Guideline No.U-03 (201510)

U-03 Marine Glass Pane

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Foreword

This Guideline is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

This Guideline is published and updated by CCS and can be found through http://www.ccs.org.cn. Comments or suggestions can be sent by email to ps@ccs.org.cn.

Historical versions and release date:

Main changes and effective date:

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Marine Glass Pane

1 Application

1.1 The Guideline applies to the works approval and inspection on the toughened safety glass pane, heated glass pane, fire-resistant glass pane, and hollow glass pane used on the ship window.

1.2 It can also be used as a reference for other types of marine glass panes.

2 Basis for approval and inspection

(1) ISO 21005:2004(E) *Ships and Marine Technology – Thermally Toughened Safety-Glass Panes for Windows and Side Scuttles*

(2) ISO3434:1992(E) *Shipbuilding and Marine Structure - Heated Glass Panes for Ships' Rectangular Windows*

(3) ISO3434:1992/Amd.1:2004(E) Amendment 1 of *Shipbuilding and Marine Structure - Heated Glass Panes for Ships' Rectangular Windows*

(4) ISO5797:2004(E) *Ships and Marine Technology - Windows and Side Scuttles of Fireproof Construction*

(5) IMO MSC.307(88) IMO *International Code for Application of Fire Test Procedure,* 2010 (2010 FTP CODE)

(6) MSC.337 (91) *Regulations on Ship Noise Level*

(7) Chapter 4, Part 3 of *CCS Guidelines for Noise Control and Testing of Ships and Products*

3 Documents

The applicant should submit the following documents to CCS for information when applying for CCS works approval:

3.1 Factory profile

It involves the factory name, address, business license, production history and present status, categories and specifications of the products manufactured at present, and status of the technical and inspection persons.

Details of the products applied for approval: Including the category, specification, structure and technical features of the glass applied for approval.

Status of main production and testing equipment: Including the name, type, manufacturing unit, main performance parameters, and quantity of the equipment.

3.2 Quality management system document

It includes the organization chart, responsibility of each management department/manager, quality control point, and procedure documents related to the quality management.

3.3 Process documents

It includes the production process flow chart, process operation regulations, operation instructions, and control standard adopted by the enterprise for various glass panes applied for approval.

3.4 Other documents related to the approval that are required to be summited to CCS.

4 Technical requirement

4.1 The materials of the toughened glass pane should meet relevant requirement of ISO21005:2004(E).

4.2 The composition, structure and material of the heated glass pane should meet relevant requirement of ISO3434:1992(E). Since the support plate glass pane has to bear pressure, it should be the toughened glass pane and meet relevant strength requirement.

4.3 The fire-resistant glass pane is categorized into composite fire-resistant glass pane and single-leaf fire-resistant glass pane as per structure, and the composite fire-resistant glass pane mentioned in the Guideline is the one with the composition of interlining fireproof fluid (transparent fireproof fluid is injected between the main glass pane and the internal glass pane) and glass panes with two or more layers. Since the main glass pane has to bear pressure (usually called as wave-proof glass pane), it should be the toughened glass pane and meet relevant strength requirement. The main glass pane should face the fire during fire test (namely, contact the fire directly), and the internal glass pane is made of toughened safety glass. Composite fire-proof glass panes with other structures should be handled separately.

4.4 The max. length and width of the fire-proof glass pane, fireproof fluid thickness of the composite fire-proof glass pane and thickness of the internal glass pane should be based on those of the fire-proof glass pane used for fire test during approval. After approval, the length and width of the product applied for inspection should not exceed the max. length and width of the product during fire test. The fireproof fluid composition and thickness of the composite fire-proof glass pane should not be changed, and the thickness of the internal glass pane should not be less than that adopted during approval. Otherwise, the factory shall apply to approval modification and carry out fire test again..

4.5 The hollow glass pane is a product that consists of two or more glass panes spaced evenly and sealed around to provide effective support, and forms a dry gas space between glass layers. Whereas, the glass pane facing outside in the ship should be made with toughened glass and meet relevant strength requirement.

4.6 The length and width of the glass pane are not subject to the standards listed in Article 1.2 of the Guideline, which should comply with relevant size requirement of the ship window, and be approved by CCS Surveyor first before being used.

4.7 If the toughened safety glass adopted for manufacturing the heating glass pane, fire-proof glass pane, and hollow glass pane is purchased, the manufacturer of such toughened safety glass should be approved by CCS.

5 Type test

5.1 Test program formulation

The test program can be formulated in two ways: formulated by the applicant and approved by CCS, or formulated by CCS and acknowledged by the applicant. The test program should cover the name, specification, type, formulation basis, reference standard, type test sample selection, as well as test item, method and requirement of the product to be applied for approval.

5.2 Selection of typical sample for type test

5.2.1 The toughened glass panes with max. and min. thicknesses should be selected for type test during approval.

5.2.2 The heated glass panes and hollow glass panes with max. and min. thicknesses should be selected according to the composition, structure, and production process for type test during approval. CCS can also add the product with intermediate dimension for approval test as per actual conditions.

5.2.3 The composite fire-proof glass panes with max. and min. thicknesses should be selected according to the structure, production process, fire-proof fluid type and thickness, as well as fire class for approval test (except for the fire test).

Samples selected for fire test should be those with the approved max. sizes (namely, the height and width or diameter), min. glass thickness and min. clearance (if any).

5.2.4 The samples of single-leaf fire-resistant glass panes with max. and min. thicknesses should be selected as per the type, fire class and production process for approval test (except for the fire test).

The samples with max. sizes (the height and width or diameter) and min. thickness should be selected for fire test.

5.3 Type test items

5.3.1 Toughened safety glass

No.	Test items	Test requirement

1	Appearance quality	It should be free of stone, crack, or broken corner; Blister: 2×S blisters for the length of L≤0.5 mm, and no blister allowed for the length of L＞0.5 mm; Scratched edge: 2×S such edges allowed for the width of W≤0.1 mm and length of L≤40 mm; Chip: For glass panes with thickness of D≤6 mm, chip with length of not more than 10 mm on each glass pane per meter, depth of not more than 2 mm from the edge of the glass pane to the glass surface, and thickness of not more than 1/3 starting from the glass surface are allowed; For glass panes with thickness of D＞6 mm, no chip is allowed. Note: S is the area of the glass pane in square meter, which is rounded to the nearest hundredth.
2	Size deviation	Meet the requirement of Article 6.1 of ISO21005:2004(E)
3	Tortuosity	Not more than 0.3%
4	Degree of parallelism	Not more than 0.03%
5	Transmittance of visible light (transparency)	Projection ratio of transparent toughened safety glass: ≥70%
6	Optical distortion	Optical distortion of transparent toughened safety glass: ≤6’
7	Punching performance test	The punching test should be carried out according to ISO614(or GB/T3385), and the glass should be free of breakage or damage after test. If the length and width of the glass is too large, the sample with the same thickness produced with the same process condition can be selected for test.

5.3.2 Heated glass:

No.	**Test items**	**Test requirement**
1	Appearance quality	The heated glass should be free of stain or impurity affecting the perspectivity.
2	Size deviation	Meet the requirement of Article 4.4 of ISO3434:1992(E)
3	Tortuosity	Not more than 0.3%
4	Degree of parallelism	Not more than 0.1%
5	Transmittance of visible light (transparency)	Transmittance: ≥70%
6	Color discrimination	It can discriminate the navigation lights, buoy signal light, and other colors.

7	Punching performance test	The strength of the pressure-bearing part (support plate glass) of the heated glass pane should meet the requirement on the toughened glass punching performance test of 5.3.1 of the Guideline.
8	Heating power	The actual power should meet the design power requirement on the selected sample.
9	Insulation resistance	Insulation resistance between insulation parts: ≥50 mΩ
10	Dielectric strength	Dielectric strength test should be conducted between insulation parts of the heated glass pane, and the insulation should not be broken through, with no flash on the surface during the test.

5.3.3 Fire-resistant glass pane

<table>
<tr><th>No.</th><th>Test items</th><th colspan="4">Test requirement</th></tr>
<tr><td>1</td><td>Appearance quality</td><td colspan="4">Blister: 2 blisters with length of 0.5 mm-1.0 mm are allowed in a circle with diameter of 300 mm;

Cementing layer impurity: 3 impurities with length of less than 2.0 mm are allowed in a circle with diameter of 500 mm;

Crack: Not allowed;

Chip: 4 chips with length of not more than 20 mm on each meter of glass pane and depth of not more than half of the thickness from the edge of the glass pane to the glass surface are allowed.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Size deviation</td><td rowspan="2">Total glass thickness t

(mm)</td><td colspan="2">Allowable deviation of the length and width (L)</td><td rowspan="2">Allowable thickness

deviation (mm)</td></tr>
<tr><td>L≤1200(mm)</td><td>1200＜L≤2400(mm)</td></tr>
<tr><td>5≤t＜11</td><td>±2</td><td>±3</td><td rowspan="2">±1.0</td></tr>
<tr><td>11≤t＜17</td><td>±3</td><td>±4</td></tr>
<tr><td>17≤t≤24</td><td>±4</td><td>±5</td><td>±1.3</td></tr>
<tr><td>t＞24</td><td>±5</td><td>±6</td><td>±1.5</td></tr>
<tr><td colspan="4">If the length exceeds 2400 mm, it should be agreed by suppliers and buyers; the allowable size and thickness deviation of the single-leaf fireproof glass should be subject to the GB15763.1-2009.</td></tr>
<tr><td>3</td><td>Tortuosity</td><td colspan="4">Not more than 0.2%</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Transmittance of visible light (transparency)</td><td colspan="2">Total glass thickness t (mm)</td><td colspan="2">Transmittance of visible light (transparency) (%)</td></tr>
<tr><td colspan="2">5≤t＜11</td><td colspan="2">≥75</td></tr>
</table>

		11≤t＜17	≥70
		17≤t≤24	≥65
		t＞24	≥60
5	Punching performance test	The strength of the pressure-bearing part (main glass pane) of the single-leaf fire-resistant glass pane and composite fire-resistant glass pane should meet the requirement on the toughened glass punching performance test of 5.3.1 of the Guideline.	
6	Heat-resistant performance test (only for the composite fire-resistant glass pane)	After test, the sample appearance and optical performance should meet the requirements of Items 1 and 4.	
7	Cold-resistant performance test (only for the composite fire-resistant glass pane)	After test, the sample appearance and optical performance should meet the requirements of Items 1 and 4.	
8	Radiation-resistant performance test (only for the composite fire-resistant glass pane)	After test, the pane should be free of significant color change, blister or turbidity, and the relative decrement rate of the transmittance should not be greater than 10%. That is: (a-b)/a×100%≤10% Where： a— transmittance before ultraviolet irradiation; b— transmittance after ultraviolet irradiation.	
9	Fire test	The fire-resistant pane should be installed on the window and subject to the fire test as a complete fire-resistant structure. The fire test should be conducted in the accepted test agency as per the requirement in Part 3 of 2010 FTP CODE of IMO, and the test result should comply with relevant provision on accepted fire class.	

5.3.4 Hollow glass pane

No.	**Test items**	**Test requirement**	
1	Appearance quality	The hollow glass pane should be free of stain, impurity or sealant splash affecting the perspectivity.	
2	Size deviation	Length (width) L (mm)	Allowable deviation (mm)
		L＜1000	±2
		1000≤L＜2000	+2 -3
		L≥2000	±3
		Total thickness t (mm)	Allowable deviation (mm)
		t＜17	±1.0

		17≤t＜22	±1.5
		t≥22	±2.0
3	Tortuosity	Not more than 0.3%	
4	Dew point temperature test	Dew point temperature should be ≤-40°C.	
5	Sealing performance test	20 samples (5 mm+9 mm+5 mm) should all meet the following conditions: (1) the initial deviation must be ≥0.5 mm when the test pressure is lower than the ambient pressure of (10±0.5)kPa; (2) the thickness deviation reduction should not exceed 15% of the initial deviation after it is maintained under such air pressure for 2.5 h; or 20 samples (4 mm+12 mm+4 mm) should all meet the following conditions: (1) the initial deviation must be ≥0.8 mm when the test pressure is lower than the ambient pressure of (10±0.5)kPa; (2) the thickness deviation reduction should not exceed 15% of the initial deviation after it is maintained under such air pressure for 2.5 h.	
6	Ultraviolet irradiation resistance	After test, the internal surface of the sample should be free of fog or contamination, and the original glass pane free of obvious malposition or tape creepage.	
7	Climatic cycle durability	The sample should be subject to dew point temperature test after cyclic test, and the dew point temperature should be ≤-40°C.	
8	High temperature and humidity durability	The sample should be subject to dew point temperature test after cyclic test, and the dew point temperature should be ≤-40°C.	
9	Punching performance test	The strength of the pressure-bearing part (external glass) of the hollow glass pane should meet the requirement on the toughened glass punching performance test of 5.3.1 of the Guideline.	

5.3.5 Sound insulation performance

The glass pane should be installed on the window and subject to the sound insulation performance test as a complete ship window. The air sound insulation index test should be conducted in the accepted test agency as per the requirements of MSC.337 (91) and CCS Guideline, and the test result should comply with relevant provision on sound insulation index (sound insulation level).

5.4 Test method

The test method of each test item should comply with relevant standard accepted by CCS.

6 Unit/batch inspection

6.1 After obtaining the CCS works approval, the factory is not required to apply for CCS unit/batch inspection or obtain the product certificate when delivering products. If the factory needs to apply for CCS unit/batch inspection, CCS can conduct the inspection in the form of report verification, and issue product certificate or equivalent document after the test report and relevant documents provided by the factory pass the verification.–

6.2 During unit/batch inspection, the test items used by CCS for report verification should be

provided:

6.2.1 Toughened safety glass pane:

Appearance quality, size deviation, tortuosity, and punching test

6.2.2 Heated glass pane:

Appearance quality, size deviation, heat power, insulation resistance, dielectric strength, and punching test

6.2.3 Fire-resistant glass pane:

Appearance quality, size deviation, tortuosity, and visible light transmittance

6.2.4 Hollow glass pane:

Appearance quality, size deviation, and punching test

6.3 Each pane should be subject to all test items by the inspection department of the manufacturer except for the punching test.

Punching test: 2% (but at least 1 pc) of the toughened glass panes (or the samples produced under the same process condition with the same thickness) with different thicknesses (the thickness of the toughened glass acting as the pressure-bearing part of the heated, fire-resistant, and hollow glass panes should also be calculated) produced under the same process conditions should be selected as per the lot grouping with respect of the weight for punching test.

6.4 Other additional test items, if necessary, should be agreed by both parties, with sample quantity and test method being in line with the recognized standard.

6.5 The factory quality certificate should include at least the following contents:

Manufacturer name, Purchaser name, and purchase order number

Glass pane name, model/specification, structure (applied for heated glass pane, fire-resistant glass pane, and hollow glass pane), batch/number, and quantity

Inspection and test conclusion, standard, and works approval certificate number

Positions for the seal and signature of the Surveyor

6.6 Inspection mark

The approved product should be provided with CCS anti-counterfeiting label or CCS inspection mark on the product body or the nameplate of the packing case.

The internal surface of the main glass of the fire-resistant glass pane should be marked with fire

class (such as A-60 or A-0) verified via fire test for the fire window (which is usually marked in the form of inverted triangle, and should not affect the transmittance of the fire-resistant glass pane).

The external side of the main glass of the fire-resistant glass pane (usually called as the wave-proofing glass pane) should face the fire during the fire test, which should be specified in the type approval certificate and marine product certificate.