# High–Frequently Operated Ball Valve







Suzhou Antiwear Valves Co., Ltd.


## Leading Manufacturer and Designer of Full Ranges of Industrial Valves

Antiwear Group, as a leader in designing and manufacturing of full ranges of industrial valves, from general use applications to harsh conditions, supplies ball valve, butterfly valve, plug value, gate valve, globe valve, check valve, piston valve, regulating valve, rotating disc valve and labyrinth control valve, which are widely applied in refinery, oil&gas, power generation, water treatment, petrochemical, urban construction, paper&pulp, pipeline transferring and other industries. The performance of above valves supplied by Antiwear is appreciated by more and more users worldwide.

Antiwear firmly believes that honesty is not just a virtue, but a work attitude and way of life. In the high-speed development of Antiwear, the company has gradually formed "It's reliable" culture, which means reliable products, reliable people and reliable service. Antiwear Group has completed the quality assurance system certification and passed a series of certificates, including ISO9001, ISO14000, ISO18000, TS, API6D, API607, ISO5848, PED, API6A and so on.

Antiwear Group boasts manufacturing workshops in Suzhou, Wenzhou, and Shanghai, China and will establish localized warehouses, sales and distributors around the world. Through the Internet + production and APP system applications, it can quickly respond to customer needs. Antiwear's ultimate goal is to "help customers enjoy a better life"

## Best Solution

In the spirit of excellence, continuous improvement, Antiwear keeps on improving the quality of the valve. Besides general use application, Antiwear has done lots of research on critical service including high temperature, high pressure, corrosion, crystallization, high frequently operating and other severe conditions in silicon chemical industry, coal gasification, petrochemical, hydrometallurgical and other areas and summed up the excellent solution in a large number of practices.

- High temperature and high pressure pure oxygen and hydrogen conditions ---- oxygen and hydrogen ball valve, globe valve, check valve
- Solid abrasive material ----- metal sealed ball valve, rotating disc valve, twin-disc valve
- High temperature exceeding 450℃ conditions ------ high temperature ball valve, high temperature rotating disc valve, high temperature gate valve

- PP/PE system annual operating cycles reaching 1.6 million ----- PDS high-frequently operating metal and soft sealed ball valve
- Solid abrasive particles at high pressure differential venting----- sliding plate valve
- Corrosive conditions ------ plug valve, ball valve
- Fiber and pulp working conditions ----eccentric semi-ball valve
- High temperature solid particles bi-directional sealed ball valve- S-ZORB ball valve
- Flushing, flashing, cavitation conditions ---- angle slurry control valve
- Zero-leakage request with gas medium at large size pipe ---- triple-eccentric butterfly valve
- Slurry conditions ---- Y-type globe valve
- Crystallization or slurry conditions ----- plug valve, eccentric semi-ball valve
- Precipitation conditions ---- piston valve
- Multi-level buck and flash conditions ---- Labyrinth control valve

## *Five strengths of Antiwear*

**Overall solution**
- Full range of valves
- All industry applications
- Application of all conditions
- Customize for customers
- Excellent performance under harsh conditions
- Extensive R&D and experience

**Best quality**
- 100% parts inspection
- 100% finished product inspection
- 100% supplier certification
- 100% process tracking
- Advanced processing and testing equipment
- Complete quality control system and certification

**Quick response**
- 24 hours fast response
- Global warehousing
- Global sales and distributors
- Quick inquiry / quote software
- Order information bar code query system
- Abnormal order information active push

**Internet + production model**
- Online sales and service
- Personalized customization
- Specialized small intelligent factory
- Online development, design, procurement, production

**Reliable culture**
- Reliable product
- Trustworthy person
- Timely service
- Wish you enjoy better life

# Product Display under Harsh Working Conditions

**Metal Seated Ball Valve**
Features: Quantitative compression, Double bearings, Belleville spring compensation, many hard alloy coatings meet different medium requests
Serve area: abrasive resistant, high temperature
Size Range: DN15 ~ DN600, 1 / 2 "~ 24"
Temperature range: -196 ° C to 850 ° C
Pressure Rating: PN10 ~ PN670,
CLASS150 ~ CLASS4000

**Oxygen Service Metal-Seated Ball Valve**
Features: No sticking while operating after fully degreased, fire-proof and anti-static, smoothly operating without any "jam", leakage rate meet ASME B16.104 VI within a long time running
Size Range: DN15 ~ DN600, 1 / 2 "~ 24"
Temperature range: -196 ℃ ~ 420 ℃
Pressure Rating: PN10 ~ PN420,
CLASS150 ~ CLASS2500

**Triple Eccentric Butterfly Valves**
Features: No sealing surface friction during operating, meet "Zero" leakage at uni-directional & bi-directional conditions.
Size Range: DN50 ~ DN4000, 2 "~ 160"
Temperature range: -196 ° C to 600 ° C
Pressure Rating: PN10 ~ PN420,
CLASS150 ~ CLASS2500

**High Pressure Differential Control Angle Valve with Solid-liquid Fluid**
Features: High pressure differential resistant, corrosive resistant, erosive resistant, pressure or flow regulating
Size Range: DN50 ~ DN300, 2 "~ 12"
Temperature range: ≤ 300 ° C
Pressure Rating: PN10 ~ PN260,
CLASS150 ~ CLASS1500

**Rotating Disc Valve**
Feature: abrasive resistant, much longer service life.
Serve area: coal gasification, polysilicon industry
Size Range: DN25 ~ DN1200, 1 "~ 48"
Temperature range: -196 ℃ ~ 850 ℃
Pressure Rating: PN10 ~ PN260,
CLASS150 ~ CLASS1500

**Double Eccentric Butterfly Valve**
Features: Small sealing surface friction during operating, very low leakage rate
Size Range: DN50 ~ DN4000, 2 "~ 160"
Temperature range: -46 ° C to 300 ° C
Pressure Rating: PN10 ~ PN50,
CLASS150 ~ CLASS300

**High Frequently Operating Ball Valve**
Features: quick opening/closing, high frequently operating, metal or soft seated
Serve area: PDS unit in polypropylene and polyethylene system, PSA unit
Size Range: DN15 ~ DN600, 1 / 2 "~ 24"
Temperature range: -46 ° C to 450 ° C
Pressure Rating: PN10 ~ PN260,
CLASS150 ~ CLASS1500

**Rotating Twin-disc Valve**
Features: Self-rotating & self-milling disc, pressure self-relieving design, frequently operating, abrasive resistant and longer service life
Serve area: lock hopper unit to feed coal powder, slurry, fly ash, silicon powder and other fluid
Size Range: DN80 ~ DN1200, 3 "~ 48"
Temperature range: -196 ° C to 850 ° C
Pressure Rating: PN10 ～ PN260,
CLASS150 ～ CLASS1500

**Labyrinth Control Valve**
Features: flashing vaporization and cavitation resistant, low noisy, up to 24 multi-stages pressure decreasing design
Serve area: steam treatment, high pressure diffential
Size Range: DN25 ~ DN600, 1 "~ 24"
Temperature range: ≤ 700 ° C
Pressure Rating: PN10 ~ PN760,
CLASS150 ~ CLASS 4500

## Patents

## Certificates

ISO9001


API607


ISO15848

PED


ISO14001


OHSAS18001


API6D

ANTIWEAR VALVES

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# Product profile

## Product application and introduction

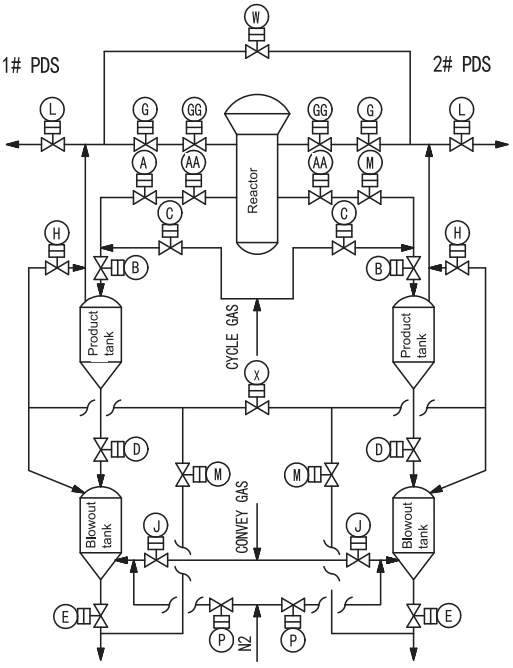
High frequently operated ball valve (average 300,000 cycles per year and even more than 1.6 million cycles annually) is widely used in chemical industry where frequently on/off operating is needed, especially at PDS (Products Discharge System) unit in PP (polypropylene) or PE (polyethylene) plant. Antiwear has done lots of research on sealing surface metal alloy coating which can meet frequently operating application based on plenty of testing and experiments. Besides that, optimizing structural design and manufacturing process takes themetal-seated ball valve a long service life of up to 3 million cycles, which would be the best choice for high-frequently operating applications.

## Performance Data

- Operating frequency: more than 300,000 cycles per year or even 3 million cycles a year
- Cycle time: normally 1.5 seconds to 3 seconds (for faster speed, please consult Antiwear)
- Leakage Rate: meets ASME B16.104 CLASS VI, other standard, please consult Antiwear
- Medium: liquid, gas, solid powder, etc.
- Fire-proof and anti-static design

## High frequently operating ball valve technical difficulties

- If solid powder particles accumulate in valve pocket and the surface of the ball, the ball and seat will damage very soon. Then operating torque will increase gradually and finally leakage and “jam” would happen.
- Ultra-fine powder particles is easy to accumulate at stem housing bore, bearing bore and seat pocket of ball valve. As a result, the stem surface would damage to increase the operating torque and even jam would happen.
- Sealing surface between ball and seat could get sticking under high-frequently and high-speed operating.
- Long-term high-frequently operating is a big risk for stem packing sealing and external leakage is very easy to happen if stem and its housing hasn’t been hardened right.
- High speed and frequently operating makes the valve always working at high and low temperature thermal changes, which means the sealing surface coatings should keep very good resistance to temperature thermal stress, otherwise coating is easy to peel off.
- Pneumatic actuator happens to leak or pass away after long-term high-frequently operating, even the actuator would fail to run finally.




Typical PDS system diagram

# Product Features

Antiwear has done lots of deep research on above problems especially on metal-seated applications. Depending upon plenty of tests and experiments, Antiwear makes out a full proposal including valve structure, sealing surface coatings, actuators, accessories, manufacturing process and quality control points. After many on-line using of high-frequently operating ball valves supplied by Antiwear, it has been proved that the valve performs very well with low on/off torque, perfect sealing surface, longer cycle life, etc.

## High-frequently Operating ball valve-Structure

**Extended stem**
- Multi-shaft sleeve positioning prevents stem leaning
- Hardened stem and housing
- Good coaxial and smoothness of stem

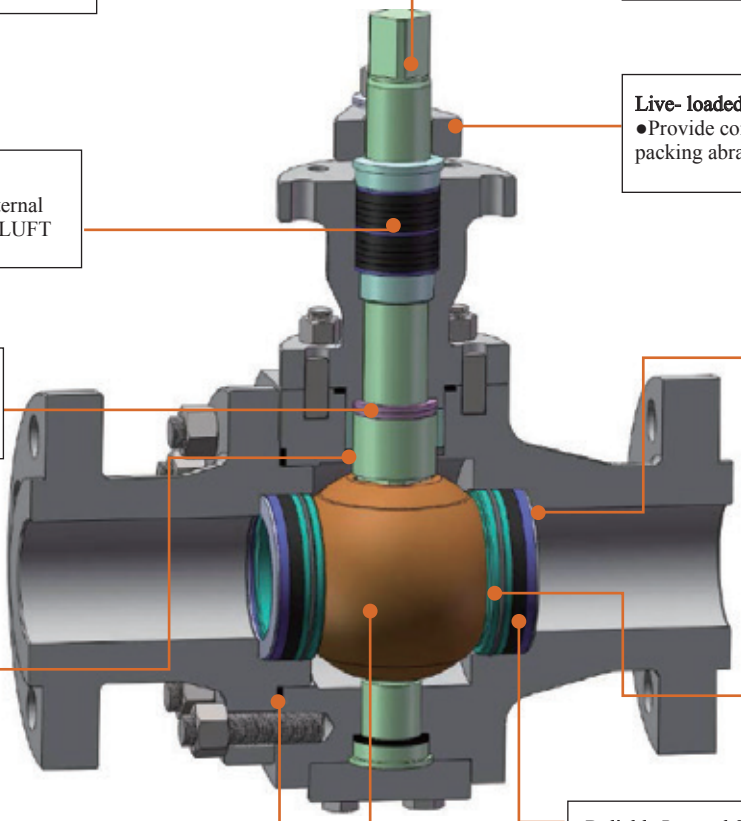
**Specify high-frequently Operating Actuator**
- Minimum 1 million cycles operating. And 4 million cycles can be meet

**Live- loaded Spring Compensation**
- Provide continuous compensation for packing abrasion

**Multiple packing**
- Multiple packing prevents external leakage and meet EPA and TA-LUFT

**Belleville Spring Compensation**
- Stable stiffness coefficient and is not affected by temperature
- Not effected by powder accumulation
- High rigidity coefficient, ensure the scraper function

**Double bearings design**
- Double bearings are hardened to make stem torque is stable



**Self-tightened bearing pocket design**
- Double wedge structure to get self-compensation and prevents particles entering stem pocket.

**Double Scraper Design**
- Self-cleaning, erase solid particles on the ball surface

**Reliable Internal Sealing**
- Meet API598 / ASME B16.104 VI leakage rating
- Reliable bi-directional sealing

**Middle flange quantitative compression**
- Reliable external sealing
- Stable torque

**Special Hard Alloy Coating**
- Suitable for gas, liquid, solid phase with no metal sticking
- Up to 3 million cycles dry friction service life
- Low friction coefficient
- Stable friction coefficient without any changes under temperature and humility variation

# Metal sealing system

The metal sealing system of the ball valve is mainly composed of ball and seat. In solid powder fluid system, ball and seat happens to friction damage while operating. Normally metal-seated ball valve seldom gets damage at low frequently operating. However, for the high-frequently operating ball valve working in discharging unit in polyethylene or polypropylene plant, the valve is operated very often. Friction damage between ball and seat will continue to increase, even serious scratches appear on ball and seat surface. As a result, friction coefficient between ball and seat will continue increasing to make the operating torque bigger and bigger. Finally the actuator would fail to open/close the valve. So the most important key of high-frequently operating ball valve is to ensure a stable anti-abrasive friction coefficient under long term frequently operating. Depending upon plenty of tests and experiments, Antiwear find two perfect coatings which can keep abrasive resistance and stable friction coefficient under long term frequent cycling.

## Damage Mechanism

Generally there're six damages mechanism as following:

| | |
|---|---|
| Metal sticking | Micro-welding between ball and seat |
| Friction oxidation | Activation after ball or valve seat friction reacts with the flow media |
| Creep deformation | thermal stress, mechanical stress alternates to make the sealing surface fatigue |
| Erosion | micro-cutting of fluid passing through valve, another kind of wear caused by fluid |
| Corrosion | the overall corrosion, point corrosion, contact corrosion, inter granular corrosion and stress corrosion |
| Wear | micro-cutting between ball and seat |

Each of above six mechanisms in different conditions may be a fatal "killer" for metal sealing system. And six mechanisms would be affected by each other. However,metal sticking and creep deformation has biggest effects at high-frequently operating application.Creep deformation would make the metal sticking happens at those coating materials which seldom get sticking, even coating could be fully peeled off.

Damage to metal sealing system by metal sticking and creep deformation

## Material selection

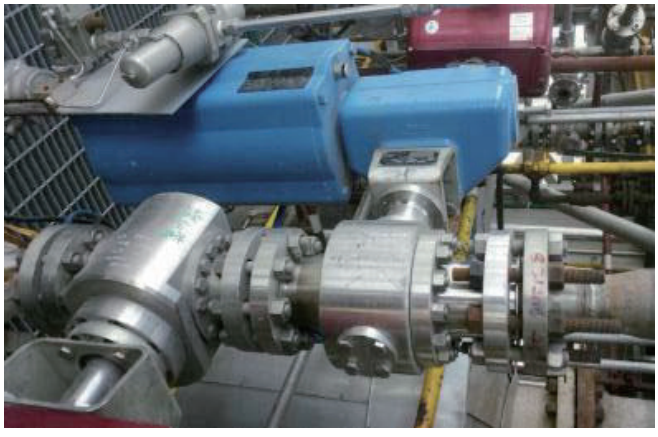
Under high-frequentlyoperating condition, only thoseabrasive resistant materialscan be used as coating. And a good coating should have low friction coefficient without any metal sticking in order to keep a long cycle life.

Depending on lots of researches and tests, Antiwear select mixed coating material under high-frequentlyoperating condition. The mixed coatings consist of basic material, hard alloy and lubricant layer.Three one are not a simple combination, but an organic overall.Basic material should be corrosive resistant and easy to be machined with good mechanic characters under high and low temperature. Hard alloy layer should be abrasive and corrosive resistant, high bonding force and low porosity.Lubricating layer should have low friction coefficient to reduce creep deformation and valve torque.

●For metal-seated high-frequentlyoperating ball valves, Antiwear has developed two kinds of coatings, named Fslloy28 and Fslloy30 as following.

| Coating Code | Hardness | Basic Composition | Coating Thickness (μm) |
|---|---|---|---|
| Fslloy28 | 67 ～ 74（HRC） | Confidential | 200 ～ 400 |
| Fslloy30 | ≥ 80（HRC） | Confidential | 200 ～ 440 |

AtShenhua Ningmei Group's polypropylene plant, Antiwear's ball valve worked at PDS system in which Fslloy28 coating is used. After 24 months running (about 800,000 cycles), the sealing surface of ball and seat is still perfect as below figure. The valve is still on-line working and meet ASME B16.104 leakage rate after checking.



Antiwear's high frequently valve afterrunning10 months

Fslloy28 coating surface after 800k cycles at polypropylene powder medium

In order to getting lower frictioncoefficient and longer cycle life, Antiwear cooperates with famous international companies to develop a new mixed coating Fslloy 30. After lots of tests, it's proved that Fslloy30 is more abrasive resistant comparing to Fslloy28. And its friction coefficient is about 10% lower than that of Fslloy28 and can keep very stable under long term frequently operating. Fslloy30 will do great help to improve the performance of the valve.

Fslloy30 coating ball and seat, after 2 million cycles in simulated working conditions, sealing surface keeps perfect with no actuated torque increasing.(As shown below picture)

Fslloy30 coating ball and seat

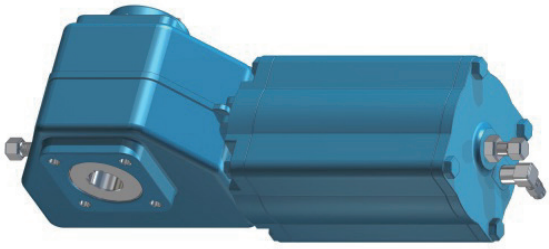
Fslloy30 sealing surface after 2 million cycles with polypropylene powder

●For some tag numbers in PDS system, soft materials such as PEEK and Nglon can be selected as seat material.

# Actuators and Accessories

High-frequentlyoperating is "killer" for the actuator. General-purposed actuator can't be operated a million cycles without special design and verification. Antiwear selects right pneumatic actuator and optimizes pneumatic diaphgram to ensure reliability of the valve.

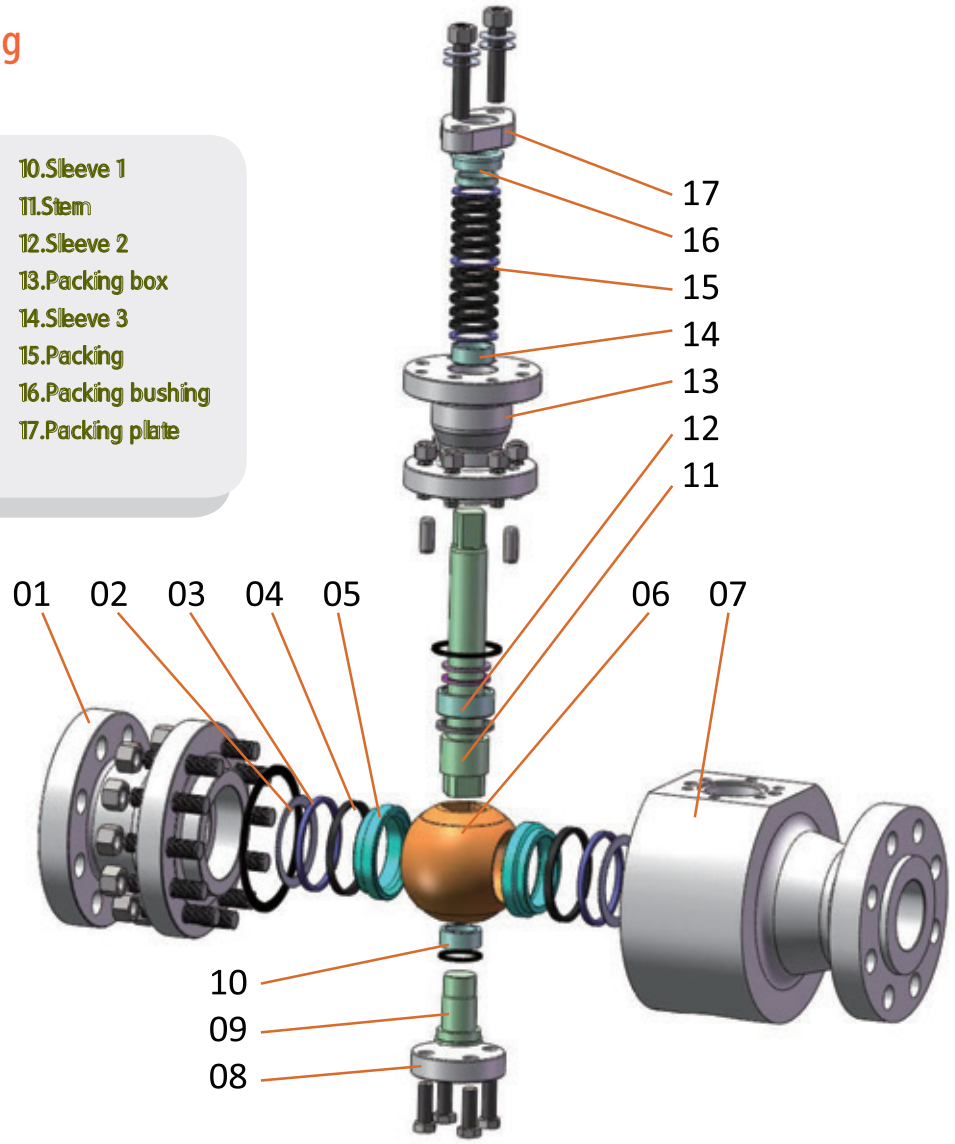
● Actuator selection: well-known brands, such as KINETROL®、MORIN®、METSO®. These actuators are specially designed and verified to meet high frequentlyoperating over one million cycles.



● Pneumatic diaphgram design: Antiwear offers a complete pneumatic solutions to meet long term frequently operating.

# Structural Drawing

1. Cap
2. Disc spring
3. Press ring
4. Seal ring
5. Seat
6. Ball
7. Body
8. Bottom bonnet
9. Bottom stem
10. Sleeve 1
11. Stem
12. Sleeve 2
13. Packing box
14. Sleeve 3
15. Packing
16. Packing bushing
17. Packing plate




Main materials:

| Part Name | Body | Stem | Ball& Seat (basic material) | Packing | Bolt |
|---|---|---|---|---|---|
| Material category | Carbon steel<br>Stainless steel<br>Duplex | Stainless steel<br>Precipitation-hardened stainless steel<br>High-temperature alloy | Stainless steel<br>Duplex | Plastic<br>Compressedpacking<br>Braided packing | Carbon steel<br>Stainless steel |
| Code material | A105/WCB<br>F11/WC6<br>F22/WC9<br>LF2/LCB<br>F51/4A<br>LCC<br>F304/CF8<br>F316/CF8M<br>F304L/CF3<br>F316L/CF3M | 630<br>XM-19<br>Inconel 750<br>Inconel 718<br>660 | F304/F304L<br>F316/F316L<br>F51<br>F53 | Flexible graphite<br>PTFE<br>RPTFE<br>Mixedpacking | B7/L7<br>B8/B8M<br>B8/B8M |

Note: The materials are not limited to above, please contact Antiwear for more materials.

# Ordering Instruction

## Model Number

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HFB | T2 | A | A | 300 | 6 | T3 | 10 | 28 | 28 | 30 | E | P | 1 | RF | 1 | 10 | 22 |

1. Company product code:HFB——High-frequentlyoperated ball valve

2. Series：

| | | | |
|---|---|---|---|
| F2 | Floating two-pieces type | F3 | Floating three-pieces type |
| T2 | Trunnion-pieces type | T3 | Trunnion-pieces type |

3.Metric/English

| English | Metric |
|---|---|
| A | B |

4.Casting/forging

| Casting | forging |
|---|---|
| A | B |

5. Pressure rating class

English

| Class150 | Class300 | Class600 | Class900 |
|---|---|---|---|
| 150 | 300 | 600 | 900 |

Metric

| PN10 | PN16 | PN25 | PN40 | PN63 | PN100 | PN160 |
|---|---|---|---|---|---|---|
| 010 | 016 | 025 | 040 | 063 | 100 | 160 |

6. Nominal diameter

| NPS(English) | 1/2 | 3/4 | 1 | 1½ | 2 | 2½ | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DN(Metric) | 15 | 20 | 25 | 40 | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 |

7. Temperature

| | |
|---|---|
| T2 | ≥ -46℃，< -29℃ |
| T3 | ≥ -29℃，< 180℃ |
| T4 | ≥ 180℃，< 315℃ |
| T5 | ≥ 315℃，< 425℃ |

8. Valve body material

| | | | | | |
|---|---|---|---|---|---|
| 10 | A105/WCB | 14 | LF2/LCB | 21 | F316/CF8M |
| 11 | F11/WC6 | 15 | LCC | 22 | F304L/CF3 |
| 12 | F22/WC9 | 20 | F304/CF8 | 23 | F316L/CF3M |
| 28 | F51/4A | 00 | Other | | |

9. Valve spool material

| F304/CF8 | F316/CF8M | F304L/CF3 | F316L/CF3M | F51/4A | Other |
|---|---|---|---|---|---|
| 20 | 21 | 22 | 23 | 28 | 00 |

10.Sealing surface

| | |
|---|---|
| 28 | FSLLOY28 |
| 30 | FSLLOY30 |
| 10 | PEEK |
| 16 | LYTON |
| 00 | Other |

11. Stem material

| 630 | 660 | XM-19 | Inconel | Incoloy | Other |
|---|---|---|---|---|---|
| 30 | 31 | 32 | 40 | 41 | 00 |

12. Packing

| Flexible graphite | PTFE | RPTFE | Composite packing | Other | Other |
|---|---|---|---|---|---|
| A | B | C | E | X | 00 |

13.Actuated mode

| Pneumatic | Other |
|---|---|
| P | X |

14. Flange standard

| ASME B16.5 | ASME B16.47 | HG20592 | HG20615 | SH3406 | Other |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 0 |

16. Design standard

| ASME B16.34 | API6D | API608 | GB/T12237 | Other |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 0 |

15. Flange connection

| Raised face | Ring connection | Plane | MFM | Tongue and groove face | Butt clamp | Butt welding | Socket | Thread | Other |
|---|---|---|---|---|---|---|---|---|---|
| RF | RJ | FF | FM/M | TG | WAF | BW | SW | TH | 0T |

17. Structure length standard

| ASME B16.10 | | | GB/T12221 | | | Other |
|---|---|---|---|---|---|---|
| Long series | Medium series | Short series | Long series | Medium series | Short series | 0 |
| 10 | 11 | 12 | 20 | 21 | 22 | |

18.Leakage test standard

| API598 | ASME B16.104 | | | Other |
|---|---|---|---|---|
| 10 | IV | V | VI | 0 |
| | 20 | 21 | 22 | |

Note: 1. ① Thread connection standard can be customized.

2. It can be customized according to other materials specified by customers.

ANTIWEAR VALVES

Antiwear enterprise culture——It's reliable

Core philosophy：Open, Reliable, Enterprising, Innovative

**Open Reliable Enterprising Innovative**

FLOWTEX
It's reliable

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