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车用压缩天然气瓶阀

Compressed natural gas cylinder valve for vehicle

(点击此处添加与国际标准一致性程度的标识)

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Foreword

This Standard is drafted in accordance with the rules given in the GB/T 1.1-2020《Directives for standardization—Part 1: Rules for the structure and drafting of standardizing documents》.

This document replaces GB/T 17926-2009 《Compressed natural gas cylinder valve for vehicle》. Compared with GB/T 17926-2009, except for structural adjustment and editorial changes, the main technical changes are as follows:

a) The provisions on the scope of application of valves are changed, the nominal working pressure of valve change from 20 MPa to no more than 25 MPa(see Chapter 1,Chapter 1 of GB/T 17926-2009);

b) The definitions of pressure relief device, burst disk device, fusible plug, combination relief device are deleted (see Chapter 3.1,3.2,3.3,3.4 of GB/T 17926-2009);

c) The terms and definition of Flow restriction device are added (see 3.1).

d) The mechanical property and chemical composition list of metallic material are deleted and changed to reference material standard directly (see 5.2.1.1, Table 1,2 of GB/T 17926-2009).

e) The heat resistance of valve is deleted. The opening and closing test, leakage tightness test, endurance test, temperature cycle test replaces heat resistance test (see 6.6.1,6.6.4,6.6.10 and 6.7.5,5.3.4 of GB/T 17926-2009).

f) The hydraulic pressure of valve is changed from 2.5 times nominal working pressure to 4 times nominal working pressure (see 5.4.1.6,5.3.5 of GB/T 17926-2009).

g) The performance requirements and test methods of resistance to over torque, bending torque, surface liquid resistance tests are added (see 5.4.1.2,5.4.1.3,5.4.1.9,6.6.2,6.6.3,6.6.9).

h) The provisions of environment, medium, temperature, pressure measuring size, flowmeter and pressure gage of type tests are added. (See 6.1.1,6.1.2,6.1.3,6.1.4).

i) The methods for chemical composition analysis of metallic valve parts are added, it can choose electrolysis atomic absorption method, volumetric method, spectral method in the case of non-arbitration (see 6.2).

j) The requirements of ozone aging resistance, dry heat resistance and test methods of non-metallic parts material are added. (See 5.2.2.2,5.2.2.3,6.3.2,6.3.3).

k) The requirements of medium compatibility and test methods of non-metallic seal are changed. (See 5.2.2.4 and 6.3.4,5.1.2 and 6.2.2 of GB/T 17926-2009).

l) The requirements to passivate the body surface are deleted. (See 5.2.1 of GB/T 17926-2009).

m) The requirements and test methods of opening and closing test are changed. (See 5.4.1.1 and 6.6.1,5.3.1 and 6.6 of GB/T 17926-2009).

n) The performance requirements and test methods of air tightness test are changed. The contents of air tightness type test and delivery inspection are stipulated separately. The air tightness test of delivery inspection is changed from high temperature, low temperature, and normal temperature to normal temperature only. (See 5.4.1.4.1,5.4.1.4.2,6.6.4.1 and 6.6.4.2 ,5.3.2 and 6.7 of GB/T 17926-2009).

o) The requirements and test methods of vibration test are changed. (See 5.4.1.5 and 6.6.5,5.3.3 and 6.8 of GB/T 17926-2009).

p) The requirements of stress corrosion resistance test are changed. The requirements for valve raw materials are changed for valve. (See 5.4.1.7 and 6.6.7, 5.1.1 and 6.1 of GB/T 17926-2009).

q) The performance requirements and test methods for the extrusion resistance, leakage tightness, endurance, accelerated life, temperature cycle, flow performance, etc. of pressure relief device are added

(see5.4.2.1,5.4.2.2,5.4.2.3,5.4.2.4,5.4.2.5,5.4.2.8,6.7.1,6.7.2,6.7.3,6.7.4,6.7.5,6.7.8). The performance requirements and test methods of pressure relief performance of pressure relief device are changed (see 5.4.2.7 and 6.7.7,5.3.9 and 6.14 of GB/T 17926-2009).

r) The performance requirements and test methods of endurance, pressure pulse of Flow restriction device is added (see 5.4.3.1,5.4.3.2,6.8.1,6.8.2). The requirements and test methods of current limiting performance of Flow restriction device are changed (see5.4.3.3 and 6.8.3,5.3.10 and 6.15 of GB/T 17926-2009). It’s stipulated that Flow restriction device should be designed with bypass channel structure (see 5.1.5).

s) The requirements of design quality and quality inspection are deleted (see 5.2.4,6.5 of GB/T 17926-2009).

t) The provisions of incoming inspection of burst disk and fusible material are added (see 7.1.3).

u) The contents of valve delivery inspection are changed. The contents of sampling and batch inspection will be listed in table (see table 4,7.2 of GB/T 1 7926-2009)

v) The test items of type test are changed. The test sample number, test sequence, test condition, test method and determination basis are stipulated again according to the test requirements (see Table 5, Table 5 of GB/T 17926-2009).

w) The design service life of valve and the principle of valve type test are added (see 5.1.6,7.3.1).

x) The contents of valve mark are changed. The product date or batch number on the valve should be changed to the batch number (see 8.1,8.1 of GB/T17926-2009).

y) The provisions on the electronic certificate in the form of QR code are added (see 8.2.2). The contents of installation torque of inlet and outlet connection are added in the manual (see 8.2.4).

z) The contents of product batch quality certificate are added (see 8.2.5).

Please note that some contents of this document may involve patents. The publisher of this document is not responsible for identifying these patents.

This document is proposed by and under the jurisdiction of the National Standardization Technical Committee of gas cylinders (SAC/TC 31).

This document was drafted by: Ningbo Fuhua Valve Co., Ltd, Shanghai Special Equipment Inspection and Research Institute, Jiangsu Baocheng Special Equipment Inspection Group Co., Ltd, China Special Equipment Inspection and Research Institute, Dalian Boiler and Pressure Vessel Inspection and Research Institute Co., Ltd, Chongqing Special Equipment Inspection and Research Institute, Shanghai Baitu low-temperature Valve Co., Ltd, Rotarex Valve (Shanghai) Co., Ltd, Zhejiang Mingshi xing xin nuan tong Technology Co., Ltd, Ningbo Sanan Valve Manufacture Co., Ltd, Zhejiang Valtec Special Gas Control Technology Co., Ltd, Jiaxing Special Equipment Inspection and Research Institute, Jiangsu Mingsheng Heavy Industry Co., Ltd.

The chief drafter: GU Qiuhua, SUN Li, HUANG Qianghua, WANG Yanhui, LUO Xuewu, HU Liang, DAI Xingtao, LI Bin, FAN Gaoping, FENG Junhua, LI Qian, WENG Guodong, WANG Jifeng, ZHU Chaoming, NI Fei, TIAN Feng.

This document was published originally in 1999 and was revised first time in 2009 and This is the second revision.

Compressed natural gas cylinder valve for vehicle

* 1. Scope

This standard specifies requirements for basic types, specifications, test methods, inspection rules, markings, packaging, transportation, and storage of compressed natural gas cylinder valve for vehicle.

This standard is applicable to compressed natural gas cylinder valve for vehicle (hereinafter referred to as valve) used at service temperature -40℃～＋85℃, and nominal working pressure less than 25 MPa.

* 1. Normative references

The following referenced documents are indispensable of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 197 General purpose metric screw threads-Tolerances

GB/T 228.1 Metallic material-Tensile testing-Part 1:Method of test at room temperature

GB/T 1173 Casting aluminum alloy

GB/T 3512 Rubber, vulcanized or thermoplastic-Accelerated ageing and heat resistance—Air-oven method

GB/T 3934 Specification of gauges for general purpose screw threads

GB/T 4423 Copper and copper-alloy cold-drawn rod and bar

GB/T 5121.1 Methods for chemical analysis of copper and copper-alloy—Part 1: Determination of copper content

GB/T 5121.3 Methods for chemical analysis of copper and copper-alloy—Part 3: Determination of lead content

GB/T 5121.9 Methods for chemical analysis of copper and copper-alloy—Part 9: Determination of iron content

GB/T 5231 Designation and chemical composition of wrought copper and copper alloys

GB/T 8335 Special threads for gas cylinders

GB/T 8336 Special thread gauges for gas cylinders

GB/T 8337 Fusible plug device for gas cylinders

GB/T 12716 Pipe threads with the thread angle of 60 degrees where pressure-tight joints are made on threads

GB/T 13005 Terminology of gas cylinders

GB/T 13642 Rubber, vulcanized or thermoplastic-Resistance to ozone cracking-Dynamic strain testing

GB/T 15383 Connection types and dimensions for gas cylinder valve outlets

GB/T 16918 Bursting disc safety devices for gas cylinders

GB 18351 Ethanol gasoline for motor vehicles

GB/T 33215 Pressure relief devices for gas cylinders

* 1. Terms and definitions

The following terms and definitions list in GB/T 8337、GB/T 13005 、GB/T 16918、GB/T 33215 are applicable to this document.

Flow restriction device

Device that can operate and limit the flow of gas when the gas flow or inlet and outlet pressure difference exceeds a set value

* 1. Basic type

The opening and closing type of valve is manual control.

Pressure relief device, PRD. The valve shall have a pressure relief device (PRD), The type of which is burst disk-fusible plug connected in series.

The Flow restriction device can be set on the valve according to use requirements.

Model Denotation Method

The model of valve should be composed of the following parts: the compressed natural gas cylinder valve for vehicle code should be represented by “CTF”; When the valve has an Flow restriction device, the Flow restriction device code should be added and represented by “X”; The design structure serial number of should be represented by Arabic numbers in order, and the improvement serial number should be represented by capital English letters in order.

Marks：

C T F X - □ □

Improved serial number

Design structure serial number

Flow restriction device code

Compressed natural gas cylinder valve for vehicle code

Example：

CTFX-2A, represent the compressed natural gas cylinder valve for vehicle with Flow restriction device first improved in the second design structure

* 1. Technical requirements
     1. Design requirements

PZ27.8 taper thread or M25×2 regular screw thread should be used as connecting thread of valve’s inlet.

W21.8-14LH Whitworth screw, NPT1/4 taper pipe thread or M12×1 regular screw thread should be used as connecting thread of valve’s outlet.

The nominal drift diameter of the valve should not be less than 4mm and meet the use requirements in work.

The pressure relief device should meet the requirements of the safety release of cylinder volume and the fire test requirements stipulated in the supporting cylinder product standards.

The Flow restriction device should be designed with bypass channel.

The design working life of the valve should be specified and should be at least one cylinder inspection cycle.

* + 1. Material requirements
       1. Material of metallic part

It is recommended to use HPb59-1 rods and bars for main metallic parts of valve (valve body, valve stem, spindle, gland nut, safety nut). Its mechanical properties and chemical composition should meet the provisions of GB/T 4423, GB/T5231. If other materials are used, its mechanical properties should not be lower than the provisions of HPb59-1.

It is recommended to use ZL 102 for handwheel materials and meet the provisions of GB/T 1173.

Burst disk materials should meet the provisions of GB/T 16918.

Fusible materials should meet the provisions of GB 8337.

* + - 1. Material of non-metallic seal
         1. Resistance to oxygen aging

Visible crack and aging phenomenon shall not occur after the non-metallic seals are kept in oxygen which purity reaches over 99.5% with pressure of 2 MPa and temperature of 70±5 ℃ for 96 hours

* + - * 1. Resistance to ozone aging

Crack phenomenon shall not occur after the rubber seals at 20% elongation are kept in ozone which the concentration is （50±5）×10-8 with temperature of 40±2 ℃ for 72 hours.

* + - * 1. Resistance to dry heat

The change of tensile strength should not be more than 25% and the change range of elongation should be within -30%～+10% after the rubber seals are kept in air with temperature of 85℃ for 168 hours.

* + - * 1. Compatibility of medium

Crack, tear phenomenon shall not occur, and the volume expansion rate should not exceed 25% or the shrinkage rate should not exceed 1% and the moss loss rate should not exceed 10% after the non-metallic seals are kept in natural gas which working pressure isn’t less than 0.95 times nominal working pressure for 70 hours.

The volume change rate should not exceed 20% after the non-metallic seals are kept in n-pentane with temperature of 23±2 ℃ for 72 hours. And then the moss loss rate should not exceed 5% after the non-metallic seals are kept in air with temperature of 40℃ for 48h.

* + 1. Process requirements

The valve body should be forged and molded, and the surface should not have defects that impair the performance of the valve such as cracks, wrinkles, inclusions, loose, shrinkage holes and underfill. When the surface of valve body take shot blasting process, the size and depth of surface pit should be uniform.

The connection thread size and manufacturing accuracy of the valve inlet should meet the specifications in GB/T 8335 or GB/T 197.

The connection type size and manufacturing accuracy of the valve outlet should meet the specifications in GB/T 15383, GB/T 12716, or GB/T 197.

* + 1. Performance requirements
       1. Performance of valve
          1. Operating performance

The valve shall be fully opened and closed according to the temperature and test torque in Table 1 at nominal working pressure.

Table 1 Torques to be used for operating performance test

|  |  |  |
| --- | --- | --- |
| Nominal drift diameter  mm | Max torque（room temperature）  N•m | Max torque（-40℃）  N•m |
| ≤6 | 1.7 | 3.4 |
| 8 or 10 | 2.3 | 4.5 |
| 12 | 2.8 | 5.6 |

* + - * 1. Resistance to over torque

The threads connecting the valve inlet and outlet to the external parts shall bear the following over torque:

a) The connecting threads of valve outlet bear 150% installation torque for at least 15min and it shall not show any deformation or damage of valve and meet the specifications in 5.4.1.4.1 and 5.4.1.6.

Note: The installation torque should be stipulated by manufacturer and make sure interface tightness under normal operating conditions.

b) The connecting threads of valve inlet bear torque given in Table 2, and it shall not show any visible deformation or damage of valve and meet the specifications in 5.4.1.4.1 and 5.4.1.6

Note: The actual installation torque of valve may be higher than torque given in Table 2 due to the inertia that the mechanical equipment is subjected to before stopping.

Table 2 Torque to be born for valve inlet connecting threads

|  |  |
| --- | --- |
| Thread specification | Max installation torque  N•m |
| PZ27.8 | 300 |
| M25×2 | 200 |

* + - * 1. Bending torque

The valve rotates along the horizontal axis of the outlet for four times, each time with 90º and apply the torque given in Table 3 with the pressure of 0.05MPa for 15min.The joint shall not show deformation and meet the specification in 5.4.1.4.1 and 5.4.1.6.

Table 3 Minimum bending torque

|  |  |
| --- | --- |
| Diameter  mm | Force  N |
| 6 | 3.4 |
| 8 | 9.0 |
| ≥12 | 17.0 |

* + - * 1. Leakage test

Leakage test for type test

The bubbles shall not be observed, or the leak rate of valve shall be less than 20cm3/h (standard condition) when the valve is in the closed and arbitrary open state under the following condition:

a) The test temperature of the valve remains at least 2min at 0.75 times and 0.025 times nominal working pressure with temperature of -40℃.

b) The test temperature of the valve remains at least 2min at 0.025 times and 1.5 times nominal working pressure with temperature of 15℃～30℃.

c) The test temperature of the valve remains at least 2min at 0.05 times and 1.5 times nominal working pressure with temperature of 85℃.

Leakage test before delivery

The test temperature of the valve remain at least 1min at 0.025 times and 1.2 times nominal working pressure with room temperature and the bubbles shall not be observed when the valve is in the closed and arbitrary open state.

* + - * 1. Vibration resistance

The valves shall be free from damage and looseness at the screw connection after the vibration test with the frequency of resonant frequency or 500HZ for 30min in each of the three vertical directions of X, Y and Z under nominal working pressure and shall meet the specification in 5.4.1.4.1,5.4.2.2,5.4.2.1,5.4.2.7c and5.4.1.6.

* + - * 1. Pressure resistance

Leakage and other abnormal phenomenon shall not occur after the valve remain 3min at 2.5times nominal working pressure.

* + - * 1. Stress corrosion resistance

Crack phenomenon shall not occur after the valves are ammonia smoked in container of ammonia-air mixture with temperature of 34±2 ℃ for 240 hours.

* + - * 1. Salt spray corrosion resistance

The result of salt spray test which in salt spray room with temperature of 33℃～36℃ for 500h shall meet the specification in 5.4.1.4.1,5.4.2.1,5.4.2.2,5.4.2.7c and 5.4.1.6.

* + - * 1. Liquid resistance on the surface

Performance damage and affecting phenomenon such as crack, softening, swelling shall not occur after the valves are soaked in the following three liquid for 24h and it shall meet the specification in 5.4.1.4.1,5.4.2.2,5.4.2.1 and 5.4.1.6.

The liquid used in the test：

a) Sulfuric acid aqueous solution: a solution of sulfuric acid and water with a volume ratio of 19:81.

b) Ethanol/gasoline: E10 fuel with a volume ratio of 10:90 which meet the specification in GB 18351.

c) Windshield washing solution: a solution of methanol and water with a volume ratio of 1:1.

* + - * 1. Endurance test

The valve shall meet the specification in5.4.1.4.1,5.4.1.4 and 5.4.1.6 under the following conditions:

a) Full stroke opening and closing 1920 times with temperature of 15℃～30℃ and nominal working pressure.

b) Full stroke opening and closing 40 times with temperature of 85℃ and nominal working pressure.

c) Full stroke opening and closing 40 times with temperature of -40℃ and nominal working pressure.

* + - 1. Performance of safety relief device
         1. Resistance to extrusion

The fusible alloy plug of PRD shall not be extruded with the pressure increased to 2.25 times nominal working pressure at the rate of 0.5MPa/s after remaining pressure at 1.2 times nominal working pressure for 30min.

* + - * 1. Leakage test

The pressure relief device shall be free of bubbles under the following conditions. If bubbles are observed, the leakage rate shall be tested by appropriate methods and shall be less than 2cm3/h (in standard state):

a) The test pressure of PRD shall remain at 0.75 times nominal working pressure for at least 2 min with temperature of -40℃.

b) The test pressure of PRD shall remain at 1.3 times nominal working pressure for at least 2 min with temperature of 85℃.

* + - * 1. Endurance test

PRD shall meet the specification in 5.4.2.2 and 5.4.2.7c under the following conditions:

a) 2,000 cycle times at the range of 10%～100% nominal working pressure with temperature of 85℃.

b) 18,000 cycle times at the range of 10%～100% nominal working pressure with temperature of 57℃±2℃.

* + - * 1. Accelerated life

The accelerated life of PRD shall meet the following requirements:

a）The PRD can operate within 10h under the condition of maximum bursting pressure and flow temperature of fusible alloy.

b）The PRD shall not operate within 500h under the condition of nominal working pressure and accelerated life test temperature（*T*L）.

The accelerated life test temperature （*T*L） is expressed as:

*T*L=12.88×*T*f0.420

*T*f is flow temperature and the unit is degree centigrade. (℃）

* + - * 1. Temperature cycle

The temperature of PRD shall meet the following requirements:

a) 15 temperature cycles completed with the temperature remained at -40℃ and 85℃for at least 2h.

b) 100 temperature cycles completed with the temperature remained at -40℃ for at least 2h under （10%～100%）nominal working pressure and meet the specification in 5.4.2.2 and 5.4.2.7c.

* + - * 1. Resistance to condensate corrosion

The PRD shall meet the specifications in 5.4.2.2 and 5.4.2.7c after soaked in the prepared test solution for 100h and heated to 85℃ for 100h with temperature of 21℃±2℃.

* + - * 1. Pressure relief performance

The pressure relief performance of PRD shall meet the following requirements:

1. The bursting pressure of PRD is the hydrostatic test pressure of the supporting gas cylinder, with the allowed deviation +10% 0;
2. The flow temperature of fusible alloy is 110℃±5℃
3. The operating pressure of PRD shall be within the range of 75%～105% of standard operating pressure after the endurance, temperature cycle, resistance to condensate corrosion, resistance to salt spray corrosion and vibration test with the temperature that 11℃±1℃ higher than fusible alloy flow temperature.

Note: The standard operating pressure of PRD is the average value of burst pressure measured in a）.

* + - * 1. Flow performance

The differential value between the maximum flow and minimum flow of PRD shall be within 10% of the maximum flow under the pressure of 0.8MPa～0.9MPa.

* + - 1. Performance of Flow restriction device
         1. Endurance test

The Flow restriction device shall complete 20 opening and closing cycle at nominal working pressure and meet the specification in 5.4.3.3.

* + - * 1. Pressure pulse test

The inlet and outlet of Flow restriction device shall be applied with 100 times nominal working pressure pulse and meet the specification in 5.4.3.3.

* + - * 1. Flow restriction performance

The Flow restriction device shall operate and limit the current when the pressure difference between the inlet and outlet of Flow restriction device is more than 0.65MPa. The bypass flow of the Flow restriction device shall not be more than 0.05m3/min (in standard state) when the pressure difference reaches 10 MPa.

* 1. Inspection and test methods
     1. Test conditions
        1. Test environment

Unless there are special requirements, the tests specified in this document are carried out at an ambient temperature of 15°C to 30°C. The test room should be protected from vibration, humidity, corrosion, and ventilation.

* + - 1. Test medium

Unless otherwise specified, the pressure test medium is clean water, other test mediums are pure dry air or nitrogen, etc., and the test solvent for the low temperature air tightness test should be anhydrous alcohol.

* + - 1. Test temperature, test pressure and measurement dimensions

Unless there are special requirements, the maximum deviation of all parameters such as test temperature, test pressure and rated measurement dimension during test operation is ±5%.

* + - 1. Flow meter and pressure gauge for test

The accuracy of the flow meter used in the test is 0.5 grade. The accuracy of the pressure gauge should not be lower than Class 1.6, and the range of the pressure gauge should be (1.5-2) times the test pressure.

* + 1. Material mechanical property test and chemical composition analysis of metal parts

The main metal parts of the valve (valve body, valve stem, upper/lower spindle, press cap, safety cap) material mechanical properties test method according to the provisions of GB/T 228.1, chemical composition analysis method according to GB/T 5121.1, GB/T 5121.3, and the provisions of which shall also comply with the provisions of 5.2.1.1 GB/T 5121.9.

Note: Under non-special circumstances, the chemical composition analysis method of metal materials can be electrolysis, atomic absorption, volumetric, and spectroscopy.

* + 1. Non-metallic seal material performance test
       1. Oxygen aging resistance test

Place 3 pcs non-metallic seal test pieces in the aging test device, remove the air in the device, fill with oxygen with a purity of ≥99.5%, and make the pressure reach 2MPa, heat up to 70℃±5℃, keep it for 96h and take it out. Observe the changes, and they should meet the requirements of 5.2.2.1.

* + - 1. Ozone aging resistance test

According to the test method specified in GB/T 13642, place 3 pcs rubber seal material specimens at 20% elongation at a temperature of 40℃±2℃ and an ozone concentration of (50±5) ×10-8 In the air ozone box, keep it for 72 hours and take it out, and check the changes with a 25-fold magnifying glass, which should meet the requirements of 5.2.2.2.

* + - 1. Dry heat resistance test

According to the test method specified in GB/T 3512, place three rubber seal material specimens in an air box with a temperature of 85°C for a 168h-dry heat resistance test, which should meet the requirements of 5.2.2.3.

* + - 1. Medium compatibility test

6.3.4.1 The test medium is compressed natural gas for vehicles, and it shall be carried out at room temperature. Three samples are used for each test. Each sample should be placed on a small diameter wire loop, and its volume is determined by first weighing in air (M1), and then in water (M2). Then the samples were wiped dry and placed in a test device of compressed natural gas for vehicles not less than 0.95 times the nominal working pressure. After 70h, the samples should be taken out of the device without cracking and placed on the same wire loop and weighed in the air (M3), this mass should be weighed within 3 minutes of leaving the test medium. Then immediately determine the final mass in the water (M4). Before obtaining the water mass (M2 and M4), each sample should be immersed in ethanol and then in water. The volume change (⊿V) is calculated by formula (1), and the result should be the average of 3 samples. After the weight of the volume change (⊿V) is determined, the sample is placed in the air at room temperature for 70h to reach a constant mass, and then the sample is weighed in the air (M2'), and the mass loss (⊿M) should be calculated according to the formula (2) Calculation, the result should be the average of 3 samples, and meet the requirements of 5.2.2.4.1:

**⊿*V* =**  …………………………………（1）

**⊿*M* =**   ………………………………………………（2）

6.3.4.2 The test medium is n-pentane, and it shall be carried out at a temperature of 23°C ± 2°C. Three samples are used for each test. Each sample should be placed on a small diameter wire loop, and its volume is determined by first weighing in air (M1), and then in water (M2). Then the samples were wiped dry and placed in the test device of n-pentane. After 72 hours, the samples were taken out of the device one by one, placed on the same wire loop and weighed in the air (M3). This mass should be less than 30 seconds away from the test medium. Internal weighing. Then immediately determine the final mass in the water (M4). Before obtaining the water mass (M2 and M4), each sample should be immersed in ethanol and then in water. The volume change (⊿V) is calculated by formula (1), and the result should be the average of 3 samples. After the volume change (⊿V) quality is determined, the sample should be placed in the air with a temperature of 40℃ for 48h to reach a constant mass, and then the sample should be weighed in the air (M2'), and the mass loss (⊿M) should be in accordance with the formula (2) calculation, the result should be the average of 3 samples, and meet the requirements of 5.2.2.4.2.

* + 1. Valve body appearance inspection

The appearance of the valve body shall be checked by visual inspection and shall meet the requirements of 5.3.1 and 8.1.1.

* + 1. Inlet and outlet thread inspection

The inlet connecting thread of the valve shall be inspected with a gauge manufactured in accordance with the GB/T 8336 or GB/T 3934 standard and shall meet the requirements of 5.3.2.

The outlet connecting thread of the valve shall be inspected with a gauge made in accordance with GB/T 3934 or the corresponding thread standard and shall meet the requirements of 5.3.3.

* + 1. Valve performance test
       1. Open and close test
          1. Normal temperature open and close test

Install the valve on the test device, keep the valve closed, infuse the air source from the valve inlet to the nominal working pressure, block the outlet, open the valve according to the torque specified in Table 1, the valve should be fully open, and then Then close the valve according to the torque specified in Table 1. The valve should be able to close and meet the requirements of 5.4.1.1.

* + - * 1. Low temperature open and close test

Install the valve on the test device, place it in a temperature control box at -40℃, keep the valve closed, fill the air source from the valve inlet to the nominal working pressure, and block the air outlet, as specified in Table 1. The valve should be able to fully open, and then close the valve according to the torque specified in Table 1, the valve should be able to close and meet the requirements of 5.4.1.1.

* + - 1. Over-torque resistance test

Block the valve outlet with a nut or screw plug, and then tighten the nut or screw plug with 150% of the installation torque respectively. The applied torque should be maintained for more than 15 minutes, and then remove the nut or screw plug. Visually check that the valve should not be deformed or deformed. If it is damaged, the test shall be carried out according to the provisions of 6.6.4.1 and 6.6.6, and it shall meet the requirements of 5.4.1.4.1 and 5.4.1.

Install the air inlet of the valve on the special test device and use a torque wrench to tighten it according to the installation torque specified in Table 2, and then perform the test according to the requirements of 6.6.4.1 and 6.6.6, which should meet 5.4.1.4.1 and 5.4. 1.6.

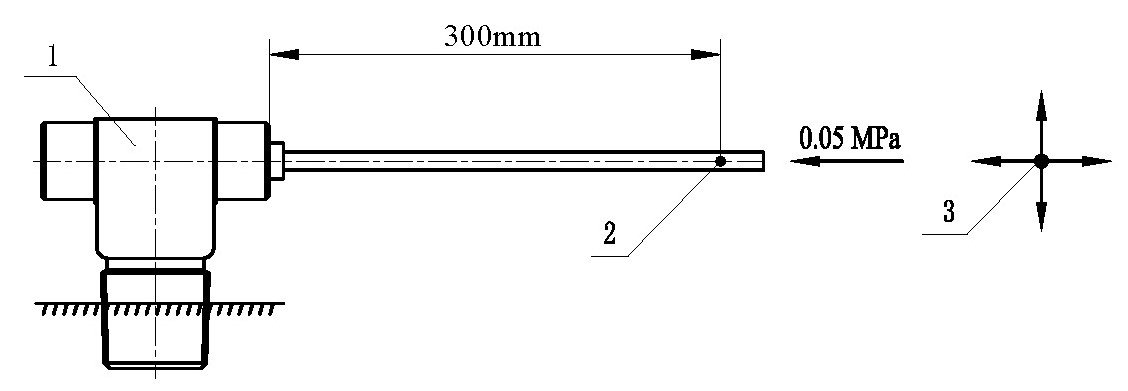
* + - 1. Bending torque test

Fix the inlet of the valve on the test device (see Figure 1), connect a pipe with a length greater than 300mm to the air outlet of the valve, fill the pipeline with 0.05MPa compressed gas and follow the steps below:

a）Select any one of the four directions of the force point to apply the force specified in Table 3 in the vertical (up and down) and horizontal (left and right) directions and keep it for at least 15 minutes. Without removing the force, coat the valve outlet with leak detection agent and there should be no leakage at the threaded connection by visual inspection.

b）Follow step a) to complete the other three axis tests.

c）After completing the above steps, remove the valve, visually check that the valve should not be deformed, and then carry out the test according to the requirements of 6.6.4.1 and 6.6.6, which should meet the requirements of 5.4.1.4.1 and 5.4.1.6.



Description of indexing sequence number:

1— Valve under test.

2— Stress point.

3— The direction of force.

Figure 1 Schematic diagram of bending torque test

* + - 1. Leakage test

6.6.4.1 Type test for leakage

Low temperature test

Install the valve on the test device, keep the valve open, block the outlet and place it in absolute alcohol, then put it into the temperature control box, and fill the valve with air source through the external pipeline, fill 0.75 times and 0.025 times of the nominal working pressure and maintain. Then, when the initial temperature is at room temperature, gradually decrease the temperature to -40℃±2℃. When the sample valves reach this temperature, observe the valves for at least 2 minutes, which should meet the requirements of 5.4.1.4.1a).

For a valve with a spherical seal structure, the valve should be in a fully open state when the leakage test is performed. The following requirements are roughly the same.

Room temperature test

Install the valve on the test device, keep the valve open, block the outlet, fill the valve with compressed gas to 0.025 times and 1.5 times the nominal working pressure, and maintain. Then put the valve in water to maintain the pressure for at least 2 minutes, which should meet the requirements of 5.4.1.4.1 b).

Install the valve on the test device, close the valve, and fill with compressed gas to 0.025 times and 1.5 times the nominal working pressure, and maintain. Then put the valve in water to maintain the pressure for at least 2 minutes, which should meet the requirements of 5.4.1.4.1b).

High temperature test

Install the valve on the test device, keep the valve open, block the outlet and place it in water, then put it into the temperature control box, through the external pipeline, fill the valve with compressed gas to 0.05 times and 1.5 times the nominal working pressure, and maintain. Then, when the initial temperature is at room temperature, gradually increase to 85°C ± 2°C. When the sample valves reach this temperature, observe the valves for at least 2 minutes, which should meet the requirements of 5.4.1.4.1c).

Install the valve on the test device, close the valve and place it in water, then put it into the temperature control box, through the external pipeline, fill the valve with compressed gas to 0.05 times and 1.5 times the nominal working pressure, and maintain. Then, when the initial temperature is at room temperature, gradually increase to 85°C ± 2°C. When the sample valves reach this temperature, observe the valves for at least 2 minutes, which should meet the requirements of 5.4.1.4.1c).

* + - * 1. Leakage test before delivery

At room temperature, according to the test method specified in 6.6.4.1.2, fill the valve with 0.025 times and 1.2 times of the nominal working pressure for leakage test. The pressure holding time is 1 min, which should meet the requirements of 5.4.1.4.2.

* + - 1. Vibration resistance test

Install the valve on the test device, block the outlet and open the valve, fill compressed gas to the nominal working pressure, and install the device on the vibration test bench. In the sinusoidal range of 10Hz to 500Hz, the vibration is swept for 10min at an acceleration of 1.5g, and the resonance frequency of the valve shall be found. At this frequency, the valve is subjected to a 30min vibration test along the three orthogonal axis directions. If no resonance frequency is found, the valve shall be subjected to a 30-minute vibration test along the three orthogonal axis directions at a frequency of 500 Hz. After the test, there should be no damage and no looseness in the threaded connection, which is specified in 6.6.4.1, 6.7.2, and 6.7.1. The tests specified in 6.7.7.3 and 6.6.6 shall meet the requirements of 5.4.1.4.1, 5.4.2.2, 5.4.2.1, 5.4.2.7c) and 5.4.1.6.

* + - 1. Pressure resistance test

Remove the safety relief device on the valve, block all the inlets and outlets of the valve (except the inlet connected to the gas cylinder), open the valve, connect the inlet of the valve to the hydraulic pump, and fill the valve with clean water, pressurized to 2.5 times the nominal working pressure, keep the pressure for 3 minutes, the result should meet the requirements of 5.4.1.6.

* + - 1. Stress corrosion resistance test

Pour ammonia with a relative density of 0.94 (proportion) into a glass container with a lid, and the volume ratio of the added ammonia to the container is 21.2ml/L (for example, a 30L glass container should be filled with 636ml ammonia). Screw the plug on the inlet and outlet of the valve with the torque specified by the manufacturer. No fillings such as polytetrafluoroethylene are allowed on the thread. Then put the valve in a glass container with a lid that is well-proportioned with ammonia. The valve should be located Place the glass cover 40mm above the ammonia liquid level, put the glass container into the temperature control box, set the temperature to 34℃±2℃, keep the temperature for 240h, check the valve under 25 times magnifying glass, and it should conform to the requirements in 5.4.1.7.

* + - 1. Salt spray corrosion resistance test

Put the valve in the salt spray chamber between 33℃～36℃ and block the inlet and outlet. Without any cover, use a salt solution composed of 5% sodium chloride and 95% distilled water (by weight). The valve is continuously subjected to the salt spray test for 500 hours, and then taken out, immediately rinse the test piece with clean water, and gently wipe off the salt deposits, then test it according to 6.6.4.1, 6.7.2, 6.7.1, 6.7.7.3 and 6.6. and the results should meet the requirements of 6.4.1.4.1, 5.4.2.2, 5.4.2.1, 5.4.2.7c) and 5.4.1.6.

* + - 1. Liquid resistance on surface test

Block the inlet and outlet of the valve, and carry out the test according to the following steps:

a) Place the valve in a solution of sulfuric acid and water with a volume ratio of 19:81. After 24 hours, rinse the valve with clean water. It should meet the results of no cracks, softening or swelling and affecting its performance as specified in 5.4.1.9.

b) Place the valve in a mixture solution of E10 fuel ethanol and gasoline with a volume ratio of 10:90. After 24 hours, rinse the valve with clean water. It should meet the results of no cracks, softening or expansion and other damage and affecting its performance as specified in 5.4.1.9.

c)Place the valve in a 1:1 volume ratio of methanol and water in the windshield washing liquid. After 24 hours, rinse the valve with clean water. It should meet the results of no cracks, softening or expansion and other damage and affecting its performance as specified in 5.4.1.9.

d) After being immersed in the three liquids, the test shall be carried out according to the requirements of 6.6.4.1, 6.7.2, 6.7.1 and 6.6.6, and shall meet the requirements of 5.4.1.4.1, 5.4.2.2, 5.4.2.1 and 5.4.1.6.

* + - 1. Durability test

Install the valve on the test device, then install the test device on the life testing machine, connect the device with the compressed gas source, close the valve, and fill the valve with compressed gas to the nominal working pressure according to 5.4.1.10. Start the life testing machine at the specified temperature, start a full-stroke opening and closing cycle at a rate of (10s ± 2s)/time, during each cycle, when the valve is opened, the outlet should be exhausted to less than 0.5MPa, and when the valve is closed, the inlet should be refilled to the nominal working pressure, the opening and closing of the valve should always be in a state of pressure cycle, and each opening and closing cycle is one durability set of the valve. After the valve has completed the cycles, it shall be tested according to the requirements of 6.6.4.1, 6.6.1 and 6.6.6, and shall meet the requirements of 5.4.1.4.1, 5.4.1.1 and 5.4.1.6.

* + 1. Safety pressure relief device performance test
       1. Anti-extrusion test

Install the valve with PRD on the test device, charge 1.2 times the nominal working pressure from the inlet of the valve, keep the pressure for 30 minutes, and then increase the pressure to 2.25 times the nominal working pressure at a rate of 0.5MPa/s, the result should meet the requirements of 5.4.2.1.

* + - 1. Leakage test

Install the valve with PRD on the test device, keep the valve closed, place it in absolute alcohol, then put it into the temperature control box, and fill the valve with compressed gas to 0.75 times the nominal work pressure, and maintain. Then, when the initial temperature is at room temperature, gradually decrease the temperature to -40°C±2°C. When the sample valves reach this temperature, observe the valve for at least 2 minutes, the result should meet the requirements of 5.4.2.2a).

Install the valve with PRD on the test device, keep the valve closed, place it in clean water, then put it into the temperature control box, and fill the valve with compressed gas to 1.3 times the nominal work pressure, and maintain. Then, when the initial temperature is at room temperature, gradually decrease the temperature to 85℃±2℃. When the sample valves reach this temperature, observe the valve for at least 2 minutes, the result should meet the requirements of 5.4.2.2a).

* + - 1. Durability test

Install the valve with PRD on the test device, close the valve, then install the test device into the temperature control box, fill the valve with water pressure through the external pipeline to the nominal working pressure, then reduce the pressure to below 10% of the nominal working pressure, and then gradually increase the pressure to the nominal working pressure. One process from pressure increase to pressure reduction is one pressure cycle. In this pressure range, PRD completes 2000 cycles at 85°C±2°C and 18000 cycles at 57°C±2°C at a cycle frequency of no more than 10 times/min. After completing the specified number of cycles, the fusible alloy plug should have no signs of extrusion.

After completing the above tests, perform the tests according to 6.7.2 and 6.7.7.3, the results should meet the requirements of 5.4.2.2 and 5.4.2.7c).

* + - 1. Accelerated life test

Install the valve with PRD on the test device, keep the valve closed, place it in a high-low temperature box or a liquid bath, and gradually increase the temperature so that the temperature of the PRD is controlled within the range of the flow temperature ± 1 ℃, fill the inlet of the valve through the external pipeline with compressed gas to the maximum burst pressure. It should act within 10 hours at this pressure and temperature and meet the requirements of 5.4.2.4a).

Install the valve with PRD on the test device, keep the valve closed, place it in a high and low temperature box or a liquid bath, and gradually increase the temperature so that the temperature of the PRD is controlled at the accelerated life test temperature TL, then fill the inlet through an external pipeline with compressed gas to the nominal working pressure (tolerance ±0.7MPa), and keep it at this pressure and temperature for more than 500h, the results should meet the requirements of 5.4.2.4b).

* + - 1. Temperature cycle test

PRD should be tested according to the following steps:

a) Put the valve with PRD in a liquid tank or high and low temperature tank with a temperature of -40℃ for at least 2h, then take out the valve for 5 minutes and put it in a liquid tank or high and low temperature tank with a temperature of 85℃ for at least 2h.

b) Take out the valve that has been placed in a liquid tank or high and low temperature tank with a temperature of 85°C for at least 2 hours and place the valve in a liquid tank or high and low temperature tank with a temperature of -40°C for at least 2 hours within 5 minutes.

c）Steps a) and b) above combine one temperature cycle, repeat steps a) and b) to complete 15 temperature cycles.

d）Put the valve that has completed the temperature cycle in a liquid tank or a high and low temperature tank with a temperature of -40°C for at least 2h, and fill the inlet of the valve through an external pipeline with compressed gas to the nominal working pressure, and then from the nominal working pressure drops below 10% of which, the pressure increase to pressure reduction process is one pressure cycle, the PRD should complete 100 pressure cycles at the frequency of not more than 10 times/min/cycle.

After the above tests are completed, the next tests shall be carried out according to the provisions of 6.7.2 and 6.7.7.3, the results shall meet the requirements of 5.4.2.2 and 5.4.2.7c).

* + - 1. Condensation corrosion resistance test

Place the valve with PRD in a container with the prepared test solution for 100 hours, then take out the valve, the drain the test solution, put the valve in a thermostat and heated to 85°C for 100 hours. Then carry out the test according to the requirements of 6.7.2 and 6.7.7.3, the results shall meet the requirements of 5.4.2.2 and 5.4.2.7c).

Composition of test solution prepared by volume:

84.8%…………… Dry cleaning solvent gasoline

10.0%…………… Benzene

2.5% …………… No. 20 compressor oil

1.5%…………… Water

1.0%…………… Methanol

0.2%…………… Mercaptan

* + - 1. Pressure relief test

Install the valve with PRD that has not been tested, block the outlet, and put it into the heating furnace. The temperature should be controlled at 11°C±1°C above the flow temperature of the fusible alloy plug, and then pressurize the valve and relieve the pressure, record the pressure value during the process, which is the burst pressure. The burst pressure value should meet the requirements of 5.4.2.7a).

Process the flow temperature test of fusible alloy materials in accordance with the test method specified in GB/T 8337, which shall meet the requirements of 5.4.2.7b)

Install the valve with PRD after the durability test, temperature cycle test, condensation corrosion resistance test, salt spray corrosion resistance test, and vibration resistance test on the test device, block the outlet, put it into heating furnace, the temperature in the furnace should be controlled at 11°C±1°C above the flow temperature of the fusible alloy, then pressurized the valve and relieve the pressure, the pressure value during the process shall be recorded respectively, which should meet the requirements of 5.4.2.7c).

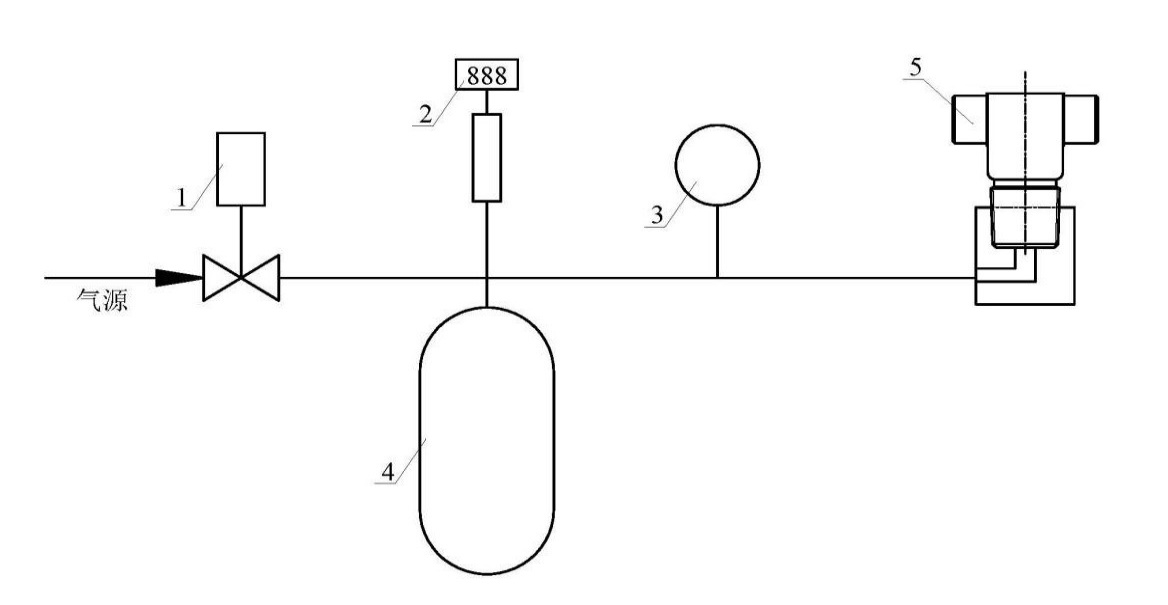
* + - 1. Flow performance test

Take three PRDs that have completed the pressure relief test, do not clean, disassemble parts or repair, and test the three samples separately according to the following steps:

a) Install the valve with PRD on the test device (see Figure 2). The pipe diameter of the test device should be larger than the PRD discharge diameter. Open the control valve to ensure that the value of the pressure gauge should be maintained at 0.8MPa～0.9MPa.

b) Check the flowmeter and pressure gauge and record the value after the pressure and flow are stable.

Measure the flow rates of the three sample valves, and the difference between the maximum flow rate and the minimum flow rate should meet the requirements of 5.4.2.8.



Description of indexing sequence number:

1—Control valve.

2—Pressure gauge or pressure sensor.

3—Flowmeter.

4—Buffer tank.

5—The valve to be tested.

Figure 2 Diagram of flow performance test

* + 1. Performance test of flow restriction device
       1. Durability test

Install the tested valve with a flow restriction device on the test device (see Figure 3), connect the inlet to the compressed gas source to the nominal working pressure, quickly open the control valve 1, the flow restriction device acts, and then close the control valve 1, reset the core of the device so that the opening and closing constitutes a cycle. Perform 20 opening and closing cycles on the flow restriction device, and then perform the test according to 6.8.3, which should meet the requirements of 5.4.3.3.

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Description of indexing sequence number:

1— Control valve.

2—The valve to be tested.

Figure 3 Diagram of durability test of flow restriction device

* + - 1. Pressure impulse test

Install the valve under test with a flow restriction device on the test device (see Figure 4), connect the inlet to the compressed gas source, connect the outlet to the release control valve 4, connect a one-meter pipeline between the tested valve and the control valve 4, the valve shall be fully opened and follow the steps below:

a）Open control valve 1, fill the pipeline with gas to the nominal working pressure, and close control valve 1.

b）Open the control valve 4 quickly to reduce the pressure in the pipeline to atmospheric pressure and close the control valve 4.

c) Repeat steps a) and b) for 100 positive pressure pulses.

d）Use the same method for another 100 reverse pressure pulses.

After completing the above-mentioned pressure impulse test, carry out the test according to 6.8.3, the results shall meet the requirements of 5.4.3.3.

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Description of indexing sequence number:

1—Control valve.

2—The container, the volume should not be less than 1 liter.

3—The valve to be tested.

4—Control valve.

Figure 4 Diagram of pressure impulse test of flow restriction device

* + - 1. flow restriction performance test

Install a valve with a flow restriction device on the test device and connect with compressed gas source. When the pressure difference exceeds 0.65MPa, the flow restriction device should be able to act and limit the flow. A flow meter shall be connected to the outlet to measure flow at the moment. When the inlet pressure difference reaches 10MPa, the bypass flow rate of the flow restriction device shall meet the requirements of 5.4.3.3.

* 1. Inspection rules
     1. Incoming inspection of materials and parts

Materials and parts income should have a batch product quality certificate.

The mechanical properties and chemical composition of metal raw materials shall be re-inspected according to the incoming batch number and shall meet the requirements of 5.2.1.1.

Bursting discs and fusible alloy materials shall be re-inspected according to the incoming batch number and shall meet the requirements of 5.4.2.7a) and 5.4.2.7b).

Non-metallic sealing parts shall be re-inspected according to the incoming batch number and shall meet the requirements of 5.2.2.

* + 1. Inspection before delivery
       1. One-by-one Inspection

Valves should be inspected one by one before leaving the factory, and the inspection items are in accordance with Table 4. During the inspection process, if one item is unqualified, the valve is judged as unqualified.

* + - 1. Batch Inspection

The batch inspection of valves should be carried out from each batch (no more than 5,000 pcs) of continuous production, with passed one-by-one inspection, and 5 pcs samples shall be picked from each batch. When the batch quantity is less than 5,000 pcs, 5 samples should also be taken. The inspection items are in accordance with items in Table 4. During the inspection process, if a valve does not meet the requirements of a certain item specified in Table 4, sampling quantity should be doubled. During the re-inspection, if there are still unqualified items, the whole batch of valves should be determined unqualified.

Table 4 List of items for inspection before delivery

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sequence no. | Inspection Items | One-by-one inspection | Batch inspection | Inspection methods | Judgment basis | Sampling no. |
| 1 | Appearance inspection | √ | √ | 6.4 | 5.3.1、  8.1.1 | V1～V5 |
| 2 | Leakage inspection | √ | √ | 6.6.4.2 | 5.4.1.4.2 | V1～V5 |
| 3 | Threads inspection for inlets and outlets | - | √ | 6.5 | 5.3.2、  5.3.3 | V1～V5 |
| 4 | Extrusion resistance of safety relief device | \_ | √ | 6.7.1 | 5.4.2.1 | V2 |
| 5 | Pressure relief performance of safety relief device | \_ | √ | 6.7.7.1 | 5.4.2.7a） | V3 |
| 6 | Flow restriction test | \_ | √ | 6.8.3 | 5.4.3.3 | V4 |

* + 1. Type test
       1. Principle of type test

The type test of the valve should be carried out by qualified inspection agencies in accordance with the relevant regulations and technical specifications.

When the valve body material and sealing structure type are the same, the type test shall be carried out according to the following principles:

a) Valves with high nominal working pressures cover the scope of low nominal working pressures.

b) Valves with large nominal diameters cover the scope pf small nominal diameters.

For valves have been type tested in accordance with 7.3.1.2, when part of their design conditions changed, the type test shall be performed in accordance with the following principles:

a) The handwheel/handle material and size of the valve need to be supplemented with open and close tests and durability tests.

b) When the raw material of the valve body and the material of the pressure-bearing metal parts are changed, the related material inspection and the test caused by the change shall be supplemented.

c）When the non-metallic seal material of the valve is changed, the test of the non-metallic seal material and the test caused by the change shall be supplemented.

d) When the connection dimensions of the valve's inlet and outlet are changed, over-torque test and the bending torque test shall be supplemented.

* + - 1. Documents for type test

The manufacturer should provide the following technical documents for the type test：

a) Product design drawings and catalogs/lists.

b) Material quality certificate of raw materials and pressure-bearing parts.

c) Quality certificates for non-metallic sealing parts.

d) Product qualification approvals, batch quality certificates.

e) Operation manuals.

* + - 1. Type test items

The valve type test items are listed in Table 5.

Table 5 Type test items

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test samples | | Sequence no. | Inspection Items | Sample condition | Test methods | Judgment basis | Sampling no. |
| Materials and Spare Parts | Metal parts materials | 1 | 1. Mechanical performance test 2. Chemical composition detection | NEW | 6.2 | 5.2.1.1 | J1 |
| Non-metallic parts and materials | 2 | Oxygen aging resistance test | NEW | 6.3.1 | 5.2.2.1 | F1～F3 |
| 3 | Ozone aging resistance test | NEW | 6.3.2 | 5.2.2.2 | F4～F6 |
| 4 | Dry heat resistance test | NEW | 6.3.3 | 5.2.2.3 | F7～F9 |
| 5 | Medium compatibility test | NEW | 6.3.4.1 | 5.2.2.4.1 | F10～F12 |
| 6.3.4.2 | 5.2.2.4.2 | F13～F15 |
| Flow restriction device verification | | 6 | Durability test | NEW | 6.8.1 | 5.4.3.1 | V1 |
| 7 | Pressure pulse test | NEW | 6.8.2 | 5.4.3.2 | V2 |
| 8 | Flow restriction test | From Sequence 6, 7 | 6.8.3 | 5.4.3.3 | V1,V2 |
| Valve performance verification | | 9 | Appearance check | NEW | 6.4 | 5.3.1、8.1.1 | V3-V7 |
| 10 | Inlet and outlet thread inspection | From Sequence 9 | 6.5 | 5.3.2、5.3.3 | V3-V7 |
| 11 | Over-torqued resistance test | From Sequence 10 | 6.6.2 | 5.4.1.2 | V3 |
| 12 | Bending torque test | From Sequence 10 | 6.6.3 | 5.4.1.3 | V4 |
| 13 | Vibration resistance test | From Sequence 10 | 6.6.5 | 5.4.1.5 | V5 |
| 14 | Stress corrosion resistance test | From Sequence 8 | 6.6.7 | 5.4.1.7 | V2 |
| 15 | Salt spray corrosion resistance test | From Sequence 10 | 6.6.8 | 5.4.1.8 | V6 |
| 16 | Surface liquid resistance test | From Sequence 10 | 6.6.9 | 5.4.1.9 | V7 |
| 17 | Durability test | NEW | 6.6.10 | 5.4.1.10 | V8 |
| 18 | Leakage test | From Sequence 11, 12, 13, 15, 16, 17 | 6.6.4.1 | 5.4.1.4.1 | V3-V8 |
| 19 | Open and close test | From Sequence 18 | 6.6.1 | 5.4.1.1 | V8 |
| 20 | PRD leakage test | From Sequence 18 | 6.7.2 | 5.4.2.2 | V5-V7 |

Table 5 Type test items (Continued)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Valve performance verification | 21 | PRD Extrusion resistance | From Sequence 20 | 6.7.1 | 5.4.2.1 | V5-V7 |
| 22 | PRD Pressure relief | From Sequence 21 | 6.7.7.3 | 5.4.2.7c) | V5-V6 |
| 23 | Pressure resistance test | From Sequence 18, 19, 21, 22 | 6.6.6 | 5.4.1.6 | V3-V8 |
| PRD  Verification | 24 | PRD Durability test | NEW | 6.7.3 | 5.4.2.3 | V9-V13 |
| 25 | PRD Temperature cycle test | NEW | 6.7.5 | 5.4.2.5 | V14 |
| 26 | PRD Condensation corrosion resistance test | NEW | 6.7.6 | 5.4.2.6 | V15 |
| 27 | PRD Leakage test | From Sequence 24, 25, 26 | 6.7.2 | 5.4.2.2 | V9-V15 |
| 28 | PRD Extrusion resistance test | NEW | 6.7.1 | 5.4.2.1 | V16-V18 |
| 29 | PRD Pressure relief test | NEW | 6.7.7.1 | 5.4.2.7a） | V19-V20 |
| 30 | NEW | 6.7.7.2 | 5.4.2.7b） | J2a |
| 31 | From Sequence 27 | 6.7.7.3 | 5.4.2.7c） | V9-V15 |
| 32 | PRD Accelerated life test | NEW | 6.7.4 | 5.4.2.4a) | V21-V23 |
| 33 | NEW | 6.7.4 | 5.4.2.4b) | V24-V28 |
| 34 | PRD Flow capacity test | From Sequence 31 | 6.7.8 | 5.4.2.8 | V10-V12 |
| a Test sample shall be PRD fusible alloy material. | | | | | | |

* + - 1. Sampling inspection method and judgment

Valves for type tests shall be selected from the batch products that have passed the delivery inspection at the manufacturer. The quantity of sampling inspections and judgments shall be in accordance with the requirements from Table 5. If a valve does not meet any one of the requirements of a certain item in Table 5, the sampling quantity shall be doubled; during re-inspection, if there is still unqualified item(s), the valves should be judged unqualified.

* 1. Marking, packaging, storage and transportation
     1. Marking

The following permanent marks should be on the valve:

a) The model/type of the valve.

b) The nominal working pressure of the valve.

c) The burst pressure and operating temperature of the safety relief device.

d) Product reference standard(s).

e) Manufacturer's name or trademark.

f) The serial number of the production batch.

g) Manufacturing license number and mark.

h) The opening and closing direction of the valve.

i) Designed service life.

The electronic certificate in the form of a QR code shall be attached to the valve and shall contain at least the following contents:

a） Manufacturer's name.

b） Product reference standard(s).

c） The name and model/type of the valve.

d） Nominal diameter, nominal working pressure.

e） The burst pressure and operating temperature of the safety relief device.

f） Production batch number.

g） Manufacturing license number and mark.

h） Inspection date.

* + 1. Packaging

8.2.1 The water remaining in the valve should be removed before packaging. The valve should be kept clean during packaging. The threads of the inlet and outlet should not be damaged. The packing list, instruction manual and product batch quality certificate should be attached to the packaging box.

* + 1. The following marks should be on the packing box:

a） Manufacturer's name and address.

b） The name and model/type of the valve.

c） Product reference standard(s).

d） Quantity and weight.

e） Volume (length \* width \* height).

f） Production batch number.

g） Necessary operation requirements symbols.

1.  Manufacturing license number and mark.

8.2.3 The packing list should indicate the following items:

a） Manufacturer's name and address.

b） The name, model/type, and specification of the valve.

c） Quantity, gross weight, and net weight.

d） Production batch number.

e） Packing date.

8.2.4 The instruction manual should include the following items:

a） Installation torque of inlet and outlet connection.

b) Structure and function introduction.

c） Usage and precautions.

d） Common failure modes and troubleshooting methods.

8.2.5 The product batch quality certificate shall indicate the following items:

a） Product certificate content.

b) Production batch number and quantity.

c) Raw material grade of valve body.

d） Delivery inspection items and results.

e） Signature of Quality Assurance Engineer/Quality Inspection Representative.

* + 1. Storage and transportation

The valves should be stored in a ventilated, dry, and clean area to prevent moisture and chemical corrosion. During transporting, loading, and unloading, handle with care to prevent from being crushed, dropped, and bumped.

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