Guideline No. T-14(202502)

T-14

Spiral Wound Gasket

Issued date: February 1, 2025

Foreword

The product inspection guideline of China Classification Society (hereinafter referred to as "CCS") specifies the applicable technical requirements and inspection and test requirements for classification products and authorized statutory products of ships to be approved/inspected by CCS.

The Guidelines allow users to adopt alternative test methods and requirements, provided they meet or exceed the standards set by the Guidelines.

The Guidelines are prepared and updated by CCS and published on http://www.ccs.org.cn. In case of any comments and suggestions, please contact CCS via service@ccs.org.cn.

Historical release version and release time: newly edited

Main modifications in this version: None

Contents

Spiral Wound Gasket

1 Scope of Application

1.1 The Guidelines are applicable to spiral wound gaskets (hereinafter referred to as gaskets) for pipe flanges during transportation or for use in natural gas-fueled systems. Gaskets for pipe flanges used in methanol or ammonia systems may be implemented by reference.

1.2 Other equivalent standards may be accepted by CCS for the technical requirements and test methods mentioned in the Guidelines.

2 Normative References

(1) Chapter 5 of Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk

(2) Resolution MSC.370(93) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)

(3) GB/T 4622.1 Spiral Wound Gaskets for Pipe Flanges - Part 1: PN Designated

(4) GB/T 4622.2 Spiral Wound Gaskets for Pipe Flanges - Part 2: Class Designated

(5) ASME B16.20 Metallic Gaskets for Pipe Flanges

(6) API Spec.6FB "Standard for Fire Test for End Connectors"

(7) CCS Guidelines for Ships Using Methanol/Ethanol Fuel

(8) CCS Guidelines for Ships Using Ammonia Fuel

3 Terms and Definitions

The terms and definitions defined in the above survey basis are applicable to the Guidelines. For the convenience of preparation and use, the following definitions are directly quoted or supplemented in the Guidelines.

(1) Spiral wound gasket: It is formed by overlapping and continuously winding V-shaped (or W-shaped) metal strips and nonmetallic strips, and the metal strips are fixed by spot welding at the beginning and end.

4 Drawings and Data

4.1 During works approval, the approval drawings/materials shall at least include the following contents:

(1) Factory overview: factory name, address, production history, production capacity, technical and inspection personnel, main products, affiliation, product trademarks, etc.;

(2) Details of products applied for approval (series/model, structure, nominal diameter, nominal pressure, design temperature, applicable medium, materials, etc.);

(3) List of main production equipment;

(4) List of main testing equipment;

(5) Brief production process of the product to be approved;

(6) Quality management documents or quality system certificates;

(7) Enterprise registration certificate;

(8) Qualification certificate and/or production license, if applicable;

(9) Product quality certificate or sample of certificate;

(10) Quality control plan, if applicable;

(11) List of qualified suppliers, if applicable;

(12) Type test program.

5 Technical Requirements

5.1 Materials

5.1.1 The selection of materials shall comply with the requirements of working medium, temperature and pressure.

5.1.2 The metal strip shall be cold-rolled steel strip with a thickness of 0.190 mm ± 0.040 mm. The surface of the metal strip shall be free from defects that affect its performance. The chemical composition and mechanical properties of stainless steel strips and other materials shall comply with the standards accepted by CCS.

5.1.3 The thickness and density of the filler strip shall be determined by the manufacturer, but it shall comply with the performance requirements of relevant standards. The material shall be flexible graphite, polytetrafluoroethylene, asbestos-free fiber or other equivalent materials. The technical requirements of flexible graphite strip, PTFE strip and asbestos-free fiber strip for gaskets shall comply with the standards accepted by CCS.

5.1.4 The corrosion resistance of the inner ring and centring ring shall be equal to or better than that of the metal strip. The materials of inner ring and centring ring shall comply with the standards accepted by CCS.

5.2 As for dimensional deviation, the measurement range shall comply with the provisions of CCS acceptance criteria.

5.3 Appearance quality

5.3.1 The surface of the sealing element shall be free from defects that affect the sealing performance.

5.3.2 The filler strip on the surface of the sealing element shall be evenly raised above the metal strip, and the metal strip shall not be exposed.

5.3.3 The welding spot shall be on the symmetrical plane of the V-shaped section of the metal strip, and there shall be no defects such as incomplete fusion and superfusion.

5.3.4 The surfaces of the inner ring and centring ring shall be free from defects such as burrs, unevenness and rust spots; the upper and lower sealing surfaces of the sealing element shall be in the center position of the upper and lower surfaces of the inner ring and/or centring ring; the inner ring and the sealing element shall be tightly fixed; the centring ring and the sealing element are allowed to slide relatively in the circumferential direction, but they shall not fall off.

5.4 Compression performance

5.4.1 Compression performance test conditions and indexes for PN designated gaskets with inner ring and centring ring shall comply with the requirements in Table 5.4.1:

Table 5.4.1

<table>
<tr><td colspan="4">Test Conditions</td><td rowspan="2">Compression Performance Index Value</td></tr>
<tr><td>Sample specification</td><td colspan="2">Pre-tightening stress MPa</td><td>Loading speed MPa/s</td></tr>
<tr><td rowspan="3">Thickness: 4.5 mm
≤DN 100
The filler material is flexible graphite (other filler materials can refer to this or other applicable standards)</td><td>≤PN 25</td><td>52</td><td rowspan="3">0.5</td><td rowspan="3">Thickness after compression ≥3.43 mm</td></tr>
<tr><td>PN 40~PN 100</td><td>70</td></tr>
<tr><td>≥PN 160</td><td>140</td></tr>
<tr><td colspan="5">The gasket shall tolerate a certain amount of compression, and the sealing performance shall comply with the requirements in Table 3.</td></tr>
</table>

5.4.2 Compression test conditions and indexes for Class designated gaskets with inner ring and centring ring shall comply with the requirements in Table 5.4.2:

Table 5.4.2

<table>
<tr><td colspan="4">Test Conditions</td><td rowspan="2">Compression Performance Index Value</td></tr>
<tr><td>Sample specification</td><td colspan="2">Pre-tightening stress MPa</td><td>Loading speed MPa/s</td></tr>
<tr><td rowspan="3">Thickness: 4.5 mm
DN≤100 (NPS≤4)
The filler material is flexible graphite (other filler materials can</td><td>Class 150</td><td>52</td><td rowspan="3">0.5</td><td rowspan="3">Thickness after compression ≥3.43 mm</td></tr>
<tr><td>Class 300</td><td>70</td></tr>
<tr><td>Class 600~Class</td><td>140</td></tr>
</table>

refer to this or other applicable standards)	1500			
The gasket shall tolerate a certain amount of compression, and the sealing performance shall comply with the requirements in Table 4.				

5.5 Sealing performance, if methane medium is used for test, shall conform to the provisions of SW-2.6 in ASME B16.20. If nitrogen medium is used, it shall be implemented according to the requirements of Articles 5.5.1 and 5.5.2 of the Guidelines.

5.5.1 For PN designated gaskets with inner ring and centring ring, the test conditions and indexes for sealing performance using nitrogen as the medium shall comply with the requirements specified in Table 5.5.1:

Table 5.5.1

Test Conditions				Test Medium	Leakage Rate cm^3/s
Sample specification	Pre-tightening stress MPa		Test medium pressure MPa		
Thickness: 4.5 mm ≤ DN 100 The filler material is flexible graphite (other filler materials can refer to this or other applicable standards)	≤PN 25	35	2.0	Nitrogen, 99.9% pure	≤1.0x10-4
	PN 40, PN 63	36	4.0		
	≥PN 100	70	4.0		

5.5.2 For Class designated gaskets with inner ring and centring ring, the test conditions and indexes for sealing performance using nitrogen as the medium shall comply with the requirements specified in Table 5.5.2:

Table 5.5.2

Test Conditions				Test Medium	Leakage Rate cm^3/s
Sample specification	Pre-tightening stress MPa		Test medium pressure MPa		
Thickness: 4.5 mm DN≤100 (NPS≤4) The filler material is flexible graphite (other filler materials can refer to this or other applicable standards)	Class 150	35	2.0	Nitrogen, 99.9% pure	≤1.0x10-4
	Class 300	36	4.0		
	Class 600~Class 1500	70	4.0		

5.6 Fire resistance test. For gaskets intended to be used in piping systems that are dangerous due to leakage caused by high temperature of fire, metal and flexible graphite gaskets can be used for fire protection, combustible medium and other systems according to material composition and material characteristics. To determine the ability of such gaskets to withstand the effects of a fire that likely occurs in service, a fire resistance test shall be carried out. The fire resistance test shall be carried out in accordance with API Spec.6FB "Standard for Fire Test for End Connectors" or other equivalent standard accepted by CCS, with a minimum fire exposure time of 30 minutes.

5.7 Low-temperature tightness test. Gaskets intended to be used in liquefied natural gas piping system shall be subject to low-temperature tightness test. Nitrogen or helium is used as the test medium, and the test pressure is 2 MPa. The gasket sealing device shall be taken out after being cooled in liquid nitrogen (-196°C) for 2 hours and then completely restored to normal temperature. Repeat this process for 5 times. Test the airtightness after the cycles and during the cooling process, and the result shall be no leakage.

6 Raw Materials, Parts and Components

Raw materials and components of the product shall be controlled in accordance with the current specifications of CCS and relevant requirements on implementing SOLAS Convention "prohibited asbestos".

7 Type Test

7.1 Selection of typical samples:

7.1.1 The selected samples shall be adequate to verify the factory's production and test capabilities and conditions, and cover the products within the approval scope, so as to verify the quality assurance capability of the factory to produce the applied products.

7.1.2 During type test, gaskets of the same material combination shall be taken as a batch, and 3 pieces shall be taken respectively according to the sample specifications in Table 1/Table 2 and Table 3/Table 4. If there is no sample

specification, a sufficient number of samples shall be manufactured according to the same process, but it shall be considered that the sampling range shall cover the maximum pressure, minimum operating temperature and size range not less than 80% of the maximum specification as far as possible.

7.1.3 Spiral wound gasket samples shall be randomly selected from the warehouse or finished product site.

7.2 Type test items shall include the following:

7.2.1 Review of quality certificates of materials and parts;

7.2.2 Appearance quality;

7.2.3 Dimension measurement;

7.2.4 Compression performance test;

7.2.5 Sealing performance test;

7.2.7 Fire resistance test (if applicable);

7.2.8 Low temperature tightness test (if applicable).

7.3 Determination of results

7.3.1 If 1 piece in any item fails to comply with the requirements in Article 5 or the standard, double the number of gaskets and retest the item. If there is still 1 piece that does not comply with the above requirements, this batch of products shall be determined as unqualified.

8 Unit/Batch Inspection

8.1 Gaskets are subject to CCS requirement of "approval only, no product survey". The approved products shall be surveyed by the manufacturer in accordance with the product survey plan approved by CCS. If the survey is passed, the manufacturer shall issue a certificate of conformity and deliver it to the user together with a copy of the approval certificate of CCS. The manufacturer shall ensure that the

products conform to the conventions, regulations, CCS specifications and CCS-recognized standards.

8.2 If the customer applies for issuing marine product certificate, the survey shall be carried out under the condition that the manufacturer has completed effective pre-survey.

8.3 Sampling rules: The appearance quality shall be fully inspected according to the requirements of Article 5.3. For gaskets of the same structural type and the same material combination, 100 pieces shall be taken as a batch, and 5 pieces shall be randomly selected from each batch (3 pieces shall be selected when there are less than 100 pieces, and full inspection shall be carried out if the sampling quantity is insufficient).

8.4 The test items to be witnessed by the surveyor are as follows:

8.4.1 Appearance quality;

8.4.2 Dimension measurement;

8.5 The test items submitted for review by CCS are as follows:

8.5.1 Review of quality certificates of materials and parts;

8.5.2 Factory self-test report;

8.5.3 Verification certificate or verification list of test instruments/meters.

8.6 Determination of results

8.6.1 If 1 piece in any item fails to comply with the requirements in Articles 5.2 and 5.3 or the standard, double the number of gaskets and retest the item. If there is still 1 piece that does not comply with the above requirements, this batch of products shall be fully tested.