲ Parameters of control valves:

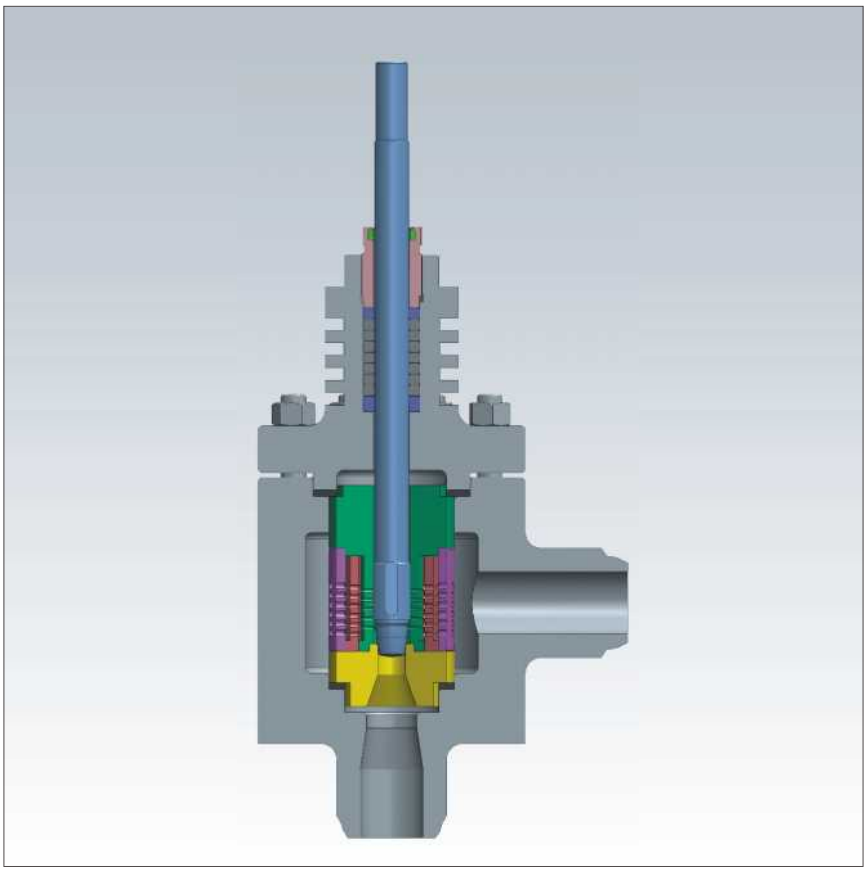
Trim features:	sleeve guided type, balanced trim structure, with balanced seal ring structure
Body type:	straight–through type, angle type
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–30℃ – 260℃ (single–seat structure) –196℃ – 570℃ (double–seat structure)
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

Automation Instrument

▶Exploded view of 10S Series



▶10S Series control valve (unbalanced trim)



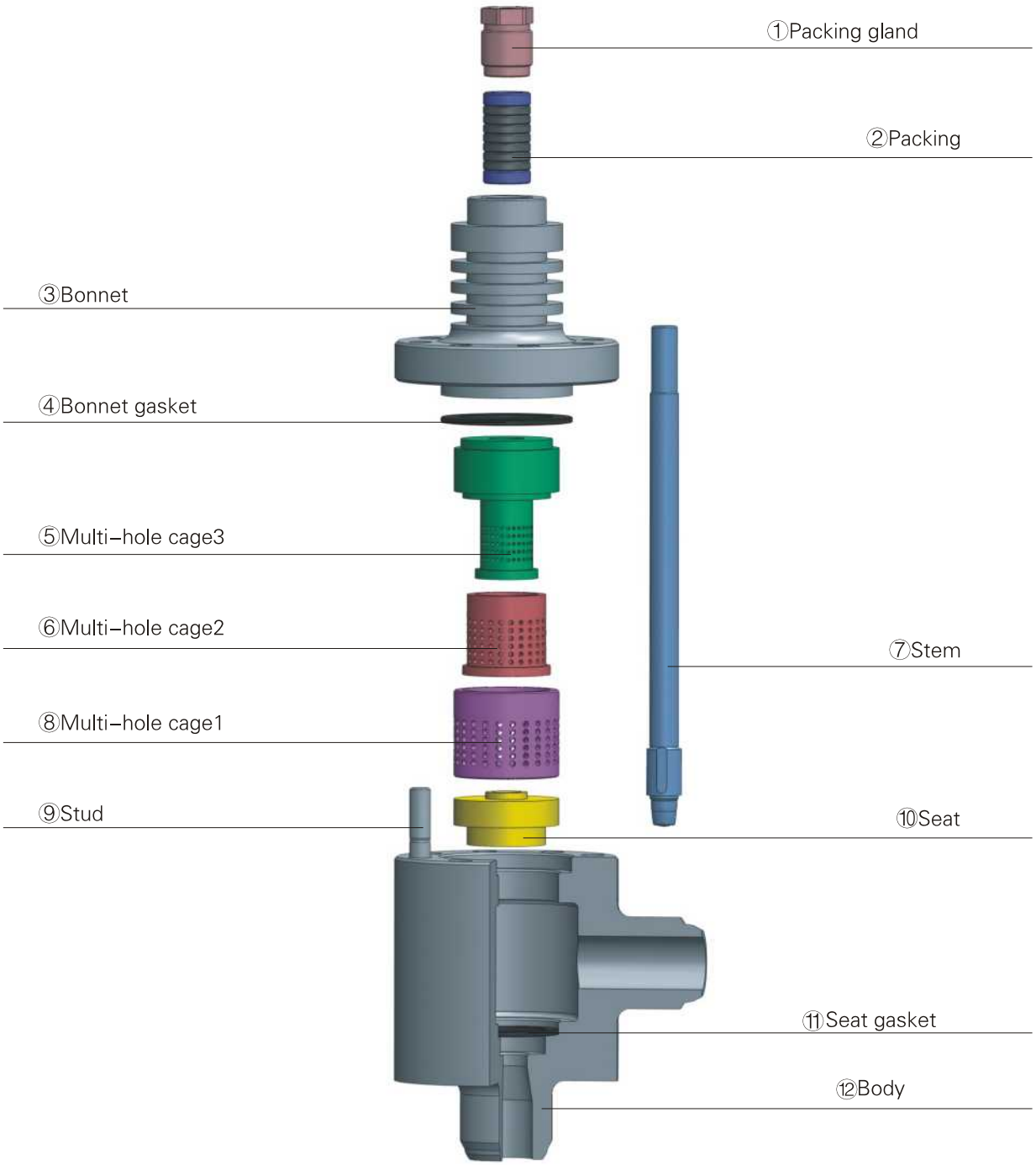
▲ Outline

The 10S Series unbalanced multi–stage pressure drop control valve is suitable for applications with high differential pressure and applications that produce flash evaporation and cavitation. According to the requirements in different service conditions, it is designed with various multi–hole cages that form a multi–stage pressure drop trim, so that the internal energy of high speed media is consumed and flow velocity is reduced from the time when the fluids contact the first cage. As it is composed of various cages, the pressure is gradually reduced so that the medium pressure is always above the saturated vapor pressure, and the occurrence of flash evaporation and cavitation is eliminated. The standard configuration is the unbalanced single–seat plug and the plug and seat are subjected to hardening treatment to prolong the service life of the trim. The valves of large sizes can be designed with the balanced single–seat plug structure.

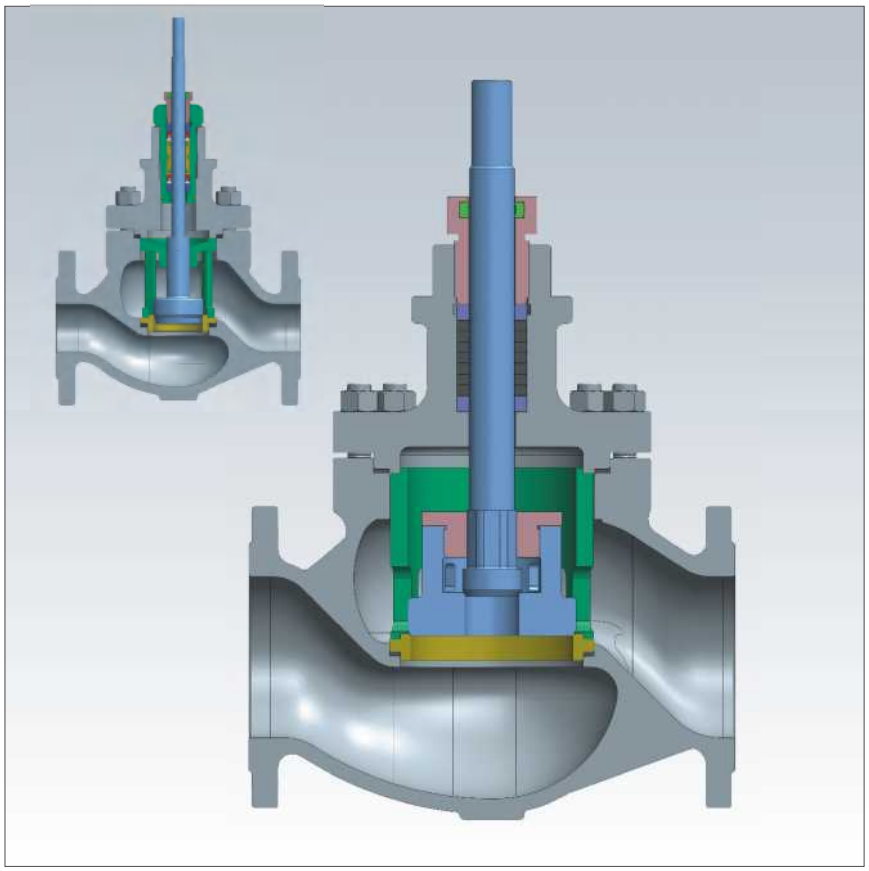
▲ Parameters of control valves:

Trim features:	sleeve guided unbalanced trim structure, combination of multi–hole cages
Body type:	straight–through type, angle type。
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–196℃ – 570℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶ Exploded view of 10S Series (unbalanced trim)



▶ 10Q Series control valve



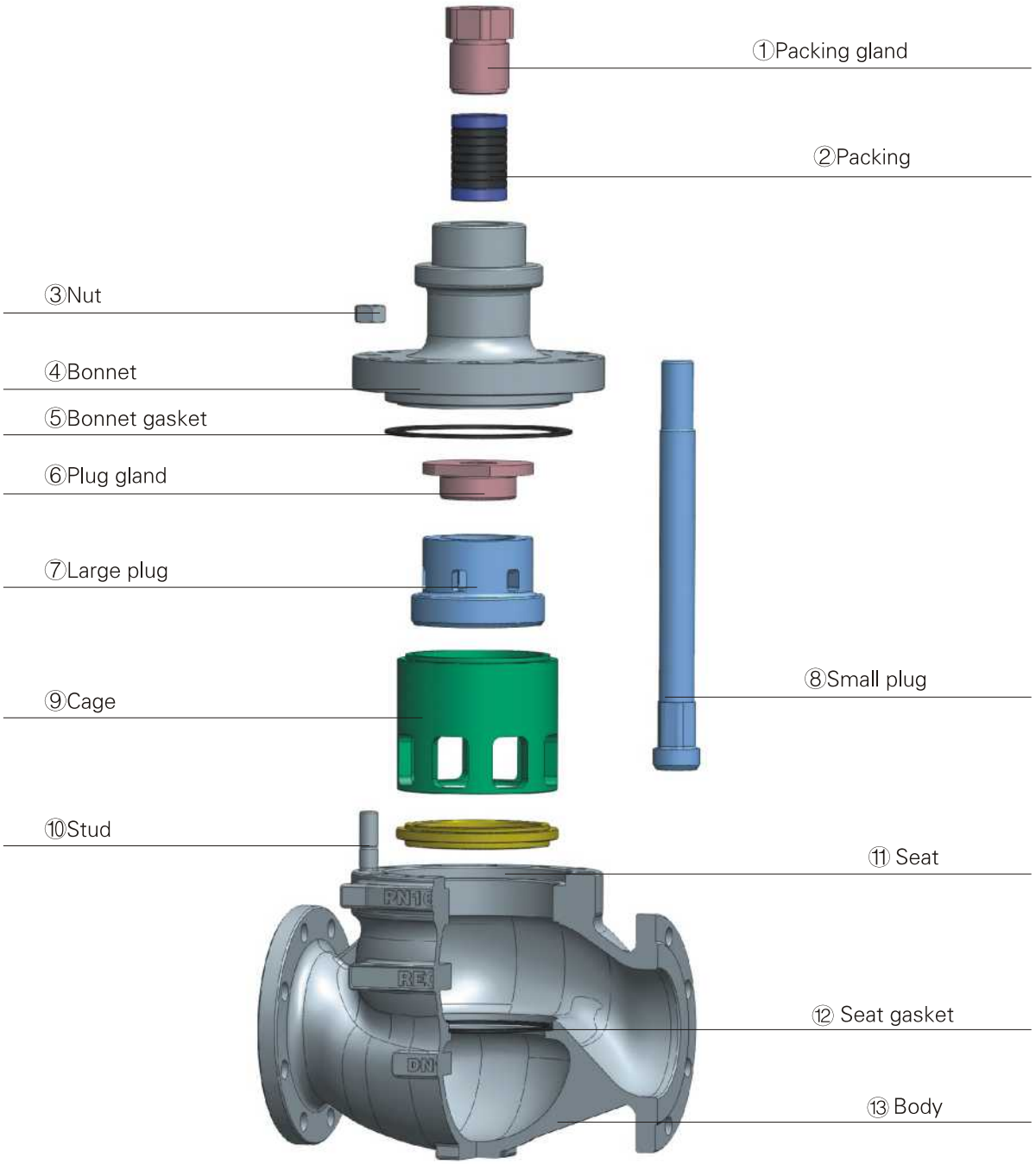
▲ Outline

The 10Q Series unbalanced shut–off valve adopts top guided pressure unbalanced plug. It is suitable for applications with low differential pressure. The plug and seat surfaces are subjected to hard alloy overlay welding to ensure long–time stable running of the valve. For shut–off applications of media of high temperature and service conditions with high differential pressure, we have specially designed the double–plug pressure relief type shut–off valve. The trim of this kind of valve adopts double–plug structure with flow to off design. When opening the valve, first open the small plug, and the starting force is relatively low because the area of thrust surface of the small plug is small. After the small plug is opened, the pressure after the valve is released and the differential pressure acting on the large plug is greatly reduced. The large plug can be opened with a relatively low actuator force. The trim of this kind of structure can meet the need for shut–off applications in service conditions with high differential pressure.

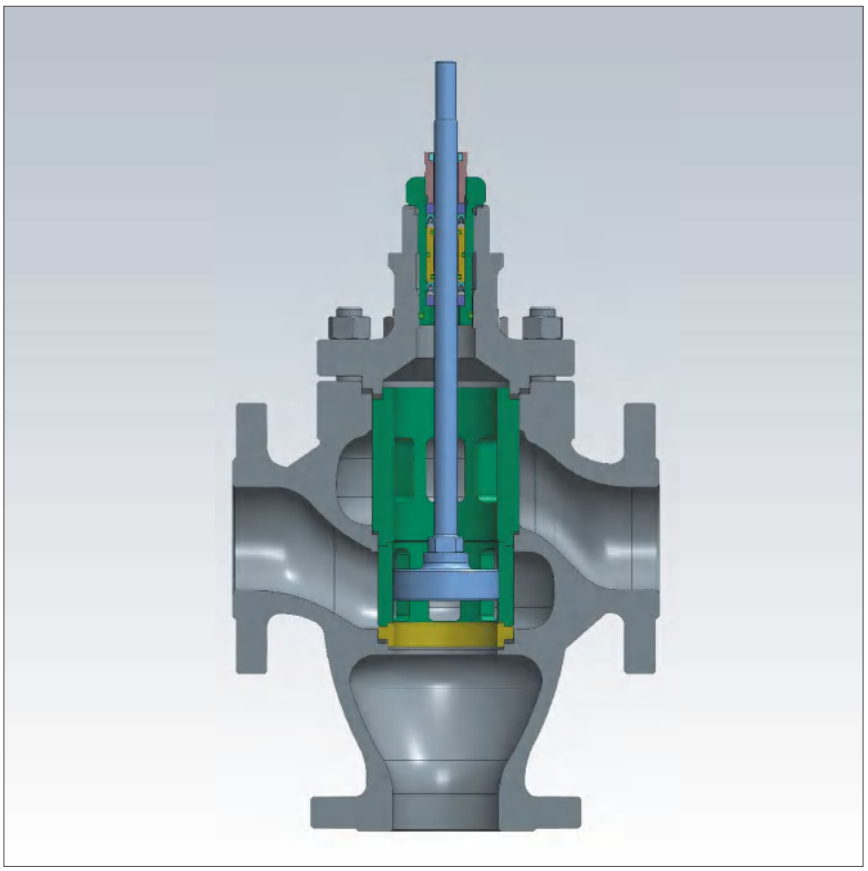
▲ Parameters of control valves:

Trim features:	sleeve guided type, balanced trim structure, with balanced seal ring structure
Body type:	straight–through type, angle type。
Bonnet type:	cryogenic type, bellows
Flow characteristic:	Fast opening characteristic
Shut–off class:	ASME B16.104 VI (standard metal seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–196℃ – 570℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶ Exploded view of 10Q Series



▶ 13H/F Series control valve



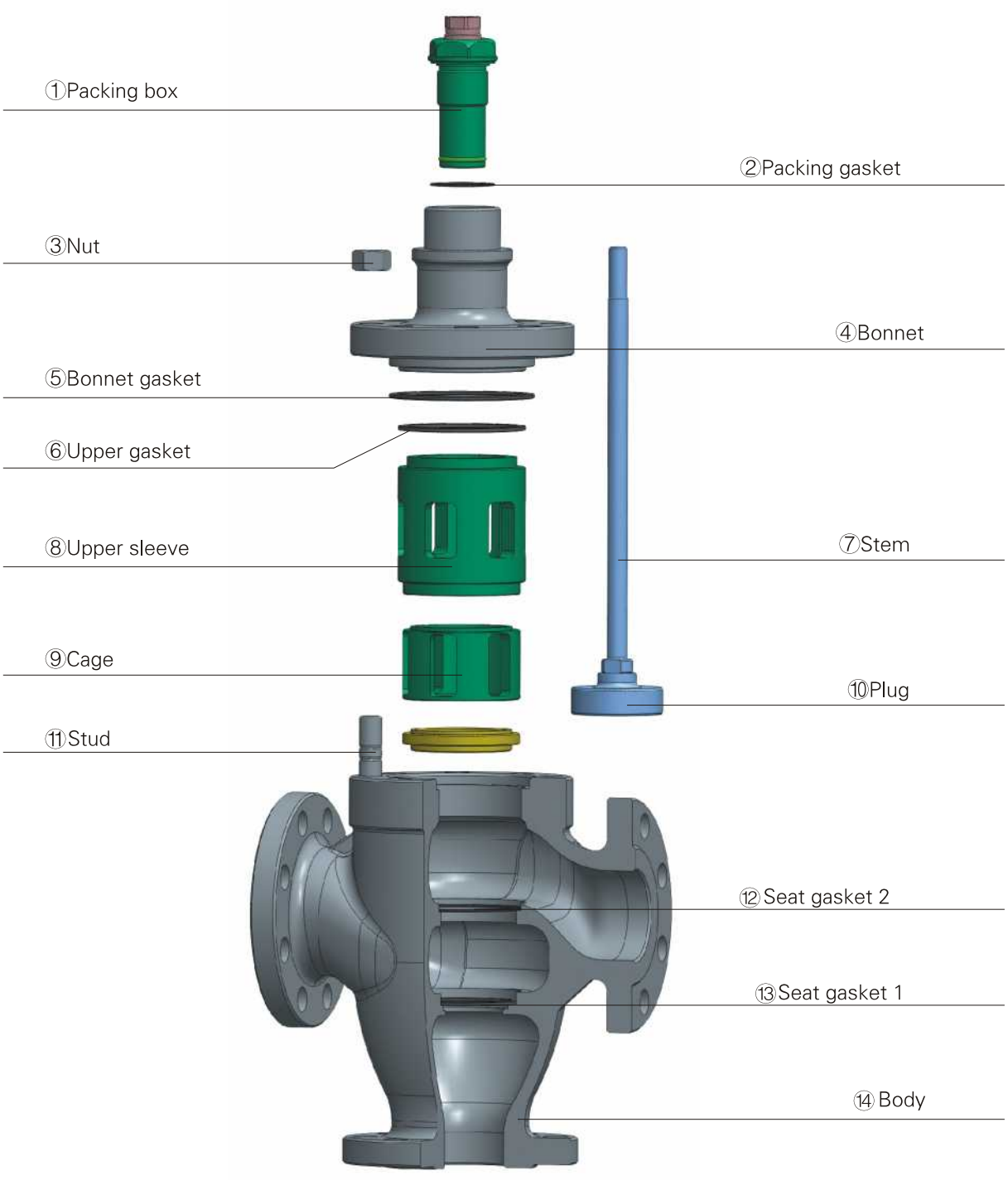
▲ Outline

The 13H/F Series three–way converging/diverging control valve adopts the top guided pressure unbalanced plug. It is mainly used for converging or diverging media of several flow channels. Entering from two channels and exiting from one channel is called three–way converging, and conversely, entering from one channel and exiting from two channels is called diverging. The three–way valve can also play the pipe shut–off and opening function. The standard converging/diverging design is the unbalanced double–seat trim structure. In addition, special cages with noise reduction and anti–cavitation functions can also be designed according to the service conditions.

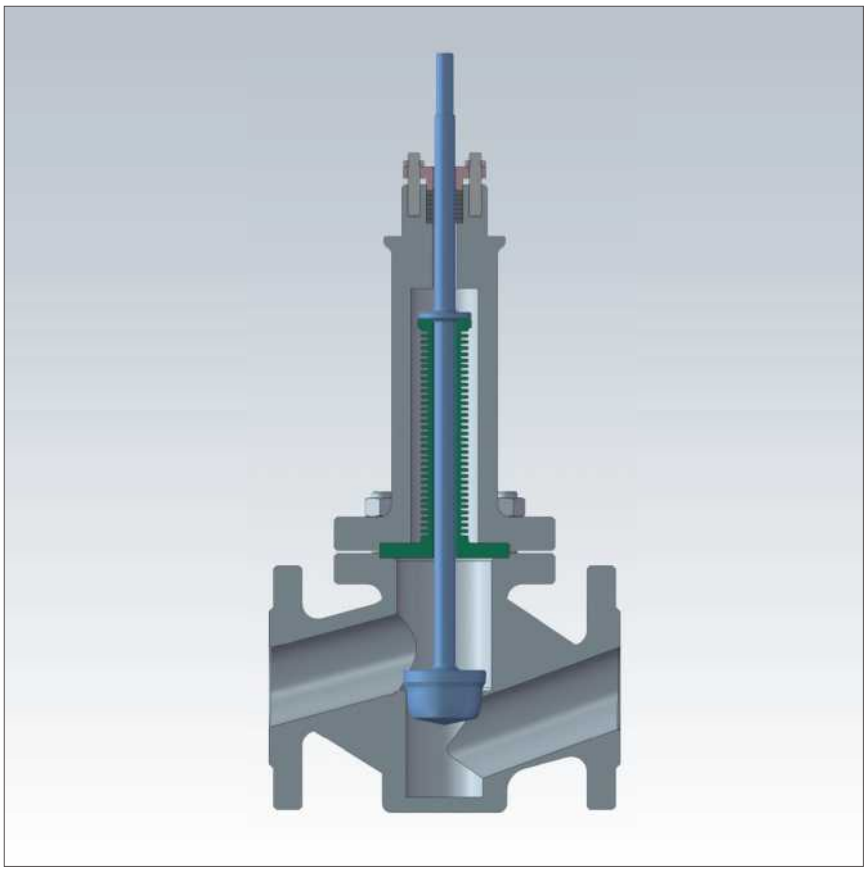
▲ Parameters of control valves:

Trim features:	Double–seat sleeve guided
Body type:	three–way type
Bonnet type:	standard type, heat dissipation type, cryogenic type, bellows
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 IV (standard metal seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–196℃ – 560℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶ Exploded view of 13H/F Series



▶ 10PF Series control valve



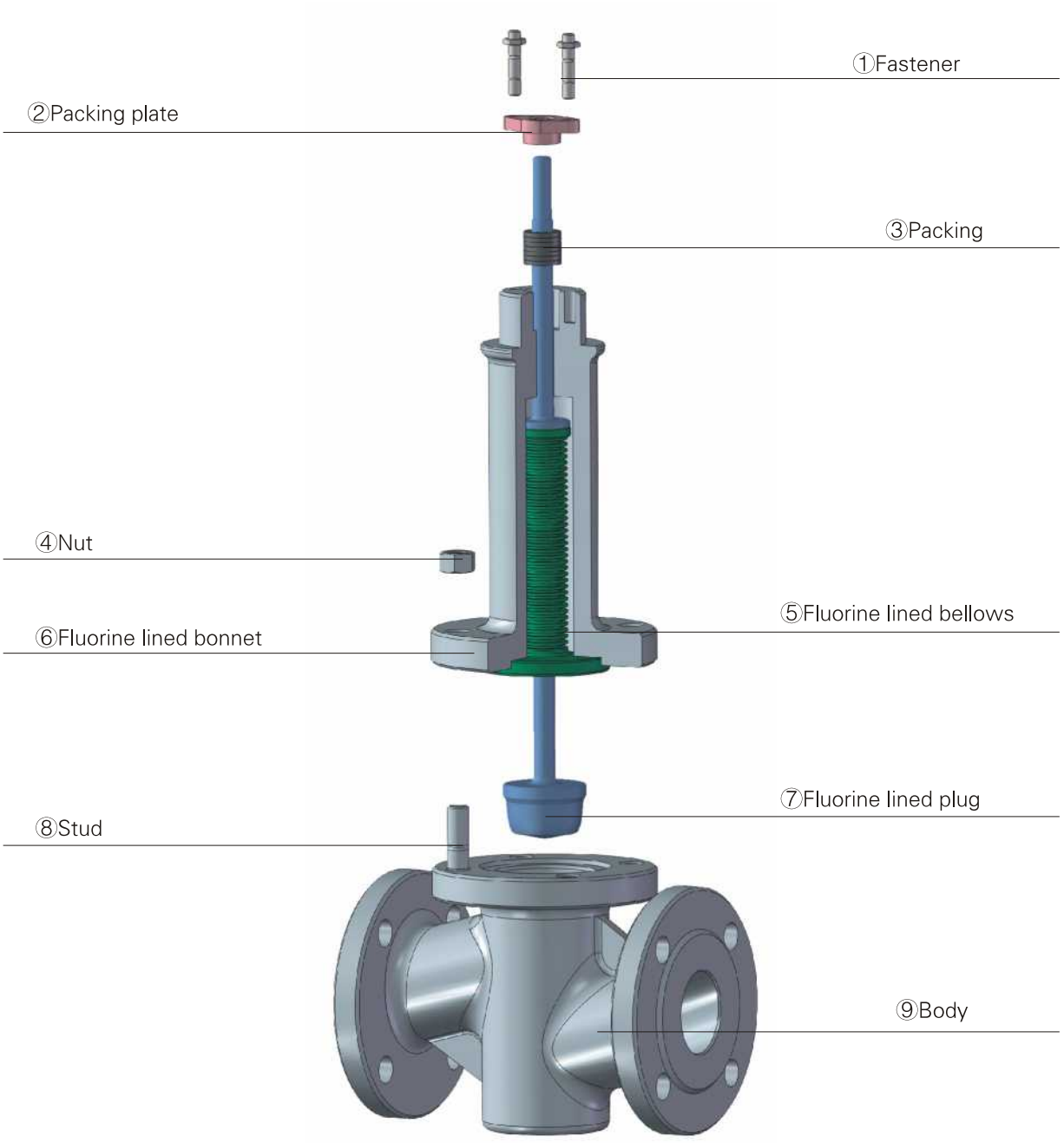
▲ Outline

The 10PF Series linear motion single–seat lined control valve adopts full fluorine lined body and trim structure to effectively prevent the corrosion of metal materials in the valve by corrosive media. The metal body cavity is subjected to serrated machining treatment so as to make the lining materials fully fit into the metal and prolong the service life and performance of lining materials. The stem seal is the compound seal of F46 bellows seal and V PTFE packing, which can eliminate the possibility of media leaking from the stem to the outside. The unbalanced full lined control valve is especially suitable for very corrosive media under low pressure and normal temperature service conditions.

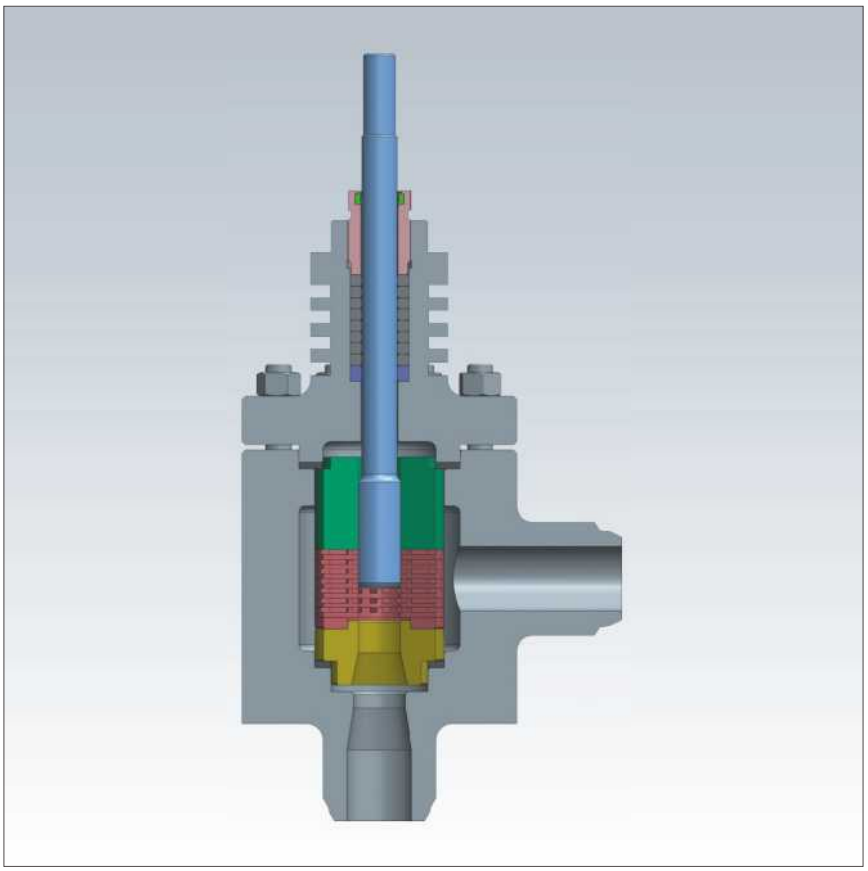
▲ Parameters of control valves:

Trim features:	unbalanced plug, lined seat, bellows stem seal
Body type:	straight–through type
Bonnet type:	standard type, bellows type
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V
Pipe connection type:	flange type
Applicable temperature range:	–45℃ – 150℃
Actuator type:	pneumatic diaphragm actuator
	pneumatic piston actuator
	Electric actuator

▶ Exploded view of 10PF Series

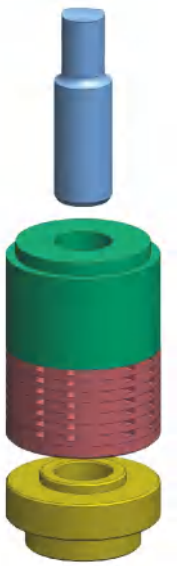


▶ 10M Series control valve (unbalanced trim)



▲ Outline

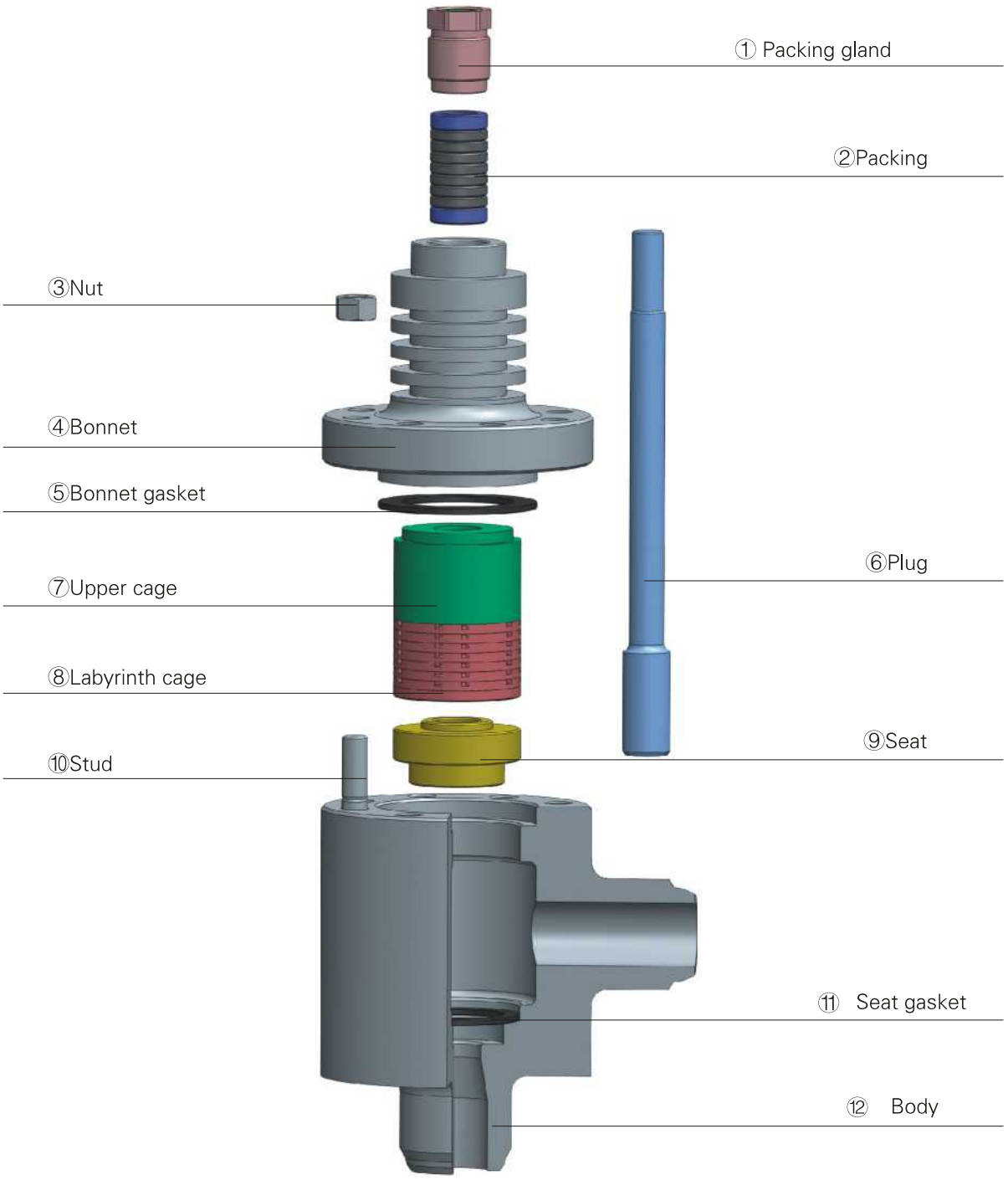
The 10M Series unbalanced labyrinth control valve adopts the labyrinth cage and unbalanced trim design. The labyrinth sleeve is composed of cylindrical discs with many coaxially distributed labyrinths. According to different technological parameters of the media, different labyrinth specifications and piling layers are designed to form the cage and the cage divides the whole flow channel into several tiny circuitous or step flow channels, forcing the fluids to continuously change the flow direction and flowing area and gradually reducing the pressure of fluids, so as to prevent the occurrence of flash evaporation and cavitation and prolong the service life of the trim. The unbalanced single–seat is adopted. The trim is suitable for service conditions under which blocked flow will easily be produced and cavitation will be caused. The unbalanced trim is suitable for applications of small sizes and high temperature.



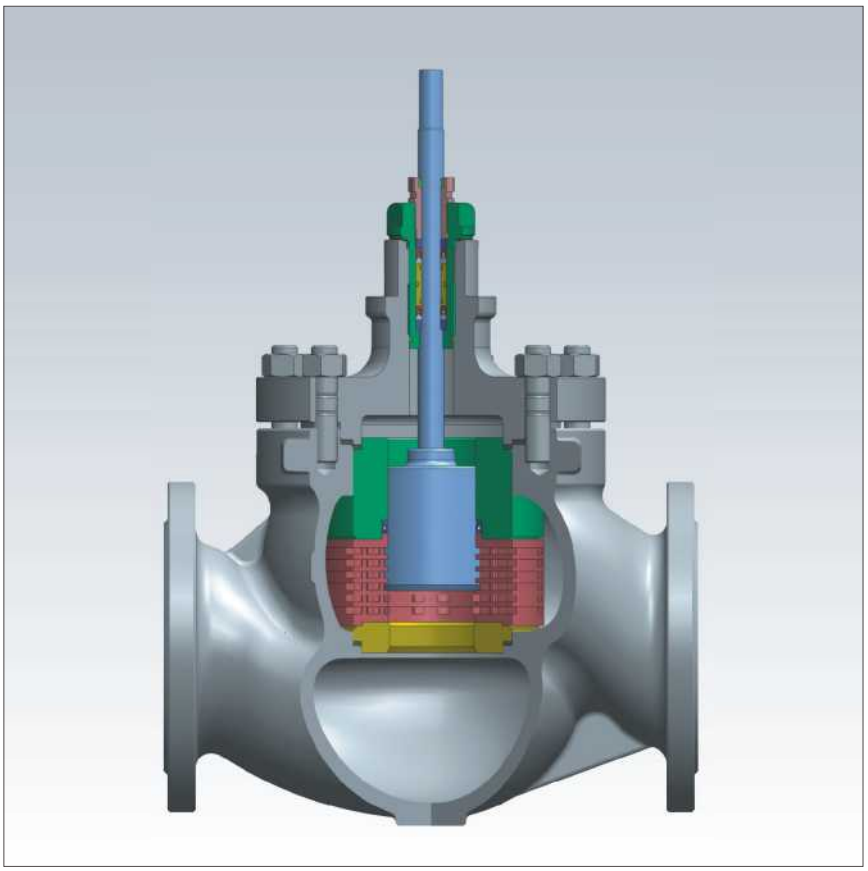
▲ Parameters of control valves:

Trim features:	sleeve guided unbalanced trim structure, labyrinth disc cage combination
Body type:	straight–through type, angle type,。
Bonnet type:	standard type, heat dissipation type, cryogenic type。
Flow characteristic:	equal percentage, linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat) ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, butt welding type
Applicable temperature range:	–196℃ – 570℃
Actuator type:	pneumatic diaphragm actuator pneumatic piston actuator Electric actuator

▶ Exploded view of 10M Series (unbalanced trim)



▶ 10M Series control valve



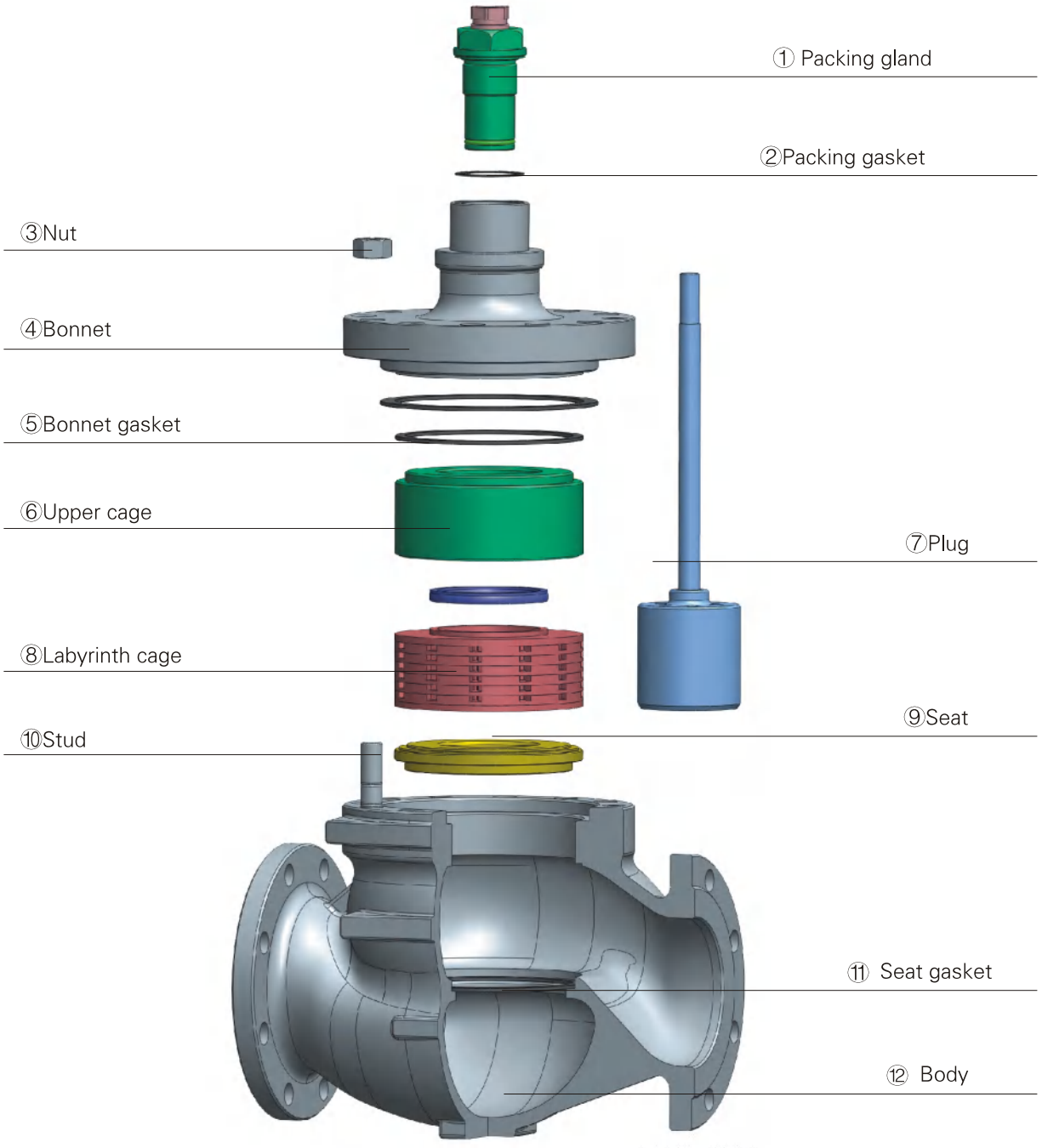
▲ Outline

The 10M Series balanced labyrinth control valve adopts the labyrinth cage and balanced plug design. The labyrinth sleeve is composed of cylindrical discs with many coaxially distributed labyrinths. According to different technological parameters of the media, different labyrinth specifications and piling layers are designed to form the cage and the cage divides the whole flow channel into several tiny circuitous or step flow channels, forcing the fluids to continuously change the flow direction and flowing area and gradually reducing the pressure of fluids, so as to prevent the occurrence of flash evaporation and cavitation and prolong the service life of the trim. The balanced sleeve plug is adopted. The closely fit plug and seat ensure very low leakage. The trim is suitable for service conditions under which blocked flow will easily be produced and cavitation will be caused.

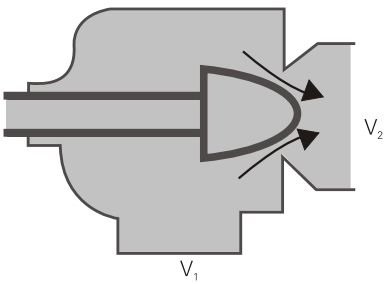
▲ Parameters of control valves:

Trim features:	sleeve guided type, balanced trim structure
Body type:	straight–through type, angle type。
Bonnet type:	standard type, heat dissipation type, cryogenic type。
Flow characteristic:	equal percentage, Linear, quick open
Shut–off class:	ASME B16.104 V (standard metal seat)
	ASME B16.104 VI (shut–off soft seat)
Pipe connection type:	flange type, Butt welding type
Applicable temperature range:	–30℃ – 260℃ (single–seat structure)
	–196℃ – 570℃(double–seat structure)
Actuator type:	pneumatic diaphragm actuator
	pneumatic piston actuator
	Electric actuator

▶ Exploded view of 10M Series



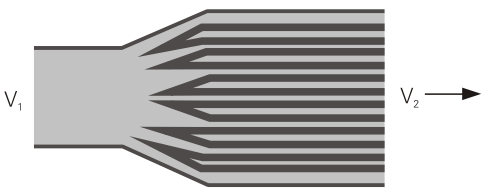
▶ Control principle of labyrinth control valve



$V_2=\sqrt{2gh}$

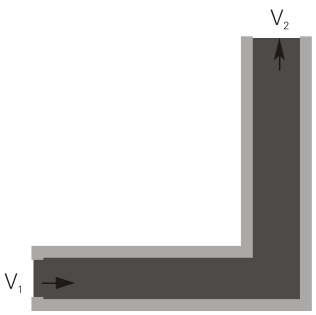
$v_2 > V_1$

Figure 1: single–stage pressure drop



$V_2=V_1$

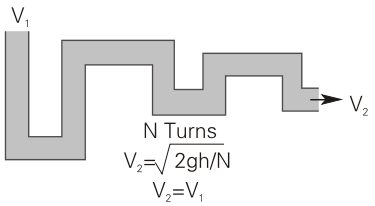
Figure 2: multiple flow channels pressure drop



$V_2=\sqrt{2gh}$

$V_2=V_1$

Figure 3: labyrinth flow channel



$V_2=\sqrt{2gh/N}$

$V_2=V_1$

Figure 4: labyrinth multi–stage pressure drop

▲ The labyrinth flow channel can realize control of flow velocity

The labyrinth control valve can prevent the plug from producing high flow velocity and ensure the final control effect: The medium pressure and flow velocity can be effectively controlled during the whole travel of the valve. The labyrinth cage scatters the fluids into several split flow to reduce the flow velocity as much as possible (figure 2). Each fluid channel is composed of specific quantities of right–angled bends that form the labyrinth flow channels (figure 3). During the process, each bend will reduce the flow velocity of the flowing media to a certain extent.
The bend number N is the number that is required for scattering the maximum differential pressure in the plug (figure 4). See the following formulas:

$$V2(Hole)=\sqrt{2gh}$$

A new formula is obtained.

$$V2(10M)^{®}=\sqrt{2gh/N}$$

▲ Speed control principle of labyrinth control valve

The valve that is damaged by cavitation, flash evaporation, vibration and noise produced by the media that passes through the valve at a high flow velocity is the main cause that leads to failure of control in the system.
Even if the valve is not damaged, bad process control caused by too high noise and severe vibration will lower product performance and influence the running capacity of the equipment.
Based on the principle of fluid mechanics, the labyrinth control valve adopts speed control principle and technology and makes use of multi–stage pressure drop to eliminate cavitation, flash evaporation, vibration, noise, etc., providing overall system control solutions for many different application fields.
Under severe service conditions, bad performance of valves is caused by too high flow velocity. The maximum flow velocity of the fluids in the valve always occurs at the throttling face (figure 1) which is at the downstream side of the restriction orifice of the plug. Even if materials of relatively high hardness are used in the valve to control the damage caused by cavitation, only a small amount of faults in the valve caused by too high flow velocity of the media can be eliminated. The flow velocity of media in all valves must be controlled so as to maintain the performance and reliability of the valves.

▶ Cavitation cause and solution

▲ Cause of cavitation

When the fluid pressure is reduced to the saturated vapor pressure or lower, flash evaporation or bubbles will occur. In most control valves (figure 5), the inlet pressure is P1, velocity is V1. When the fluid passes through the plug necking area, the velocity is increased to Vvc. According to the principle of conservation of energy, the fluid pressure suddenly drops to Pvc. When Pvc is equal to or less than the liquid saturated vapor pressure Pv, the liquid will be gasified and bubbles will be produced, so that flash evaporation occurs.
After the fluid passes through the plug, the pressure starts to be restored and the kinetic energy is transferred into potential energy again. When the pressure is restored to the downstream pressure, which is expressed as P2 and the velocity is V2. When the restored pressure exceeds the saturated vapor pressure Pv, the bubbles formed will be broken and cavitation will occur. This kind of energy release will increase the partial stress to be above 200000PSI (1400MPa) and the stress will rapidly destroy the solid plug.

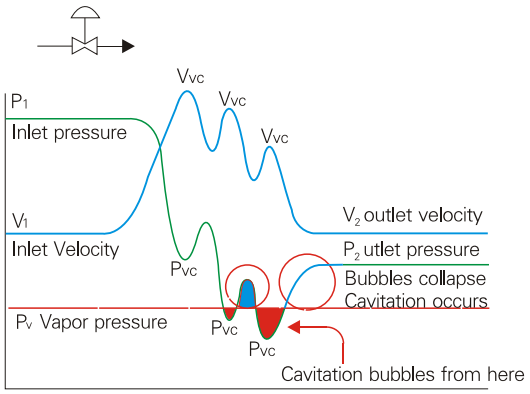


Figure 5: Cause of Cavitation

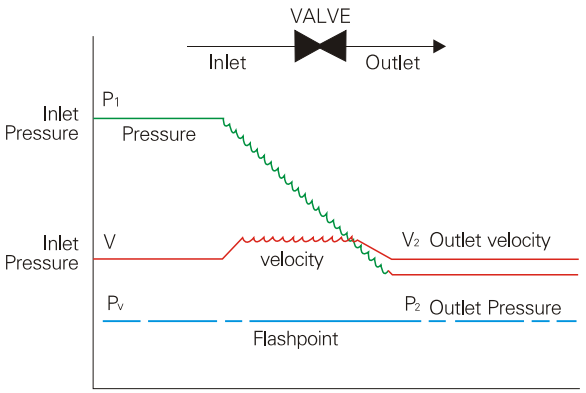


Figure 6: cavitation effectively solved by the labyrinth cage

▲ Solution to cavitation

The labyrinth control valve can effectively eliminate the damage caused by failure of control of fluid velocity.
First, the fluids are scattered into many small flow channels. Thus, even the bubbles are formed, their volume is very small and the energy is not sufficient to produce stress that can damage materials. Secondly, the flow velocity is maintained at the lowest level. Thus, the partial pressure will not be reduced to be lower than the fluid vaporizing pressure. Therefore, cavitation will not occur.
The damage caused by cavitation is a typical signal that indicates failure of control of flow velocity. As is mentioned above, the adoption of materials of high hardness, insulating sleeve or downward orifice will only eliminate a small amount of faults in the valve caused by cavitation. The high flow velocity will cause cavitation and damage the plug, and the solution to cavitation is to adopt the labyrinth cage as shown in figure 6.
According to the fluid evaporation pressure, the flow velocity can be achieved through the following formulas:

$V=\sqrt{4637(P_2-P_v)/P}$ Metric or $V=\sqrt{1000(P_2-P_v)/P}$ English

▶ Design of labyrinth disc

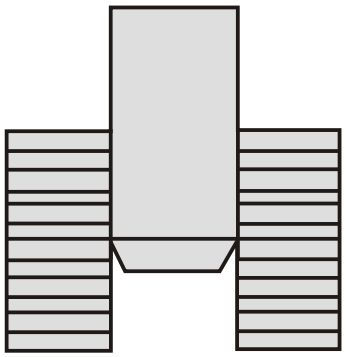


Figure 7: multi–layer labyrinth group

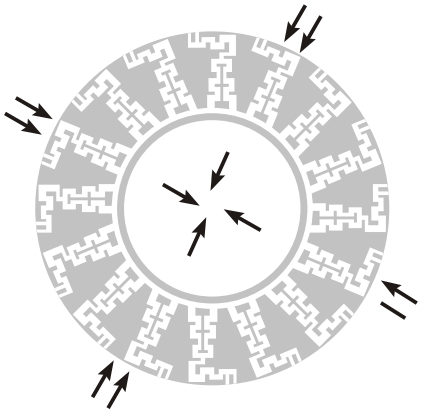


Figure 8: labyrinth disc

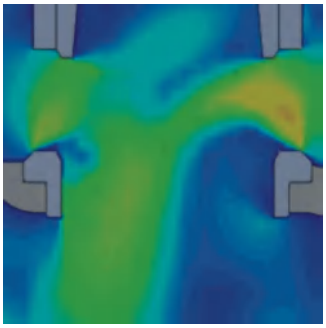
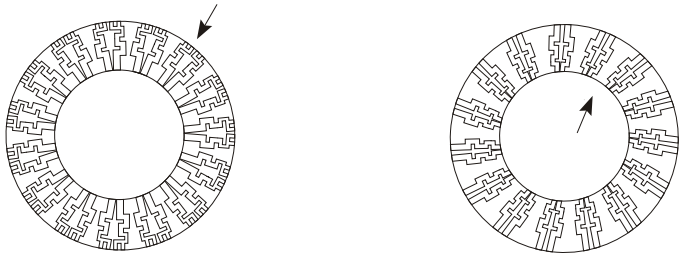


Figure 9: CFD fluid analysis

▲ Selection of flow direction of labyrinth control valve

For liquid media, the flow direction is side–in and bottom–out. For gas and steam media, the flow direction is bottom–in and side–out. This is because that the liquid is an incompressible fluid. By adopting side–in and bottom–out, the high speed liquids at the exits of all flow channels of labyrinth discs will carry out mutual collision on the central axis of the labyrinth sleeve, counteract their energy and form buffer cushion, so as to further lower flow velocity and reduce the erosion of the valve and trim by high speed liquids. The high differential pressure gas and steam are compressible fluids. After pressure drop by the labyrinth discs, the volume expands sharply. This requires that the flow cross–sectional area at the exit should be higher than that at the inlet. Therefore, the flow direction shall be bottom–in and side–out. Otherwise, the pressure drop effect will be influenced.



(B) Gas and steam flow direction: bottom–in and side–out

▲ Design of labyrinth disc of labyrinth control valve

Determine the bend number N and select the number to ensure the flow velocity when the fluid flows out of the flow passage. Each cage forms multi–layer labyrinth groups (figure 7) by adopting special technology. The labyrinth discs are processed into several flow channels similar to the labyrinth through special forming technology (figure 8). According to different service conditions, after precise calculation and in combination with CFD flow filed analysis (figure 9), each flow channel is designed with a series of right–angled bends of specific quantity to provide resistance for media and reduce the velocity stably. The technology can fully control the velocity of media in all channels of labyrinth discs, so that the media can flow at the controllable velocity within the whole range. To achieve the flow characteristic required by the system, a labyrinth group shall be composed of 3 kinds of labyrinth discs. To meet the requirements of high differential pressure and small flow, the discs at the bottom shall have few flow channels and many bends. The middle labyrinth discs shall have medium flow channels. To meet the requirements of low differential pressure and large flow, the discs at the top shall have many flow channels and few bends. The resistance, quantity and area of all flow channels in the labyrinth control valve can be customized according to the specific applications so as to control flow velocity, eliminate cavitation, flash evaporation, vibration, noise and etc. that occur during the use of fluids.

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▶ 100 series rated CV and stroke

Table 1 Rated CV value and travel of control valve

Valve size mm	Valve size mm	Rted CV EQ%	Rted CV Linear	Stroke mm
20	6	0.28	--	16
	7	0.52		16
	8	0.96	--	16
	9	1.6	--	16
	10	2.5	--	16
	15	4	--	16
	20	8	10	16
25	6	0.28	--	16
	7	0.52	--	16
	8	0.96	--	16
	9	1.6	--	16
	10	2.5	--	16
	15	4	--	16
	20	8	10	16
	25	13	16	16
32	32	20	25	16
40	40	30	35	25

Valve size mm	Valve size mm	Rted CV EQ%	Rted CV Linear	Stroke mm
50	50	46	55	25
65	65	75	85	40
80	80	110	135	40
100	100	185	210	40
125	125	280	310	60
150	150	365	425	60
200	200	650	700	60
250	250	960	1050	100
300	300	1300	1500	100
350	350	1600	1900	130
400	400	1800	2000	130
450	450	2250	2450	130

Table 2 Rated CV value and travel of three-way valve

Valve size mm	Valve size mm	Rted CV EQ%	Rted CV Linear	Stroke mm
1(25)	5/8(16)	6.3	8	16
	3/4(20)	10	13	16
1.5(40)	1(25)	17	20	25
	1.25(32)	25	30	25
2(50)	1.25(32)	25	30	25
	1.5(40)	36	40	25
3(80)	2(50)	60	70	40
	2.5(65)	100	115	40
4(100)	2.5(65)	100	115	40
	3(80)	135	150	40
6(150)	4(100)	190	215	60
	5(125)	280	315	60

Valve size mm	Valve size mm	Rted CV EQ%	Rted CV Linear	Stroke mm
8(200)	6(150)	410	435	60
	7(175)	500	550	60
10(250)	7(175)	500	550	100
	8(200)	650	735	100
12(300)	8(200)	650	735	100
	10(250)	950	1050	100
14(350)	10(250)	950	1050	100
	12(300)	1300	1400	100
16(400)	12(300)	1300	1400	100
	14(350)	1600	1900	130
18(450)	14(350)	1600	1900	130
	16(400)	1800	2000	150

▶ Maximum allowable pressure differential—10P series control valve

The actuator is L1000 Series diaphragm actuator — **Maximum allowable differential pressure (unit: Mpa)**

Action type	Actuator Size	supply Kpa G	Spring range Kpa G	Plug size (seat diameter) mm										
				20	25	32	40	50	65	80	100	125	150	200
Air to open	L102	320	80–240	5.87	3.45	1.85								
		140	20–100	0.51	0.35	0.23								
	L103	320	80–240	6.08	3.68	2.46	1.76	1.11						
		140	20–100	0.97	0.7	0.45	0.31	0.19						
	L104	320	80–240	9.34	6.77	4.54	3.26	2.06	1.37	0.98	0.57			
		140	20–100	2.04	1.46	0.97	0.69	0.42	0.27	0.19	0.1			
	L105	320	80–240	--	9.91	7.2	5.72	3.63	2.43	1.74	1.01	0.66	0.46	0.24
		140	20–100	--	2.71	1.81	1.29	0.81	0.53	0.37	0.21	0.13	0.09	0.03
Air to close	L102	320	80–240	6.45	3.8	2.03								
		140	20–100	0.56	0.38	0.25								
	L103	320	80–240	6.71	4.04	2.7	1.93	1.21						
		140	20–100	1.07	0.77	0.49	0.34	0.21						
	L104	320	80–240	10.27	7.45	4.85	3.58	2.26	1.51	1.08	0.63			
		140	20–100	2.24	1.61	1.06	0.76	0.46	0.29	0.21	0.11			
	L105	320	80–240	--	10.9	7.9	6.29	3.85	2.67	1.91	1.1	0.71	0.5	0.26
		140	20–100	--	2.91	1.9	1.3	0.85	0.55	0.39	0.23	0.15	0.1	0.031

The actuator is 361L electronic actuator. — **Maximum allowable differential pressure (unit: Mpa)**

Actuator specification	Output force (KN)	Plug specification (mm)													
		≤10	15	20	25	32	40	50	65	80	100	125	150	200	250	300
361LSA–08	0.8	3.00	1.50	1.16	0.84	0.55	0.38	0.24	--	--	--	--	--	--	--	--
361LSA–20	2.0	9.30	4.92	3.70	2.66	1.80	1.26	0.80	--	--	--	--	--	--	--	--
361LSA–30	3.0	9.50	7.50	5.60	4.10	2.73	1.90	1.23	0.82	0.58	0.34	--	--	--	--	--
361LSA–50	5.0	--	--	--	7.00	4.72	3.38	2.15	1.44	1.02	0.59	0.38	0.26	--	--	--
361LSA–65	6.5	--	--	--	--	--	--	2.90	1.90	1.35	0.80	0.51	0.35	--	--	--
361LSA–100	10.0	--	--	--	--	--	--	--	3.00	2.10	1.20	0.80	0.56	0.28	--	--
361LSA–160	16.0	--	--	--	--	--	--	--	--	--	--	1.28	0.90	0.44	0.35	0.29

The actuator is PSL electronic actuator. — **Maximum allowable differential pressure (unit: Mpa)**

Actuator specification	Output force (KN)	Plug specification (mm)														
		≤10	15	20	25	32	40	50	65	80	100	125	150	200	250	300
PSL201	1.0	3.50	2.29	1.61	1.15	0.71	0.47	0.30	--	--	--	--	--	--	--	--
PSL202	2.0	9.330	4.92	3.70	2.66	0.80	1.26	0.80	--	--	--	--	--	--	--	--
PSL204	4.5	--	--	--	6.66	4.45	3.17	1.98	1.30	0.85	0.48	--	--	--	--	--
PSL206.1	8.0	--	--	--	10.00	8.19	5.87	3.71	2.46	1.64	0.95	0.59	0.38	--	--	--
PSL210	10.0	--	--	--	--	--	--	--	3.00	2.10	1.20	0.80	0.56	0.28	--	--
PSL312	12.0	--	--	--	--	--	--	--	3.79	2.54	1.48	0.93	0.67	0.34	--	--
PSL314	14.0	--	--	--	--	--	--	--	--	--	--	1.10	0.80	0.40	--	--
PSL320	20.0	--	--	--	--	--	--	--	--	--	--	1.61	1.17	0.59	--	--
PSL325	25.0	--	--	--	--	--	--	--	--	--	--	--	--	--	0.58	0.48

Note: When selecting the detailed electric actuator model, please confirm it with the technology department or sales departmentof our company.

Automation Instrument

▶ Maximum allowable pressure differential, 10T/G series control valve

The actuator is L1000 Series diaphragm actuator — **Maximum allowable differential pressure (unit: Mpa)**

Action type	Actuator Size	supply Kpa G	Spring range Kpa G	Plug size (seat diameter) mm										
				40	50	65	80	100	125	150	200	250	300	350
Air to open	L103	320	80–240	6.11	5.1									
		140	20–100	1.05	0.92									
	L104	320	80–240	––	6.3	6.1	5.16	4.19						
		140	20–100	2.75	1.85	1.15	0.86	0.59						
	L105	320	80–240	––	––	––	––	6.3	5.28	4.51	3.35			
		140	20–100	––	––	2.25	1.8	1.5	0.92	0.71	0.39			
	L106	320	80–240	––	––	––	––	––	––	––	6.3	4.35	3.69	3.14
		140	20–100	––	––	––	––	––	2.2	1.8	1.3	0.71	0.51	0.38
Air to close	L103	320	80–240	6.7	5.6									
		140	20–100	1.15	1.1									
	L104	320	80–240	––	6.9	10.5	8.5	4.51						
		140	20–100	2.91	1.95	1.25	1.3	0.62						
	L105	320	80–240	––	––	––	––	6.3	5.72	4.91	3.65			
		140	20–100	––	––	2.45	1.9	1.65	1	0.78	0.42			
	L106	320	80–240	––	––	––	––	––	––	––	6.9	4.75	3.91	3.45
		140	20–100	––	––	––	––	––	2.3	1.9	1.4	0.78	0.56	0.45

The actuator is 361L electronic actuator. — **Maximum allowable differential pressure (unit: Mpa)**

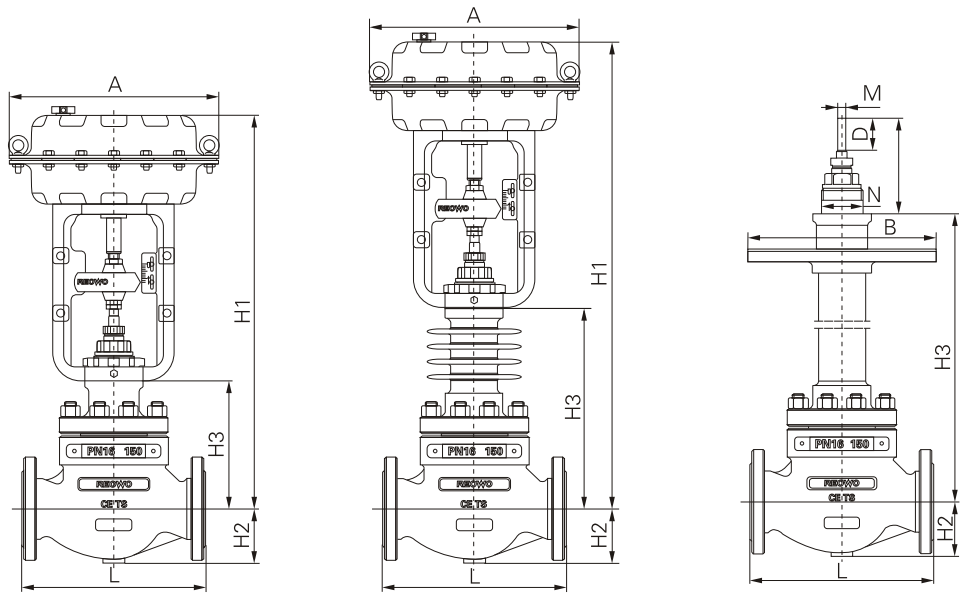
Actuator specification	Output force (KN)	Plug specification (mm)											
		40	50	65	80	100	125	150	200	250	300	350	400
361LSA–08	0.8	2.0	1.2	––	––	––	––	––	––	––	––	––	––
361LSA–20	2.0	5.1	3.0	––	––	––	––	––	––	––	––	––	––
361LSA–30	3.0	10.0	7.9	––	––	––	––	––	––	––	––	––	––
361LSA–50	5.0	10.0	10.0	10.0	10.0	6.8	4.7	2.8	––	––	––	––	––
361LSA–65	6.5	––	––	10.0	10.0	10.0	6.8	5.5	––	––	––	––	––
361LSA–100	10.0	––	––	––	––	––	10.0	10.0	7.3	5.3	3.4	2.5	1.9
361LSA–150	16.0	––	––	––	––	––	––	––	10.0	8.5	5.4	4.0	3.0

The actuator is PSL electronic actuator. — **Maximum allowable differential pressure (unit: Mpa)**

Actuator specification	Output force (KN)	Plug specification (mm)											
		40	50	65	80	100	125	150	200	250	300	350	400
PSL201	1.0	2.6	1.8	––	––	––	––	––	––	––	––	––	––
PSL202	2.0	5.1	3.0	––	––	––	––	––	––	––	––	––	––
PSL204	4.5	10.0	10.0	9.1	7.10	5.6	––	––	––	––	––	––	––
PSL206.1	8.0	––	––	10.0	10.0	10.0	––	––	––	––	––	––	––
PSL210	10.0	––	––	––	––	––	10.0	10.0	7.3	5.3	3.4	2.5	1.9
PSL312	12.0	––	––	––	––	––	10.0	10.0	8.3	6.2	4.0	2.9	2.2
PSL314	14.0	––	––	––	––	––	––	––	9.5	7.3	4.9	3.5	2.6
PSL320	20.0	––	––	––	––	––	––	––	10.0	10.0	10.0	6.7	4.7
PSL325	25.0	––	––	––	––	––	––	––	10.0	10.0	10.0	8.3	5.9

Note: When selecting the detailed electric actuator model, please confirm it with the technology department or sales departmentof our company.

Size table

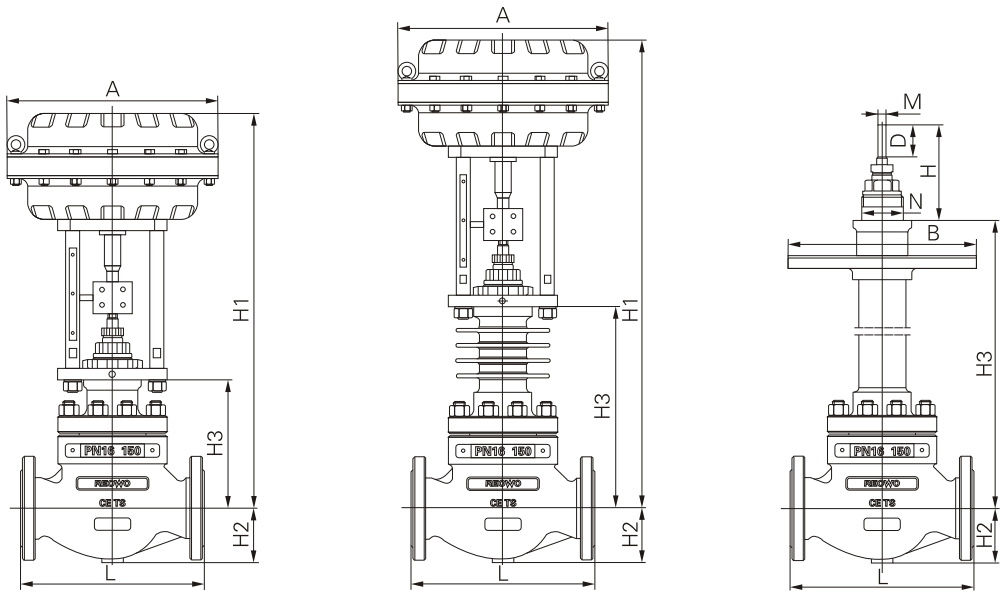


Equipped with pneumatic diaphragm actuator

Valve Size (mm)	L			H2	A (Φ)	Standard		Heat dissipation		Extended		Actuator connection dimensions			
	ANSI 150 PN1.6	ANSI 300 PN4.0	ANSI 600 PN6.4			H3	H1	H3	H1	H1 H3=800	B (Φ)	H	D	N	M
20	184	194	206	52	290	131	477	266	612	1226	290	130	40	M56X2	M12X1.25
25	184	197	210	52	290	131	477	266	612	1226	290	130	40	M56X2	M12X1.25
32	200	210	220	55	290	146	492	281	627	1226	290	130	40	M56X2	M12X1.25
40	222	235	251	66	290	170	538	303	671	1246	335	130	40	M56X2	M12X1.25
50	254	267	286	76	290	177	545	312	680	1246	370	130	40	M56X2	M12X1.25
65	276	292	311	93	365	218	660	343	785	1367	410	130	45	M68X2	M16X1.5
80	298	317	337	100	365	225	667	350	792	1519	440	130	45	M68X2	M16X1.5
100	352	368	394	115	365	233	675	358	800	1519	490	130	45	M68X2	M16X1.5
125	403	425	460	130	475	285	870	440	1025	1536	560	160	50	M80X2	M20X1.5
150	451	473	508	145	475	300	885	455	1060	1536	630	160	50	M80X2	M20X1.5
200	543	568	610	185	475	334	920	489	1075	1536	760	160	50	M80X2	M20X1.5
250	673	700	770	235	590	475	1245	675	1445	--	--	180	50	M90X2	M22X1.5
300	737	775	819	240	590	490	1260	690	1460	--	--	180	50	M90X2	M22X1.5

Automation Instrument

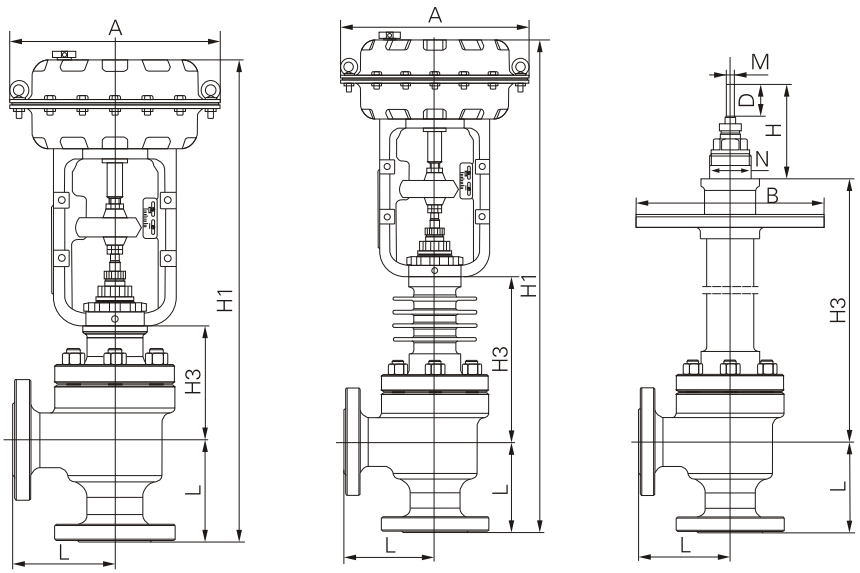
▶ Size table



Equipped with cylinder actuator

Valve Size (mm)	L			H2	A (Φ)	Standard		Heat dissipation		Extended		Actuator connection dimensions			
	ANSI 150 PN1.6	ANSI 300 PN4.0	ANSI 600 PN6.4			H3	H1	H3	H1	H1 H3=800	B (Φ)	H	D	N	M
20	184	194	206	52	290	131	526	266	661	1226	290	130	40	M56X2	M12X1.25
25	184	197	210	52	290	131	526	266	661	1226	290	130	40	M56X2	M12X1.25
32	200	210	220	55	290	146	541	281	676	1226	290	130	40	M56X2	M12X1.25
40	222	235	251	66	290	170	565	303	698	1246	335	130	40	M56X2	M12X1.25
50	254	267	286	76	290	177	572	312	707	1246	370	130	40	M56X2	M12X1.25
65	276	292	311	93	365	218	693	343	818	1367	410	130	45	M68X2	M16X1.5
80	298	317	337	100	365	225	700	350	825	1519	440	130	45	M68X2	M16X1.5
100	352	368	394	115	365	233	708	358	833	1519	490	130	45	M68X2	M16X1.5
125	403	425	460	130	475	285	930	440	1085	1536	560	160	50	M80X2	M20X1.5
150	451	473	508	145	475	300	945	455	1100	1536	630	160	50	M80X2	M20X1.5
200	543	568	610	185	475	334	979	489	1135	1536	760	160	50	M80X2	M20X1.5
250	673	700	770	235	590	475	1315	675	1515	--	--	180	50	M90X2	M22X1.5
300	737	775	819	240	590	490	1330	690	1530	--	--	180	50	M90X2	M22X1.5

Size table



Equipped with pneumatic diaphragm actuator

Valve Size (mm)	L			A (Φ)	Standard		Heat dissipation		Extended		Actuator connection dimensions			
	ANSI 150 PN1.6	ANSI 300 PN4.0	ANSI 600 PN6.4		H3	H1	H3	H1	H1 H3=800	B (Φ)	H	D	N	M
20	75	75	75	290	125	520	260	655	1301	290	130	40	M56X2	M12X1.25
25	75	75	75	290	125	520	260	655	1301	290	130	40	M56X2	M12X1.25
32	111	117	125	290	140	535	275	670	1301	290	130	40	M56X2	M12X1.25
40	111	117	125	290	149	616	319	786	1329	335	130	40	M56X2	M12X1.25
50	127	133	143	290	159	639	326	809	1354	370	130	40	M56X2	M12X1.25
65	138	146	156	365	188	780	388	980	1517	410	130	45	M68X2	M16X1.5
80	149	159	168	365	194	789	394	898	1517	440	130	45	M68X2	M16X1.5
100	176	184	197	365	234	854	413	1033	1517	490	130	45	M68X2	M16X1.5
125	200	--	--	485	270	1047	527	1307	1615	560	160	50	M80X2	M20X1.5
150	240	--	--	485	294	1071	554	1334	1615	630	160	50	M80X2	M20X1.5
200	300	--	--	485	331	1108	591	1371	1615	760	160	50	M80X2	M20X1.5

▶ Pneumatic actuator

The L1000 Series pneumatic actuator is a multi–spring diaphragm actuator with such features as light weight, small volume, stable output force, etc. Through acting on the diaphragm inside the actuator, the air supply conquers the reverse action force of the spring and makes upward and downward linear movement. When there is no air pressure, the compression spring releases pressure and pushes the push shaft of the actuator to move upwards or downwards. The actuators of this series can be classified into direct action type and reverse action type. According to different diaphragm effective areas and travels, the actuators include the following 5 specifications:

Diaphragm effective area (cm2)	Travel	Reverse action	Direct action
360	16	L112B/C	L122B/C
360	25	L113B/C	L123B/C
560	40	L114B/C	L124B/C
900	60	L115B/C	L125B/C
1400	100	L116B/C	L126B/C

The action principle of the L2000 linear motion multi–spring piston pneumatic actuator is the same as that of the multi–spring diaphragm actuator. But the L2000 Series actuator replaces the diaphragm by piston, which has solved the problems of the diaphragm actuator being unable to bear relatively high air pressure and easy ageing of the diaphragm, and the actuator can bear higher air pressure. The increase of the air pressure has enhanced the output force of the actuator. The standard configuration is single acting type. Double acting type actuator can also be designed according to the need.According to different piston diameters and travels,the actuators include the following 4 specifications:

Piston diameter	Travel	Reverse action	Direct action
210	25	L213B/C	L223B/C
270	40	L214B/C	L224B/C
365	60	L215B/C	L225B/C
460	100	L216B/C	L226B/C

▶ Hand operating mechanism

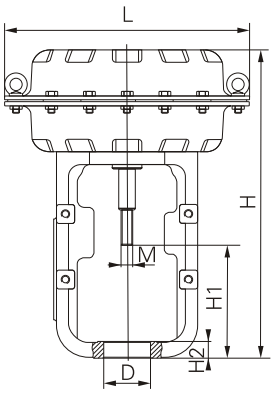
The C0 Series side mounted hand operating mechanism is designed according to the worm gear speed reducing principle. It is featured by exquisite appearance and small operating force. After the air supply is turned off at the site, the user can open or close the valve through rocking the handwheel. Compared with the top mounted handwheel, the side mounted handwheel has lower operating force. Therefore we firstly recommend users to use the side mounted handwheel.
According to different travels, we provide users with three kinds of side mounted hand operating mechanisms.

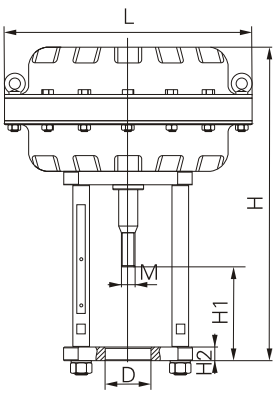
Model	Travel (mm)	Used for actuator
C2	16/25	L102/L103
C3	40	L104
C4	60	L105

The D0 Series top mounted hand operating mechanism adopts the T model thread inside it to transfer the axial movement. After the air supply is turned off at the site, the user can open or close the valve through rocking the handwheel. Compared with the side mounted handwheel, the top mounted handwheel has lower volume, but higher operating force. For valves with DN > 250, the top mounted hand operating mechanism adopts the bevel gear structure to open or close the valve in case of emergency.
According to different travels, we provide users with five kinds of top mounted hand operating mechanisms.

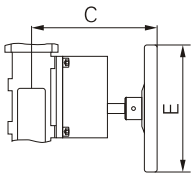
Model	Travel (mm)	Used for actuator
D2	16	L102
D3	25	L103
D4	40	L104
D5	60	L105
D6	100	L106

▶ Connection dimensions of pneumatic actuators

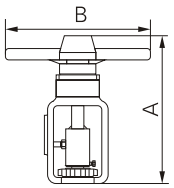




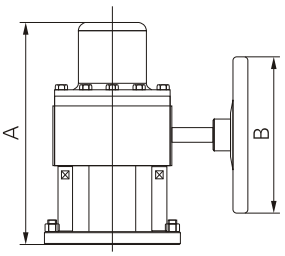
Side mounted mechanism



Top mounted mechanism



6# top mounted mechanism



Connection dimensions and output force of L1000 Series

Model	L	H	H1		H2	D	M	Output force (N)	
			ATO	ATC				B model 40–200KPa	C model 80–240KPa
L102	290	346	130	146	20	56	M14X1.5	1440	2880
L103	290	368	130	155	20	56	M14X1.5	1440	2880
L104	365	442	130	170	24	68	M20X1.5	2240	4480
L105	475	585	160	220	26	80	M24X1.5	3600	7200
L106	590	770	180	280	34	90	M33X2	5600	11200

Connection dimensions and output force of L2000 Series

Top mounted hand operating mechanism

Model	L	H	H1		H2	D	M	Output force (N)		Double acting output force (N)
			ATO	ATC				Spring range 120–360KPa		
								Starting point force	Terminal point force	
L203	290	395	130	155	20	56	M20X1.5	4140	4830	16250
L204	365	475	130	170	24	68	M20X1.5	6900	8050	28750
L205	485	645	160	220	26	80	M24X1.5	11540	13630	45250
L206	590	850	180	280	34	90	M33X2	18000	22268	78000

Note: The air pressure for the piston cylinder is 500KPa.

Connection dimensions of hand operating mechanism

Top mounted hand operating mechanism			Side mounted hand operating mechanism		
型号	A	B	型号	C	E
D2	245	240	C2	230	230
D3	245	240	C3	230	250
D4	300	280	C4	260	300
D5	370	350			
D6	425	400			

▶ Commonly used accessories of reowo

Positioner (Siemens ABB AZBIL SAMSON YTC SMC)

Name	Model	Manufacturer	Remark
Positioner	6DR500	SIEMENS	Intelligent(HART)
	V18345	ABB	Intelligent] (three–failure protector)
	AVP1/300	AZBIL	Intelligent
	YT–1000L/R	YTC	Mechanical
	HEP15/16/17	Homemade	Mechanical

Solenoid valve (ASCO SMC)

Name	Model	Manufacturer	Remark
Solenoid valve	G551H401MO	ASCO	(220V) Explosion–proof
	G551AOO1MS		(24V) Non–explosion–proof
	SY7210–4G–02–220	SMC	(220V) Non–explosion–proof
	SY7210–4G–02–24		(24V) Non–explosion–proof

Airset (CKD SMC)

Name	Model	Manufacturer	Remark
Airset	AW30–03BG	SMC	Rc3/8
	AW40–04BG		Rc1/2
	T50	Homemade	Rc3/8
	AW2000–02		Rc3/8

▶ Commonly used accessories of reowo

The purpose of selecting valve accessories is to accomplish overall functions and control features of control valves.
The commonly used accessories of reowo include positioner, Airset, solenoid valve, air valve, valve position transducer, limit switch, speed booster (amplifier), lock valve, air storage cylinder, etc. Different accessories have different purposes, so suitable accessories shall be selected according to different control purposes.

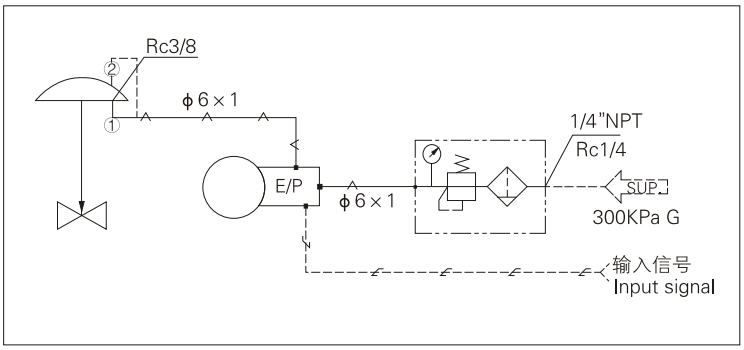
Limit switch（AZBIL YTC）

Name	Model	Manufacturer	Remark
Limit switch	1LS19JB1	AZBIL	Non–explosion–proof (SPDT)
	1LX5001		Explosion–proof dIIBT4 d II CT6(H2)
	1LX5700		d II CT6(H2)
	APL210N	YTC	Non–explosion–proof/ rotary motion
	APL310N		Non–explosion–proof/ rotary motion

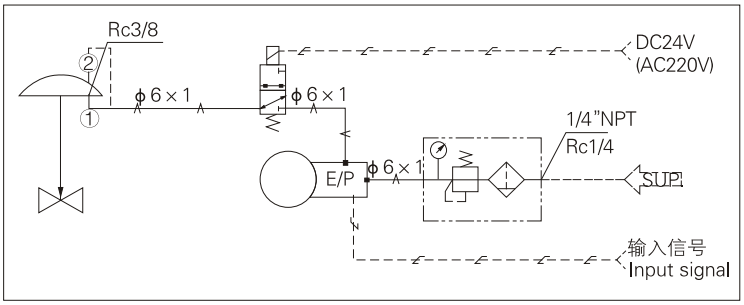
Air valve（SMC）、Speed booster、Lock valve

Name	Model	Manufacturer	Remark
Air valve	VPA342–02	SMC	Rc1/2 two–position three–way
	VPA542–03		Rc1/2 two–position three–way
	VPA742–04		Rc1/2 two–position three–way
Speed booster	IL100–02	SMC	Rc1/4
	IL100–03		Rc3/8
Lock valve	IL201	SMC	Single acting (maintaining position)
	IL211		Double acting (maintaining position)
	CL420H	KOSO	For air bag air supply

▶ Commonly used control loops of reowo control valves



1.1



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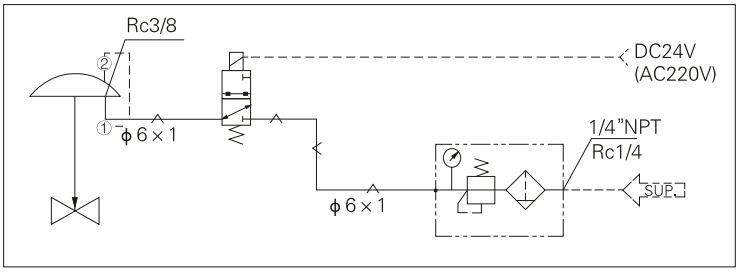


1.3

1、Equipped with L1000 actuator or L2000 cylinder actuator

▲ 1.1

① * Signal increase: valve to open
Signal decrease: valve to close
* Air failure: spring return, valve to close
② * Signal increase: valve to close
Signal decrease: valve to open
* Air failure: spring return, valve to open

▲ 1.2

① * Solenoid valve excitation: positioner controlled
Solenoid valve non–excitation: valve to close
* Air failure: spring return, valve to close
② * Solenoid valve excitation: positioner controlled
Solenoid valve non–excitation: valve to open
* Air failure: spring return, valve to open

▲ 1.3

① * Solenoid valve excitation: valve to open
Solenoid valve non–excitation: valve to close
* Air failure: spring return, valve to close
② * Solenoid valve excitation: valve to close
Solenoid valve non–excitation: valve to open
* Air failure: spring return, valve to open

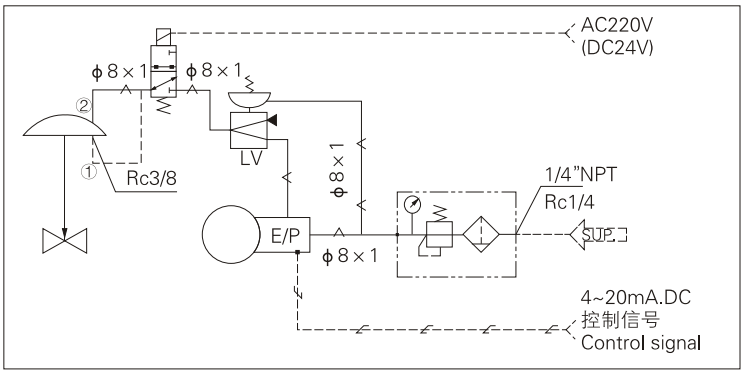
▶ Commonly used control loops of control valves

1、Equipped with L1000 actuator or L2000 cylinder actuator

▲ 1.4

① * Solenoid valve excitation: positioner controlled
Solenoid valve power failure: spring return, valve to close
* Air failure and power non–failure: retain the original position
* Signal failure: retain the original position
(Note: If the positioner is provided with self–locking function]

② * Solenoid valve excitation: positioner controlled
Solenoid valve power failure: spring return, valve to open
* Air failure and power non–failure: retain the original position
* Signal failure: retain the original position
(Note: If the positioner is provided with self–locking function)



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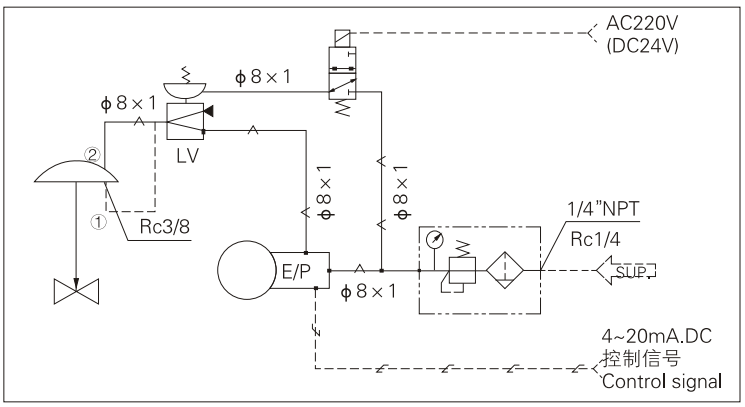
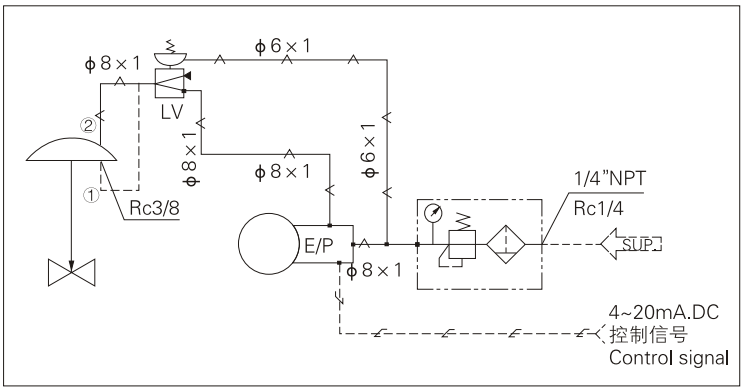


1.5

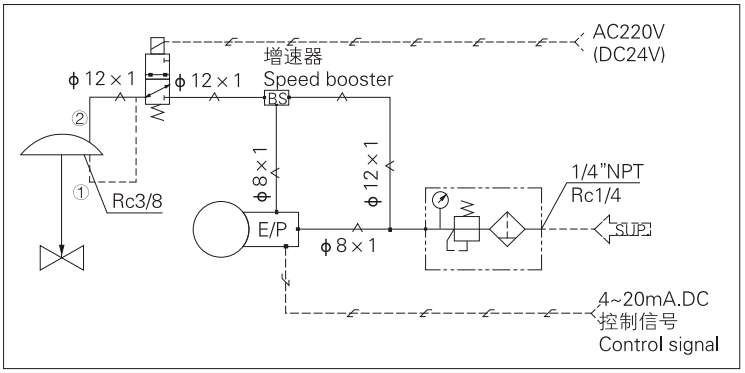
▲ 1.5

① * Solenoid valve excitation: positioner controlled
② Solenoid valve power failure: retain the original position
* Air failure: retain the original position

▶ Commonly used control loops of reowo control valves



1.6



1.7

1、Equipped with L1000 actuator or L2000 cylinder actuator

▲ 1.6

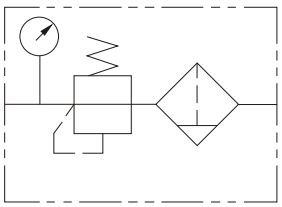
① * Signal increase: valve to open
  * Air failure: retain the original position
② * Signal increase: valve to close
  * Air failure: retain the original position

▲ 1.7

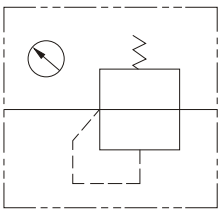
① * Solenoid valve excitation: positioner controlled
  Solenoid valve power failure: control valve to close (OTS<5 seconds)
  * Air failure: spring return, valve to close
② * Solenoid valve excitation: positioner controlled
  Solenoid valve power failure: control valve to open (STO<5 seconds)
  * Air failure: spring return, valve to open

▶ Commonly used control loops of reowo control valves

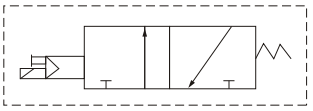
2、符号含义如下 **The meanings of the symbols are as follows:**



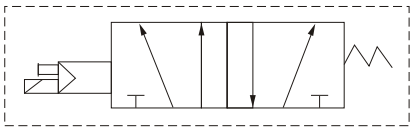
Airset



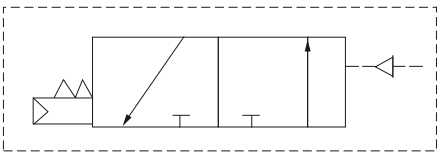
Pressure relief valve



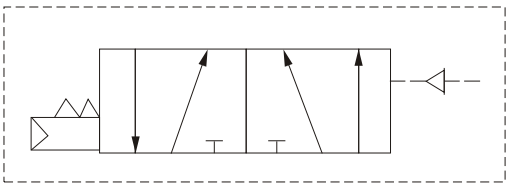
Two–position three–way solenoid valve



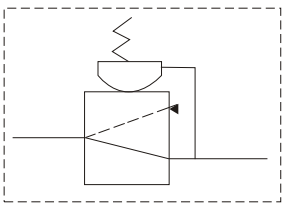
Two–position five–way solenoid valve



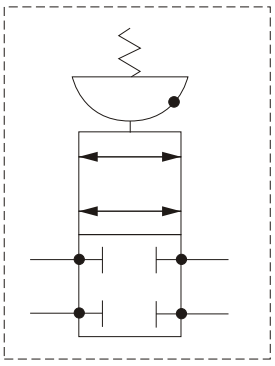
Two–position three–way air valve



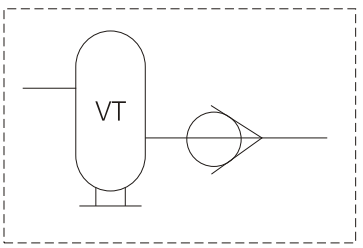
Two–position five–way air valve



Lock–up valve

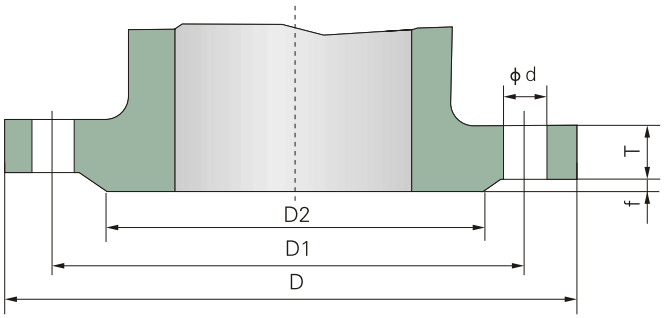


Lock–up valve



Air bag

▶ GB steel pipe flanges JB/T79.1~94



JB/T79.1 PN1.6 2.5MPa （RF）

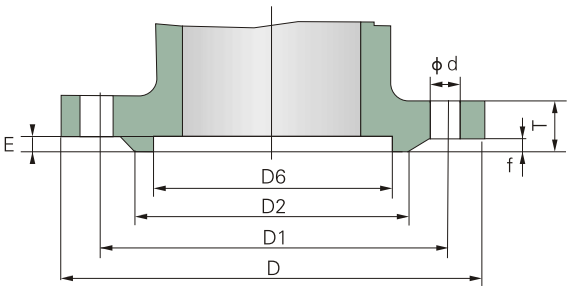
PN1.6MPa Flange deminsion

CaliberNPS	D	D1	D2	f	T	ϕ d	BolttBol
20	105	75	55	2	14	14	4–M12
25	115	85	65	2	14	14	4–M12
32	135	100	78	2	16	18	4–M12
40	145	110	85	3	16	18	4–M16
50	160	125	100	3	16	18	4–M16
65	180	145	120	3	18	18	4–M16
80	195	160	135	3	20	18	8–M16
100	215	180	155	3	20	18	8–M16
125	245	210	185	3	22	18	8–M16
150	280	240	210	3	24	23	8–M20
200	335	295	265	3	26	23	12–M20
250	405	355	320	3	30	25	12–M22
300	460	410	375	4	30	25	12–M22
350	520	470	432	4	34	25	16–M27
400	580	525	485	4	36	30	16–M27
450	640	585	545	4	40	30	20–M27
500	705	650	608	5	44	34	20–M30
600	840	770	718	5	48	41	20–M36
700	910	840	788	5	50	41	24–M36
800	1020	950	898	5	52	41	24–M36

PN2.5MPa Flange deminsion

Caliber NPS	D	D1	D2	f	T	ϕ d	BolttBol
20	105	75	55	2	16	14	4–M12
25	115	85	65	2	16	14	4–M12
32	135	100	78	2	18	18	4–M16
40	145	110	85	3	18	18	4–M16
50	160	125	100	3	20	18	4–M16
65	180	145	120	3	22	18	4–M16
80	195	160	135	3	22	18	8–M16
100	230	190	160	3	24	23	8–M20
125	270	220	188	3	28	25	12–M22
150	300	250	218	3	30	25	12–M22
200	360	310	278	3	34	25	12–M22
250	425	370	332	3	36	30	16–M27
300	485	430	390	4	40	30	16–M27
350	550	490	448	4	44	34	20–M30
400	610	550	505	4	48	34	20–M30
450	660	600	555	4	50	34	20–M36
500	730	660	610	4	52	41	24–M36
600	840	770	718	5	56	41	24–M36
700	955	875	815	5	60	48	24–M42

▶ GB steel pipe flanges JB/T79.2~4–94



JB/T79.2 PN4.0 6.4 10.0MPa（FM）

PN4.0MPa Flange deminsion

NPS	D	D1	D2	D6	f	E	T	ϕ d	Bol
20	105	75	55	51	2	4	16	14	4–M12
25	115	85	65	58	2	4	16	14	4–M12
32	135	100	78	66	2	4	18	16	4–M16
40	145	110	85	76	3	4	18	18	4–M16
50	160	125	100	88	3	4	20	18	4–M16
65	180	145	120	110	3	4	22	18	8–M16
80	195	160	135	121	3	4	22	18	8–M16
100	230	190	160	150	3	4.5	24	23	8–M20
125	270	220	188	176	3	4.5	28	26	8–M22
150	300	250	218	204	3	4.5	30	26	8–M22
200	375	320	282	260	3	4.5	38	30	12–M27
250	445	385	345	313	3	4.5	42	34	12–M30
300	510	430	408	364	4	4.5	46	34	16–M30
350	570	510	465	422	4	5	52	34	16–M30
400	655	585	535	474	4	5	58	41	16–M36

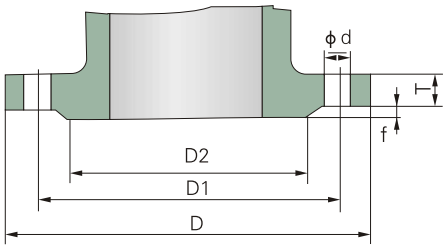
PN6.4MPa Flange deminsion

NPS	D	D1	D2	D6	f	E	T	ϕ d	Bol
20	125	90	68	51	2	4	20	18	4–M16
25	135	100	78	58	2	4	22	18	4–M16
32	160	110	82	66	2	4	24	23	4–M20
40	165	125	95	76	33	4	24	23	4–M20
50	175	135	105	88	3	4	26	23	4–M20
65	200	160	130	110	3	4	28	23	4–M20
80	210	170	140	121	3	4	30	23	8–M20
100	250	200	168	150	3	4.5	32	25	8–M22
125	285	240	202	176	3	4.5	36	30	8–M27
150	340	280	240	204	3	4.5	38	34	8–M30
200	405	345	300	260	3	4.5	44	34	12–M30
250	470	400	352	313	3	4.5	48	41	12–M30
300	530	460	412	364	4	4.5	54	41	16–M36
350	595	525	475	422	4	5	60	41	16–M36
400	670	585	525	474	4	5	66	48	16–M42

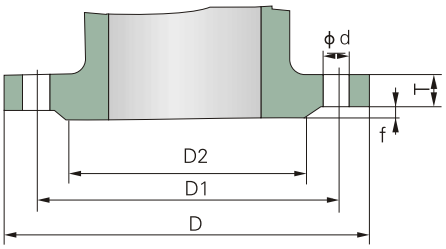
PN10.0MPa Flange deminsion

NPS	D	D1	D2	D6	f	E	T	ϕ d	Bol
20	125	90	68	51	2	4	22	18	4–M16
25	135	100	78	58	2	4	24	18	4–M16
32	160	110	82	66	2	4	24	23	4–M20
40	165	125	95	76	3	4	26	23	4–M20
50	195	145	112	88	3	4	28	25	4–M22
65	220	170	138	110	3	4	32	25	8–M22
80	230	180	148	121	3	4	34	25	8–M22
100	265	210	172	150	3	4.5	38	30	8–M27
125	310	250	210	176	3	4.5	42	34	8–M30
150	350	290	250	204	3	4.5	46	34	12–M30
200	430	360	312	260	3	4.5	54	41	12–M36
250	500	430	382	313	3	4.5	60	41	16–M42
300	585	500	442	364	4	4.5	70	48	16–M48
350	655	560	498	422	4	5	76	54	16–M48
400	715	620	558	474	4	5	80	54	16–M48

ANSI steel pipe flanges ANSI B16.5



Class 150Lb （RF）Flange



Class300/600Lb（RF）Flange

Class 150 Flange dmension

NPS In	NPS mm	D In	D mm	D1 In	D1 mm	D2 In	D2 mm	f In	f mm	T In	T mm	ϕ d In	ϕ d mm	Bol Quantity	Bol Diameter
3/4"	20	3.875	98	2.75	70	1.688	43	0.06	1.6	0.44	11.2	0.625	15	4	1 /2
1	32	4.25	108	3.125	79.5	2	51	0.06	1.6	0.44	12	0.625	15	4	1 /2
1 1/2"	40	5	127	3.875	98.5	2.875	73	0.06	1.6	0.56	15	0.625	15	4	1 /2
2	50	6	152	4.75	120.5	3.62	92	0.06	1.6	0.62	15.9	0.75	19	4	5 /8
1 1/2"	65	7	178	5.5	139.5	4.12	105	0.06	1.6	0.69	17.5	0.75	19	4	5 /8
3	80	7.5	190	6	152.5	5	127	0.06	1.6	0.75	19.1	0.75	19	4	5 /8
4	100	9	229	7.5	190.5	6.19	157	0.06	1.6	0.94	23.9	0.75	19	8	5 /8
5	125	10	254	8.5	216.5	7.31	186	0.06	1.6	0.94	23.9	0.88	22	8	3 /4
6	150	11	279	9.5	241.5	8.5	216	0.06	1.6	1	25.4	0.88	22	8	3 /4
8	200	13.5	343	11.75	298.5	10.62	270	0.06	1.6	1.12	28.6	0.88	22	8	3/4
10	250	16	406	14.25	368	12.75	324	0.06	1.6	1.19	30.2	1	25	12	7 /8
12	300	19	483	17	432	15	381	0.06	1.6	1.25	31.8	1	25	12	7 /8

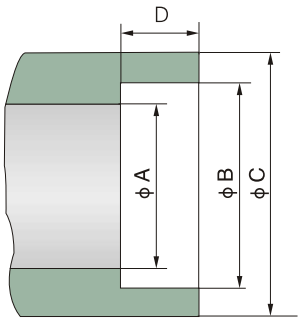
Class 300 Flange dmension

NPS In	NPS mm	D In	D mm	D1 In	D1 mm	D2 In	D2 mm	f In	f mm	T In	T mm	ϕ d In	ϕ d mm	Bol Quantity	Bol Diameter
3/4"	20	4.63	117	3.25	82.5	1.69	43	0.06	1.6	0.63	16	0.75	19	4	1 /2
1	32	4.88	124	3.5	89	2	51	0.06	1.6	0.69	18	0.75	19	4	5 /8
1 1/2"	40	6.13	156	4.5	114.5	3.38	73	0.06	1.6	7.07	21	0.88	22	4	5 /8
2	50	6.5	165	5	127	3.62	92	0.06	1.6	0.88	22.3	0.75	19.22	4	3 /4
1 1/2"	65	7.5	190	5.88	149	4.12	105	0.06	1.6	1	25.4	0.88	22	4	5 /8
3	80	8.25	210	6.62	168	5	127	0.06	1.6	1.12	28.6	0.88	22	4	3 /4
4	100	10	254	7.88	200	6.19	157	0.06	1.6	1.25	31.8	0.88	22	8	3 /4
5	125	11	279	9.25	235	7.31	186	0.06	1.6	1.38	35	0.88	22	8	3 /4
6	150	12.5	318	10.62	270	8.5	216	0.06	1.6	1.44	36.6	0.88	22	12	3 /4
8	200	15	381	13	330	10.62	270	0.06	1.6	1.62	41.3	1	25	12	7 /8
10	250	17.5	444	15.25	387.5	12.75	324	0.06	1.6	1.88	47.7	1.12	29	16	1
12	300	20.5	521	17.75	451	15	381	0.06	1.6	2	50.8	1.25	32	16	11 /8

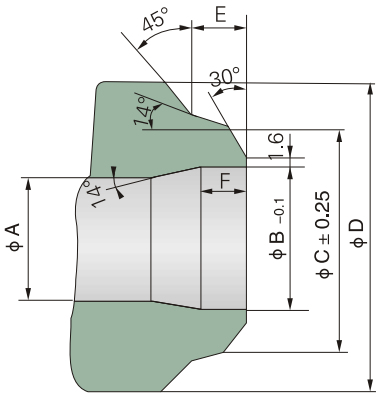
Class600 Flange dmension

NPS In	NPS mm	D In	D mm	D1 In	D1 mm	D2 In	D2 mm	f In	f mm	T In	T mm	ϕ d In	ϕ d mm	Bol Quantity	Bol Diameter
3/4"	20	4.63	118	3.25	82.5	1.69	43	0.25	6.4	0.63	16	0.75	19	4	5 /8
1	32	4.88	124	3.5	89	2	51	0.25	6.4	0.69	18	0.75	19	4	5 /8
1 1/2"	40	6.13	156	4.5	114.5	3.38	73	0.25	6.4	0.88	23	0.88	22	4	3 /4
2	50	6.5	165	5	127	3.62	92	0.25	6.4	1	25.4	0.75	19	8	5 /8
2 1/2"	65	7.5	190	5.88	149	4.12	105	0.25	6.4	1.12	28.6	0.88	22	8	3 /4
3	80	8.25	210	6.62	168	5	127	0.25	6.4	1.25	31.8	0.88	22	8	3 /4
4	100	10.75	273	8.5	216	6.19	157	0.25	6.4	1.5	38.1	1	25	8	7 /8
5	125	13	330	10.5	266.5	7.31	186	0.25	6.4	1.75	44.5	1.12	29	8	1
6	150	14	356	11.5	292	8.5	216	0.25	6.4	1.88	47.7	1.12	29	12	1
8	200	16.5	419	13.75	349	10.62	270	0.25	6.4	2.19	55.6	1.25	32	12	11 /8
10	250	20	508	17	432	12.75	324	0.25	6.4	2.5	63.5	1.38	35	16	11 /4
12	300	22	559	19.25	489	15	381	0.25	6.4	2.62	66.7	1.38	35	20	11 /4

▶ Valve booy welding joint (ANSI900、1500、2500)



Sw Welding Type



Bw Welding Type

SW Size table 1 of SW welding end Size of welding side joint table 1

DN(mm)	PN(MPa)	A	B	C	D
40	ANSI 900	35	49.1	74	30
	ANSI 1500	34.4	49.1	74	21
	ANSI 2500	34.4	49.1	84	21
50	ANSI 900	48	61.1	92	24
	ANSI 1500	48	61.1	92	24
	ANSI 2500	38	61.1	103	25
80	ANSI 900	67	90	118	30
	ANSI 1500	67	90	130	30
	ANSI 2500	52	90	133	20

BW Size table 2 of BW welding end2 Size of welding side joint table 2

DN(mm)	PN(MPa)	A	B	C	D	E	F
80	ANSI 900	63	--	--	103	--	9
	ANSI 1500	63	66.9	89.1	120	20	9
	ANSI 2500	52	--	--	133	--	15
100	ANSI 900	84	--	--	134	--	9
	ANSI 1500	84	87.3	114.3	152	25	9
	ANSI 2500	73	--	--	177	--	15
150	ANSI 900	126	128.8	165.2	194	33	9
	ANSI 1500	126	128.8	165.2	218	33	9
	ANSI 2500	110	120	200	260	35	30
200	ANSI 900	190	192	--	260	--	
	ANSI 1500	178	192	260	290	30	20
	ANSI 2500	146	150	220	322	50	

Attachment 1

GB/T4213–2008
ANSI B16.104–1976
control valve leakage standard

GB/T4213–2008 "pneumatic control valve"

Shut–off class	Testing medium	Testing pressure	Maximum seat leakage
I	Agreed by the user and manufacturer		
II	Water, air or nitrogen	A	$5x10^{-3}$ x valve rated capacity
III			10^{-3} x valve rated capacity
IV	Water	AorB	10^{-4} x valve rated capacity
	Air or nitrogen	A	
IV–S1	Water	AorB	$5x10^{-6}$ x valve rated capacity
	Air or nitrogen	A	
IV–S2	Air or nitrogen	A	$20 \times 10^{-4} \times \triangle P \times D$
V	Water	B	$1.8 \times 10^{-7} \times \triangle P \times D$
VI	Air or nitrogen	A	$3x10^{-3}x\triangle Px$ (leakage in the continued table)

Continued table

Seat size		20	25	40	50	65	80	100	150	200	250	300	350	400
Leakage	Ml/min	0.1	0.15	0.3	0.45	0.6	0.9	1.7	4.0	6.75	11.1	16.0	21.6	26.4
	Bubbles/Min		1	2	3	4	6	11	27	45	--	--	--	--

Note: A: Testing pressure=0.35MPa. When the allowable differential pressure of the valve is lower than 0.35MPa, use the allowable differential pressure stipulated in the design.
B: Testing pressure is the maximum working differential pressure of the valve.

ANSI B16.104–1976

Shut–off class	Maximum allowable leakage	Testing Medium	Testing pressure
II	0.5%Cv	Air or water at 10–52℃	Maximum working differential pressure △P or 50lb/in2(3.5bar) differentialpressure, whichever is lower
III	0.1%Cv	Air or water at 10–52℃	Maximum working differential pressure △P or 50lb/in2(3.5bar) differential pressure, whichever is lower
IV	0.01%Cv	Air or water at 10–52℃	Maximum working differential pressure △P or 50lb/in2(3.5bar) differential pressure, whichever is lower
V	0.0005ml/min of water leakage per inch of nominal diameter per psi differential pressure is allowed	Water at 10–52℃	Maximum working differential pressure △P
VI	Valve size In / mm; Ml/min; Bubbles/min (see below)	Air or water at 10–52℃	Maximum working differential pressure △P or 50lb/in2(3.5bar) differential pressure, whichever is lower

Valve size In	Valve size mm	Ml/min	Bubbles/min
1	25	0.15	1
11/2	38	0.30	2
2	51	0.45	3
21/2	64	0.60	4
3	76	0.90	6
4	102	1.70	11
6	152	4.00	27
8	203	6.75	45
10	250	11.1	
12	300	16.0	
14	350	21.6	
16	400	28.4	

Attachment 2
Commonly used materials of control valves

Attachment 2 steel grade contrast table of commonly used materials of control valves

Material name	(ASTM) ASTM	(JIS) JIS	(DIN) DIN	(GB) GB	Main chemical component
Carbon steel (cast)	WCA、WCB、WCC	SCPH2	1.0501	WCA、WCB、WCC	C: ≤0.30
Cr–Mo steel (cast)	WC6 WC9	SCPH21 SCPH32	1.7335	15CrMo 15Cr2MoV	C：≤0.20 C：≤0.18
Stainless steel (cast)	Cf8	SCS13 SCS13A	1.4308	CF8(GB12230)	C：≤0.08 Cr：18.0–21.0
	CF8M	SCS14 SCS14A	1.4580 1.4581	CF8M(GB12230)	C：≤0.08 Cr:18.0–21.0 Mo:2.0–3.0
	Cf3	––	1.4306	CF3(GB12230)	C：≤0.03 C：17.2–21.0
	CF3M	––	1.4435	CF3M(GB12230)	C：≤0.03 Cr:17.0–21.0
Stainless steel (rod)	304	SUS304	1.4301	0Cr18Ni9	C：≤0.08 Cr:17.0–20.0
	316	SUS316	1.4401 1.4436	0Cr17Ni12M02	C：≤0.08 Cr:16.0–18..0 Mo:2.0–3.0
	304L	SUS304L	1.4036	00Cr19NI10	C：≤0.03 Cr:18.0–20.0
	316L	SUS316L	1.4435 1.4404	00Cr17Ni14Mo2	C：≤0.03 Cr:2.0–3.0
	410	SUS410	1.4006	1Cr13	C：≤0.15 Cr:11.5–13.0
	416	SUS416	1.4005	YICr13	C：≤0.15 Cr:12.0–14.0
	420	SUS420	1.4021	2Cr13	C:0.16–0.25 C;16.0–18.0
	440B	SUS440B	1.4112	9Cr18Mov	C:0.75–0.95 C:16.0–18.0
	440C	SUS440C	1.4125	9Cr18	C:0.75–0.95 C:16.0–18.0
	630	SUS630 SUS24 (cast)	1.4542	0Cr17Ni4Cu4Nb (17–4PH)	Cr:16.5 Ni:4.0 Cu:3.5

Attachment 3
Anticorrosive materials of valves

selection table of anticorrosive materials of control valves

Fluid	Material													
	Carbon steel	Cast iron	320 or 304SS	316 316SS	Bronze	Monel	Haste lloy B	Haste lloy C	#20 SS #20	Titani um	Co–Cr alloy #6	416 SS	440C SS	17–4PH SS
Acetaldehyde	A	A	A	A	A	A	I.L	A	A	I.L	I.L	A	A	A
Acetic acid (air free)	C	C	B	B	B	B	A	A	A	A	A	C	C	B
Acetic acid (aerated)	C	C	A	A	A	A	A	A	A	A	A	C	C	B
Acetic acid vapor	C	C	A	A	B	B	I.L	A	A	A	A	C	C	B
Acetone	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Acetylene	A	A	A	A	I.L	A	A	A	A	I.L	A	A	A	A
Alcohols	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Aluminum sulfate	C	C	A	A	A	A	A	A	A	A	I.L	C	C	I.L
Ammonia	A	A	A	A	A	A	A	A	A	A	A	A	A	I.L
Ammonium chloride	C	C	B	B	A	A	A	A	A	A	A	C	C	I.L
Ammonium nitrate	A	A	A	A	C	C	A	A	A	A	A	C	C	I.L
Ammonium phosphate (univalent)	C	C	A	A	B	B	A	A	A	A	A	B	B	I.L
Ammonium sulfate	C	C	B	A	B	B	A	A	A	A	A	C	C	I.L
Ammonium sulfite	C	C	A	A	C	C	I.L	A	A	A	A	C	C	I.L
Aniline	A	A	A	A	A	A	A	A	A	A	A	C	C	I.L
Asphalt	A	A	A	A	C	C	A	A	A	I.L	A	A	A	A
Beer	B	B	A	A	B	B	A	A	A	A	A	B	B	A
Benzene	A	A	A	A	A	A	B	A	A	A	A	A	A	A
Benzoic acid	C	C	A	A	A	A	I.L	A	A	A	I.L	A	A	A
Boric acid	C	C	A	A	A	A	B	A	A	A	A	B	B	I.L
Butane	A	A	A	A	A	A	A	A	A	I.L	A	A	A	A
Calcium chloride (alkaline)	B	B	C	B	C	A	A	A	A	A	I.L	C	C	I.L
Calcium hypochlorite	C	C	B	B	B	B	C	A	A	A	I.L	C	C	I.L
Carbolic acid	B	B	A	A	A	A	A	A	A	A	A	I.L	I.L	I.L
Carbon dioxide (dry)	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Carbon dioxide (wet)	C	C	A	A	A	A	A	A	A	A	A	A	A	I.L
Carbon disulfide	A	A	A	A	C	B	A	A	A	A	A	B	B	A
Carbon tetrachloride	B	B	B	B	A	A	B	A	A	A	I.L	C	C	C
Carbonic acid	C	C	B	B	B	A	A	A	A	I.L	I.L	A	A	I.L
Chlorine, gas (dry)	A	A	B	B	B	A	A	A	A	C	B	C	C	A
Chlorine, gas (wet)	C	C	C	C	C	C	C	B	C	A	B	C	C	C
Liquid chlorine	C	C	C	C	B	C	A	A	B	C	B	C	C	C
Chromic acid	C	C	C	C	C	A	C	A	C	A	B	C	C	C
Citric acid	I.L	C	B	B	A	B	A	A	A	A	I.L	B	B	B
Coke oven gas	A	A	A	A	B	B	A	A	A	A	A	A	A	A
Copper sulfate	C	C	B	B	B	C	I.L	A	A	A	I.L	A	A	A
Cottonseed oil	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Creosote	A	A	A	A	A	A	A	A	A	I.L	A	A	A	A
Ethane	A	A	A	A	A	B	A	A	A	A	A	A	A	A
Ether	B	B	A	A	B	A	A	A	A	I.L	A	A	A	A
Ethyl chloride	C	C	A	A	A	A	A	A	A	A	A	B	B	I.L
Ethylene	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ethylene glycol	A	A	A	A	A	A	I.L	I.L	A	I.L	A	A	A	A
Ferric chloride	C	C	C	C	C	C	C	B	A	A	B	C	C	A
Formaldehyde	B	B	A	A	A	A	A	A	C	A	A	A	A	I.L
Formic acid	I.L	C	B	B	A	A	A	A	A	C	B	C	C	B
Freon (wet)	B	B	B	B	A	A	A	A	A	A	A	I.L	I.L	I.L
Freon (dry)	B	B	A	A	A	A	A	A	A	A	A	I.L	I.L	I.L
Furfural	A	A	A	A	A	A	A	A	A	A	A	B	B	I.L
Gasoline (refined)	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Glucose	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Automation Instrument

▶ Attachment 3 Anticorrosive materials of valves

Fluid	Material													
	Carbon steel	Cast iron	320 or 304SS	316SS	Bronze	Monel	Haste lloy B	Haste lloy C	SS #20	Titani um	Co–Cr alloy #6	416 SS	440C SS	17–4PH SS
Hydrochloric acid (aerated)	C	C	C	C	C	C	A	B	C	C	B	C	C	C
Hydrochloric acid (air free)	C	C	C	C	C	C	A	B	C	C	B	C	C	C
Hydrofluoric acid (aerated)	B	C	C	B	C	C	A	A	B	C	B	C	C	C
Hydrofluoric acid (air free)	A	C	C	B	C	A	A	A	B	A	I.L	C	C	I.L
Hydrogen	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrogen peroxide	I.L	I.L	A	A	C	A	B	B	B	B	I.L	B	B	I.L
Hydrogen sulfide (liquid)	C	C	A	A	C	C	A	A	A	A	A	C	C	I.L
Magnesium hydroxide	A	A	A	A	B	A	A	A	A	A	A	A	A	I.L
Mercury	A	A	A	A	C	B	A	A	A	A	A	A	A	B
Methanol	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Methyl ethyl ketone	A	A	A	A	A	A	A	A	A	I.L	A	A	A	A
Milk	C	C	A	A	A	A	A	A	A	C	A	C	C	C
Natural gas	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Nitric acid	C	C	A	A	C	C	C	A	B	A	C	C	C	C
Oleic acid	C	C	A	A	B	A	A	A	A	A	A	A	B	I.L
Oxalic acid	C	C	B	B	B	B	A	A	A	B	B	B	B	I.L
Oxygen	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Petroleum oils (refined)	A	C	A	B	A	A	A	A	A	A	A	A	A	A
Phosphoric acid (aerated)	C	C	A	A	C	C	B	B	B	B	A	C	C	I.L
Phosphoric acid (air free)	C	C	A	A	C	B	A	A	A	B	A	C	A	I.L
Phosphoric acid vapor	C	C	A	A	C	C	A	I.L	A	B	C	C	A	I.L
Picric acid	C	C	A	A	C	C	A	A	A	I.L	I.L	B	C	I.L
Potassium chloride	B	B	B	B	B	B	A	A	A	A	I.L	C	A	I.L
Potassium hydroxide	B	B	A	A	B	A	A	A	A	A	I.L	B	C	I.L
Propane	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Rosin	B	B	A	A	A	A	A	A	A	I.L	A	A	A	A
Silver nitrate	C	C	A	A	C	C	A	A	A	A	B	B	B	I.L
Sodium acetate	A	A	B	A	A	A	A	A	A	A	A	A	A	A
Sodium carbonate	A	A	A	A	A	A	A	A	A	A	A	B	B	A
Sodium chloride	C	C	B	B	A	A	A	A	A	A	A	B	B	B
Sodium chromate	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sodium hydroxide	A	A	A	A	A	A	A	A	A	A	A	B	B	A
Sodium hypochlorite	C	C	C	C	B–C	B–C	C	A	B	A	I.L	C	C	I.L
Sodium thiosulfate	C	C	A	A	C	C	A	A	A	A	I.L	B	B	I.L
Stannous chloride	B	B	C	A	C	B	A	A	A	A	I.L	C	C	I.L
Stearic acid	A	C	A	A	B	B	A	A	A	A	A	B	B	I.L
Sulfate liquor (black)	A	A	A	A	C	A	A	A	A	A	A	I.L	I.L	I.L
Sulfur	A	A	A	A	C	A	A	A	A	A	A	A	A	A
Sulfur dioxide (dry)	A	A	A	A	A	A	B	A	A	A	A	B	B	I.L
Sulfur trioxide (dry)	A	A	A	A	A	A	B	A	A	A	A	B	B	I.L
Sulfuric acid (aerated)	C	C	C	C	C	C	A	A	A	B	B	C	C	C
Sulfuric acid (air free)	C	C	C	C	B	B	A	A	A	B	B	C	C	C
Sulfurous acid	C	C	B	B	B	B	A	A	A	A	A	C	C	I.L
Tar	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Trichloroethylene	B	B	B	A	A	A	A	A	A	A	A	B	B	I.L
Turpentine	B	B	A	A	A	B	A	A	A	A	A	A	A	A
Vinegar	C	C	A	A	C	A	A	A	A	I.L	A	C	C	A
Water (water feed)	B	C	A	A	A	A	A	A	A	A	A	B	A	A
Water (distilled)	A	A	A	A	B	A	A	A	A	A	A	B	B	I.L
Sea water	B	B	B	B	B	A	A	A	A	A	A	C	C	I.L
Whiskey and wines	C	C	A	A	A	B	A	A	A	A	A	C	C	I.L
Zinc chloride	C	C	C	C	C	C	A	A	A	A	B	C	C	I.L
Zinc sulfate	C	C	A	A	B	A	A	A	A	A	A	B	B	I.L

Symbols: A – normally suitable; B– use with caution; C – unsatisfactory; I.L. – lack of information

Abstract from 《Handbook of Control Valves》 Second Edition, Instrument Society of America, J.W. Hutchison Editor inChief, Lin Qiuhong and Other Translators December 12, 1984

This table is intended to give only a general indication of how various metals will react when in contact with certain fluids. The recommendations cannot be absolute because concentration, temperature, pressure and other conditions may alter the suitability of a particular metal. Therefore, use this table as a guide only.

▶ Model establishment descriptions

Model establishment descriptions

Body descriptions

1Code	Control valve
1	Linear motion control valve

2Code	Body type
0	Straight– through
1	Angle
2	Z type
3	Three–way
4	Y type

3Code	Trim type
P	Single–seat
T	Sleeve single–seat
G	Sleeve double–seat
D	Multi–hole
S	Multi–stage pressure drop
M	Labyrinth
Q	Shut–off
H	Three–way converging
F	Three–way diverging
W	Diaphragm
Z	Gate

4Code	Bonnet type
1	Standard
2	Heat dissipation
3	Extended
4	Cryogenic
5	Bellows
6	Heat preservation jacket

5Code	Connection type
1	Flange
2	Wafer
3	Butt welding
4	Thread

6Code	Seal type
Y	Hard seal
R	Soft seal
F	Fluorine lined

Parameters

7Code	8Code	9Code	10Code	
DN	Plug size	PN	Flow characteristic	
Filled according to the actual parameters			D	Equal percentage
			Z	Linear
			K	Quick open

Actuator descriptions

11Code	Actuator type
L1	Linear motion diaphragm
L2	Linear motion piston

12Code	Action type
1	Air to open
2	Air to close
3	Double acting

13Code	Model
2	2#
3	3#
4	4#
5	5#
6	6#

14Code	Spring range
A	20–100Kpa
B	40–200Kpa
C	80–240Kpa
D	120–360 Kpa
E	160–400Kpa

15Code	Hand operating mechanism
C	Side mounted
D	Top mounted