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C-01 FIRE DECKS AND BULKHEADS

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Foreword:

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

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Main changes and effective date:

The main contents of this revision:

1. Clarify the expression and reference standards for the furnace temperature curve of H-grade fire-resistant structural test;

2. Suggest that the surveyor should witness the dissection of the test sample after the fire resistance structure test.

CONTENTS

FIRE DECKS AND BULKHEADS

1 Application

1.1 This Guideline applies to the approval and inspection of fire decks and bulkheads of the following specifications, which are installed and appliedonboard ships and offshore installations:

(1) A-60, A-30, A-15, A-0 of A class decks;

(2) A-60, A-30, A-15, A-0 of A class bulkheads;

(3) B-15, B-0 of B class bulkheads (including linings);

(4) H-120, H-60, ~~H-30,~~ H-0 of H class decks;

(5) H-120, H-60, ~~H-30,~~ H-0 of H class bulkheads;

(6) B-15, B-0 of B class ceilings.

2 Normative references

1.2.1 The approval and inspection of fire decks and bulkheads are to be based on the following documents and their subsequent amendments:

(1) Regulation 3, Chapter II-2 of the International Convention for the Safety of Life at Sea, 1974 (1974 SOLAS Convention) and the amendments thereof;

(2) IMO Resolution MSC.307(88) –the International Code for Application of Fire Test Procedures, 2010 (IMO 2010 FTP Code);

(3) Chapter 1, PART SEVEN of CCS Rules for ~~the Construction and~~ Classification of Mobile Offshore Units;

(4) ISO 20902-1:2018 Fire test procedures for divisional elements that are typically used in oil，gas and petrochemical industries-Part 1：General requirements

~~(4) ISO/TR 834-3:1994 "Fire-resisting Tests — Elements of Building Construction — Part 3: Commentary on Test Method and Test Data Application".~~

(5) Regulations 3~12, Chapter II-1 of International Convention for the Safety of Life at Sea, 1974 and the amendments;

(6) IMO MSC.337(91) The Code on Noise Levels on Board Ships;

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

3 Definition and classification

3.1 Definitions

(1) "A" class divisions are those divisions composed by bulkheads and decks which comply with the following criteria:

① they are constructed of steel or other equivalent material;

② they are suitably stiffened;

③ they are insulated with approved non-combustible materials such that the average temperature of the unexposed surface will not rise more than 140 ℃ above the initial temperature, nor will the temperature, at any one point, including any joint, rise more than 180℃ above the initial temperature within the period of time listed below:

Class "A-60"	60 min
Class "A-30"	30 min
Class "A-15"	15 min
Class "A-0"	0 min;

④ they are so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test; and

⑤ Conduct a test on the prototype bulkhead or deck in accordance with ISO 20902-1:2018 and the IMO 2010 FTP Code Part 3 to ensure compliance with the aforementioned integrity and temperature rise requirements.~~the Administration required a test of a prototype bulkhead or deck in accordance with the FTP Code to ensure that it meets the above requirements for integrity and temperature rise.~~

(2) "B" class divisions are those divisions composed by bulkheads, decks, ceilings or linings which comply with the following criteria:

① they are constructed of approved non-combustible materials and all materials used in the construction and erection of "B" class divisions are non-combustible, with the exception that combustible veneers may be permitted provided their low flamespread characteristics comply with Part 5 ofIMO 2010 FTP Code, their smoke and toxicity comply with Part 2 of IMO 2010 FTP Code or Annex 2 of IMO 2010 FTP Code and their gross calorific value complies with ISO 1716:2010 or Annex 2 of IMO 2010 FTP Code;

② they have an insulation value such that the average temperature of the unexposed surface will not rise more than 140℃ above the initial temperature, nor will the temperature, at any one

point, including any joint, rise more than 225℃ above the initial temperature, within the period of time listed below:

Class “B-15” 15 min
Class “B-0” 0 min;

③ they are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test; and

④ the Administrationrequireda test of a prototype division in accordance with the FTP Code to ensure that it meets the above requirements for integrity and temperature rise.

(3) “H” class divisions are those divisions composed by bulkheads and decks which comply with the following criteria:

① they are constructed of steel or other equivalent material;

② they are suitably stiffened;

③ they are insulated with approved non-combustible materials such that the average temperature of the unexposed surface will not rise more than 140℃ above the initial temperature, nor will the temperature, at any one point, including any joint, rise more than 180℃ above the initial temperature, within the period of time listed below:

Class “H-120” 120 min

Class “H-60” 60 min

Class “H-30” 30 min

Class “H-0” 0 min;

④ they are so constructed as to be capable of preventing the passage of flame to the end of the two-hour standard fire test; and

⑤ the Administration required a test of a prototype bulkhead or deck in accordance with ISO 20902-1:2018 and Part 3 of IMO 2010 FTP Code to ensure that it meets the above requirements for integrity and temperature rise.

(4) The FTP Codeis the International Code for Application of Fire Test Procedures defined in Chapter II-2 of 1974 SOLAS Convention, as amended, i.e., the International Code for Application of Fire Test Procedures, 2010 (IMO 2010 FTP Code) adopted by Resolution MSC.307(88) by the Maritime Safety Commission of the International Maritime Organization.

(5) Non-combustible material is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750℃, this being determined in accordance with the FTP Code.

(6) Steel or other equivalent material means any non-combustible material which, by itself or due to

insulation provided, has structural and integrity properties equivalent to steel at the end ofthe applicable exposure to the standard fire test (e.g., aluminium alloy with appropriate insulation).

(7) A standard fire test for A, B and F class divisions is a test in whichspecimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve in accordance with the test method specified in the FTP Code.The standard time-temperature curve is to be obtained by the following time-temperature relationship:

$$T = 345 \log10(8t + 1) + 20$$

Where: T- the averagefurnace temperature, in℃;

t - the time, in min.

(8) A standard fire test for H class divisions is a test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve in accordance with the test method specified in ISO 20902-1:2018andthe FTP Code. The standard test furnace temperature curve is to be obtained by the following time-temperature relationship:

~~T =~~
~~1100(1-0.325e-0.1667t-0.204e-1.417t-0.471e-15.833t)~~

$$T = 1\,080\,(1 - 0{,}325e^{-0{,}167t} - 0{,}675e^{-2{,}5t}) + 20$$

Where: T - the averagefurnace temperature, in℃;

t- the time, in min;

e- the constant (2.71828).

According to the above relationship, the temperature in the furnace at different times is determined as follows ~~(The real temperature is 20℃ higher than the calculated temperature)~~:

Time t, in min	Furnace temperature T , in degrees (℃)
3	880~~0~~7
5	94~~5~~8
10	1033~~0~~4
15	1071
30	1098
60	1100

120	1100
360	1100

(9) Divisions mean decks and bulkheads.

(10) Fire divisions are fire decks and bulkheads.

3.2 Classification

(1) On the basis of different fire class, fire decks are classified as A class decks, including A-60, A-30, A-15, A-0, and H class decks, including H-120, H-60, H-30, H-0.

(2) On the basis of different fire class, fire bulkheads are classified as A class bulkheads, including A-60, A-30, A-15, A-0 bulkheads, B class bulkheads, includingB-15, B-0 of bulkheads, B-15, B-0 of linings and B-15, B-0 of ceilings, and H class bulkheads, including H-120, H-60, H-30, H-0.

4 Design technical requirements

4.1 A class firedivisions (bulkheads and decks) are to comply with the relevant requirements in 2.1(1) and (2) in terms of structural design, integrity and insulation.

4.2 B class fire divisions (bulkheads, linings and ceilings) are to comply with the relevant requirements in 2.1(1) and (2) in terms of structural design, integrity and insulation.

4.3 H class fire divisions (bulkheads and decks) are to comply with the relevant requirements in 2.1(2), (3) and (4) in terms of structural design, integrity and insulation.

4.4 The main raw materials of fire-resisting structures are to meet the following requirements:

(1) Insulation materials (such as ceramic fiber, rock wool, fireproof deck covering, calcium silicate board and inorganic fireproof board): The non-combustibility is to comply with Part 1 of IMO 2010 FTP Code.

(2) Adhesives used in B class divisions: The low flame spread characteristics are to comply with Part 5 of IMO 2010 FTP Code.

(3) PVC films and veneers used in B class divisions: low flame spread characteristics are to comply with Part 5 of IMO 2010 FTP Code, smoke and toxicity are to comply with Part 2 of IMO 2010 FTP Code or Annex 2 of IMO 2010 FTP Code, and gross calorific value is to comply with the relevant requirements of ISO 1716:2010 or Annex 2 of IMO 2010 FTP Code.

(4) Non-metallic materials used for fire divisions are to be free of asbestos.

5 Plans and documents

5.1The following plans and documents are to be submitted to CCS for approval:

(1) Structural drawings of products;

(2) Drawings of installation of fire test specimens(Principle and Quantity of Thermocouples for Temperature Measurement on the Back Fire Surface of the Sample);

(3) Type test program;

(4) List of qualified suppliers of main raw materials/components and parts;

(5) Product installation specifications.

Product drawing (structure drawing、test sample installing drawing、type approval test plan and so on) need to be approved in accordance with 2.1.3,2. 2. 3,6. 1 and 9(10) of resolution Part 3 Annex1 2010 FTP Code and IACS UI FTP5(June 2010).

6 Materials and components

6.1 Materials and components are to comply with relevant requirements of CCS Rules

7 Type test

7.1 Selection of typical samples

7.1.1 Sampling of insulation materials of fire divisions and sealing of samples

(1) Sampling of insulation material: For fibrous material, generally three pieces of such products in appropriate size are to be taken, and for bulk deck covering, test sample is to be made in a specified mould so as to verify the compliance of type, model and/or specification (density and thickness); additional pieces of about 10 m2 (or more, as appropriate) are to be taken from the same batch of material as sample in type test (standard fire test) Such samples are to be marked and sealed.

(2) Where insulation material has not been approved by CCS, CCS surveyor isrequired to witness the preparation of non-combustible samples in accordance with the requirements in Part 1 of IMO 2010 FTP Code, and a non-combustible test is to be carried out by an entrusted

organization which is recognized by CCS (laboratory is to establish the Quality Control System and be subject toaudit and approval according to ISO/IEC 17025). Where insulation material has been approved by CCS, it is to check the term of validity for non-combustibility test report (24 months) or the valid approval certificate issued by CCS.

7.1.2 Preparation of standard fire test samples

(1) Appropriate standard fire test samples are to be prepared at a test organization recognized by CCS (laboratory is to establish the Quality Control System and be subjected to audit and approval according to ISO/IEC 17025) in accordance with the relevant requirements in Part 3 of IMO 2010 FTP Code,

(2) Where samples are to be made at the applicant or any other locations, CCS Surveyor is to witness the main process on site to ensure compliance with the drawings.

7.1.3 Maintenance of test samples

~~(1)~~ The maintenance of test samples is to comply with the test standards for related items.

7.2 Standard fire test drawings

(1) Structure of products and installation of fire test specimens ~~(containing arrangement of temperature-measuring thermocouples on the unexposed surface)~~ are to be submitted.

(2) The CCS branch or officecarrying out the approval is to send the examined standard fire test program and the drawings mentioned in (1) above, together with CCS “Product Test Notice” to the test organization recognized by CCS to carry out the standard fire test (laboratory is to establish the Quality Control System and be subjected to audit and approvalaccording to ISO/IEC 17025).

7.3 Type test items

(1) The type test items and requirements are given in Table 7.3(1).

Table 7.3(1)

Product name		**Item**	**Technical requirements**	**Test method**
A class bulkhead A class deck	A-0	Integrity	60 min	Testing is not required (when Annex 2 of IMO2010 FTP Code is complied with)

	A-15	Insulation	15 min	Part 3 of IMO 2010 FTP Code
		Integrity	60 min	
	A-30	Insulation	30 min	
		Integrity	60 min	
	A-60	Insulation	60 min	
		Integrity	60 min	
H class bulkhead H class deck	H-0	Integrity	120 min	ISO 20902-1:2018 Part 3 of IMO 2010 FTP Code
	~~H-30~~	~~Insulation~~	~~30 min~~	
		~~Integrity~~	~~120 min~~	
	H-60	Insulation	60 min	
		Integrity	120 min	
	H-120	Insulation	120 min	
		Integrity	120 min	
B class bulkhead	B-0	Integrity	30 min	Part 3 of IMO 2010 FTP Code
	B-15	Insulation	15 min	
		Integrity	30 min	
B class lining	B-0	Integrity	30 min	Part 3 of IMO 2010 FTP Code
	B-15	Insulation	15 min	
		Integrity	30 min	
B class ceiling	B-0	Integrity	30 min	
	B-15	Insulation	15 min	
		Integrity	30 min	

(2) The insulation is to comply with the temperature rise limits for unexposed surface of correspondingfire class specified in Part 3 of IMO 2010 FTP Code or CCS Rules for ~~the Construction and~~ Classification of Mobile Offshore Units, i.e.:

① Aclass divisions: During the period from test commencement to test end determined for corresponding fire class, the average temperature rise of thermocouples fitted as required on unexposed surface is not to be more than 140℃ and the highest temperature rise of any of such thermocouples fitted as required on unexposed surface is not to be more than 180℃;

② Bclass divisions: During the period from test commencement to test end determined for corresponding fire class, the average temperature rise of thermocouples fitted as required on unexposed surface is not to be more than 140℃ and the highest temperature of any of such thermocouples fitted as required on unexposed surface is not to be more than 225℃;

③ HClass divisions: During the period from test commencement to test end determined for corresponding fire class, the average temperature rise of thermocouples fitted as required on unexposed surface is not to be more than 140℃ and the highest temperature rise of any of such thermocouples fitted as required on unexposed surface is not to be more than 180℃;

④ For A class divisions, where the structural core is made of aluminum alloy, the average

temperature of the five thermocouples fitted respectively as required on the unexposed surface of the center of the specimen and the center of each of the four quarters is not to rise more than 200℃ above the initial temperature during the periods specified for corresponding fire class.

⑤ "A" class assemblies make test at designing maximum spacing between pins and adjacent joints. Test report comply with 2.1.3,2. 2. 3,6. 1 and 9(10) of resolution Part 3 Annex1 2010 FTP Code and 7.4（8）.

(3) Integrity (preventing the passage of smoke and flame): The requirements for corresponding fire class in Part 3 ofIMO 2010 FTP Code or CCS Rules for ~~the Construction and~~ Classification of Mobile Offshore Unitsare to be complied with, i.e. 60 min of test duration for A class divisions, 30 min of test duration for B class divisions, and 120 min of test duration for H class divisions.

① Flame: No flame is to occur on the unexposed surface;

② Cotton wool pads: Required pads are to be used and are not to be ignited, i.e. flame or flameless combustion occurs;

③ Gap gauges: Gap gauges are to be of a required size. The 6 mm gauge is not to be capable of penetrating specimen to enter furnace and moving about 150 mm along the opening or crack; or 25 mm gauge is not to be capable of penetrating specimen to enter furnace..

(4) B class continuous ceilings and linings: to be in compliance with the requirements in Part 3 ofIMO 2010 FTP Code (Appendix 4).

(5) B class bulkheads, linings and ceilings (composite rock wool/metal honeycomb panels/calcium silicate/inorganic fire boards, etc.) are to comply with the manufacturer's technical standards in terms of appearance, size, geometric tolerance, resistance to impact/other physical properties.

(6) Where necessary, samples of insulation and other non-metallic materials may be taken, sealed and sent to a test organization recognized by CCS to carry out asbestos free test or approval.

(7) The products which met the requirements Regulations 6.2 Chapter 6 of IMO MSC.337(91) The Code on Noise Levels on Board Ships should be tested for acoustic noise index at the test and inspection institutes approved by CCS.The specific testing methods, please see to Chapter 4 Part 3 CCS Guidelines for Noise Control and Testing for Ships and Products.

（8）After the fire resistance test is completed, if the insulation and integrity are qualified, it is recommended that the tested fire-resistant structure be dissected under the witness of the surveyor (with a focus on the location of temperature measurement points) to determine the consistency between the tested fire-resistant structure and the approved drawings.

7.4 Test report

(1) The non-combustibility test report for insulation materialsis to comply with the requirements in Part 1 of IMO 2010 FTP Code. The term of validity of non-combustibility test report for insulation materials of A, B and H class decks and bulkheads is not to be beyond 24 months before the date of the fire test of decks and bulkheads, or valid CCS certificates for insulation materials are to be furnished with.

(2) The standard fire test report for fire divisions is to comply with Part 3 of IMO 2010 FTP Code or ISO 20902-1:2018&Part 3 of IMO 2010 FTP Code. (5) Linear density calculation

(3) Adhesive used in B class divisions: The test report of low flame spread characteristics are to comply with Part 5 of IMO 2010 FTP Code.

(4) PVC films and veneers used in B class divisions: low flame spread characteristics are to comply with Part 5 of IMO 2010 FTP Code, smoke and toxicity are to comply with Part 2 of IMO 2010 FTP Code or Annex 2 of IMO 2010 FTP Code, and gross calorific value is to comply with ISO 1716:2010 orAnnex 2 of IMO 2010 FTP Code.

(5) Test reports for application are not to be more than 5 years old. If the approval depends on several test reports with different dates, the date of the oldest report governs. However, a type approval certificate may be renewed without retesting provided that the test report is not more than 15 years old and that no alternation of components or construction has been made to the product.

(6) Prior to 1 July 2013, fire tests may still be carried out in accordance with the older edition of FTP Code (1996 FTP Code). The term of validity for test reports is not to exceed 15 years.

(7) The test and inspection institutes approved by CCS should provide uniform acoustic test report format by CCS.

（8）To demonstrate that the tested “A” class assemblies are representative of that used on board ships, the following details shall, as a minimum when applicable, be clearly indicated in test reports and included in type approvals:

- Type, thickness, density and number of layers of thermal insulation material;

- Size, types, materials and fixing methods of pins and washers;

- Spacing between pins;

- Maximum spacing between pins and adjacent joints;

- Stepping of joints for multi-layers if applicable;

- Insulation and pinning details on and around stiffeners;

- Details of wire mesh, alu tape etc, if used in the test;

- The type approval test report shall contain the information required by2.1.3,2. 2. 3, 6. 1 and 9(10) of resolution Part 3 Annex1 2010 FTP Code;

- Type approval certificate shall refer to drawing numbers of the test sample.

8 Unit/batch inspection

8.1 Approved A class and H class bulkheads/decks: According to Chapter 3, PART ONE of CCS Rules for Classification of Sea-Going Steel Ships, A class and H class bulkheads/decks after approval will not be inspected by CCS. However, CCS unit/batch inspection is to be requested for insulation materials (non-combustible materials) used in bulkheads/decks according to other relevant CCS requirements (such as relevant shipbuilding industry standards or appropriate standards determined in the approval), and such materials used on board are to be furnished with product certification/equivalent documentation to verify and ensure the consistence between the actually applied insulation materials (density and thickness) as well as the installation method and the approved structure.

8.2 The unit/batch inspection scope of the approved B class bulkheads, linings and ceilings is as follows:

8.2.1 Sampling: A batch is to be of the same model and the same thickness specified for the same purchase order. Three pieces are to be taken for each type of bulkheads, linings and ceilings in each batch for visual examination and inspection of size and geometric tolerance, covering most of the specifications; for calcium silicate boards/inorganic fire boards,additional samples with physical properties of routine delivery inspection are to be kept by the manufacturer for on-site inspection by CCS Surveyor.

8.2.2 Inspection requirements

(1) Composite rock wool panels/metal honeycomb panels

① Plastic-covered steel plates: confirming the quality certificate for PVC films, compliance with requirements of Parts 2 and 5 of IMO 2010 FTP Code for low flame spread, smoke, toxicity

and gross calorific value, furnished with CCS certification or test reports, as well as compliance of steel plate brand and thickness with the approval requirements, furnished with the quality certificate of the manufacturer.

② Insulation materials (core material): such materials are to benon-combustible materials approved by CCS and in compliance with Part 1 of IMO 2010 FTP Code, of which the model, density/size are to comply with the requirements of approved drawings and be kept consistent with the approval, furnished with CCS certification.

③ Adhesives: confirming the quality documentation at receiving deliveries and compliance with the low flame spread characteristics required in Part 5 of IMO 2010 FTP Code, furnished with CCS certification.

④ Product performance: visual examination, size (length, width and thickness) and geometric tolerance are to be in compliance with the approval requirements.

(2) Calcium silicate boards/inorganic fire boards

① Finish materials (veneers): such materials are to be in compliance with requirements of Parts 2 and 5 of IMO 2010 FTP Code for low flame spread, smoke, toxicity and gross calorific value, furnished with CCScertification.

② Product performance: appearance, size (length, width and thickness), geometric tolerance, density and rupture strengthare to be in compliance with the requirements for approval.

(3) Products are to comply with the asbestos free requirement and provide asbestos free statement or approval certificate.