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Fire test procedures for divisional elements that are typically used in oil, gas and petrochemical industries —

Part 1: General requirements

Méthodes d'essais au feu des éléments de séparation habituellement utilisés dans les industries pétrolières, gazières et pétrochimiques —

Partie 1: Exigences générales

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 2, *Fire containment*.

This corrected version of ISO 20902-1:2018 incorporates the following correction:

— the second paragraph of subclause 7.5.1 has been reworded for clarification purposes.

A list of all parts in the ISO 20902 series can be found on the ISO website.

Introduction

This document describes a test procedure to assess the protection afforded by fire protection materials and systems to divisional elements. It gives an indication of how fire protection materials perform when exposed to a set of specified fire conditions.

The classification of divisional elements (bulkheads and decks) in the marine industry (i.e. ships as defined by IMO, SOLAS) is primarily undertaken in accordance with classification society procedures through testing to the FTP codes, IMO resolution 307(88), formerly IMO A.754(18). Historically FTP code compliant test evidence has been used to support non-marine applications by implementing hydrocarbon time temperature regime profiles. To reduce the burden on industry, this document is compatible with MSC 307(88) where relevant, allowing testing to both IMO and ISO test procedures for specific classification ratings.

Fire test procedures for divisional elements that are typically used in oil, gas and petrochemical industries —

Part 1: General requirements

1 Scope

This document specifies a test procedure for determining the fire resistance of divisional elements with a fire protection system, when exposed to cellulosic or hydrocarbon-pool type fire conditions. It is applicable to divisional elements intended for non-marine applications but suitable for offshore fixed and mobile installations.

The test data obtained, when used in conjunction with published fire test standards, permit subsequent classification of the divisional elements based on the duration of their performance against specified criteria.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 834-1:1999, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

ISO 13943, *Fire safety — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 13943 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
bulkhead
vertical divisional element typically used in the marine industry

3.2
deck
horizontal divisional element typically used in the marine industry

3.3
divisional element
element that is intended for use in maintaining separation between two adjacent areas of facilities within the oil and gas industry, and which may or may not be load bearing

3.4
critical temperature
temperature at which the yield strength of the material is reduced to the minimum allowable under operating loading conditions

3.5
structural core
primary component or components of the divisional element responsible for providing load bearing capability or integrity (as appropriate), excluding additional components provided for insulation purposes

Note 1 to entry: This typically consists of a metallic plate (either flat or corrugated) with stiffeners.

4 Principle

The method provides an indication of how divisional elements protected with fire protection systems or materials perform when they are exposed to fire conditions specified by furnace time-temperature curves. It simulates the thermal and mechanical loads to a divisional element engulfed in fire, through the use of furnace testing and exposed external loads, if necessary. To maintain compatibility with both prescriptive regulations and performance-based requirements derived from risk-analysis, it is non-prescriptive in terms of failure criteria and thermal loads. Classification procedures are given to facilitate the correct interpretation of test results derived in compliance with this standard.

5 Test specimen

5.1 General

The test specimen shall be representative of the construction for which classification is required. Test specimens intended to satisfy the requirements of the FTP Code, IMO Resolution MSC 307(88), Annex 1, Fire Test Procedures, Part 3, "Test for "A" (et al.) class divisions" are subject to additional requirements relating to their design and construction as described within the above resolution. Additional requirements within MSC 307(88) beyond the scope of this document shall be considered compatible with the requirements herein, i.e. tests may comply with both MSC 307(88) and this document.

Test results shall only be applicable in the orientation in which they have been tested; therefore, vertical divisional elements shall be tested vertically mounted, and horizontal divisional elements shall be tested horizontally mounted.

Vertical divisional elements shall be tested in the most onerous manner, which is considered to be with the insulation on the unexposed face and the stiffeners also on that side. For "restricted application", i.e. where the fire hazard has been identified as being from the insulated side only, the vertical divisional element can be tested with the insulation on the exposed face and with the stiffeners also on that side.

If approval of a vertical divisional element is being sought involving fire-hazard from both sides and the use of "double-sided application" of the insulation, the thickness of the insulation being equal on both sides of the structural core, it shall be tested with the stiffeners on the unexposed side of the vertical divisional element, otherwise it shall be tested with the side with the thinnest thickness of insulation on the exposed face.

5.2 Vertical divisional element dimensions

The minimum overall dimensions of the test specimen, including the perimeter details at the top, bottom and vertical edges, are 2 440 mm width and 2 500 mm height. When the maximum overall height in practice is less than that given above, then the test specimen shall be of the maximum height to be used in practice and the tested dimensions reported.

The overall dimensions of the structural core shall 20 mm less in both the width and the height than the overall dimensions of the specimen. Any joints in the plating shall be fully welded, at least from one side.

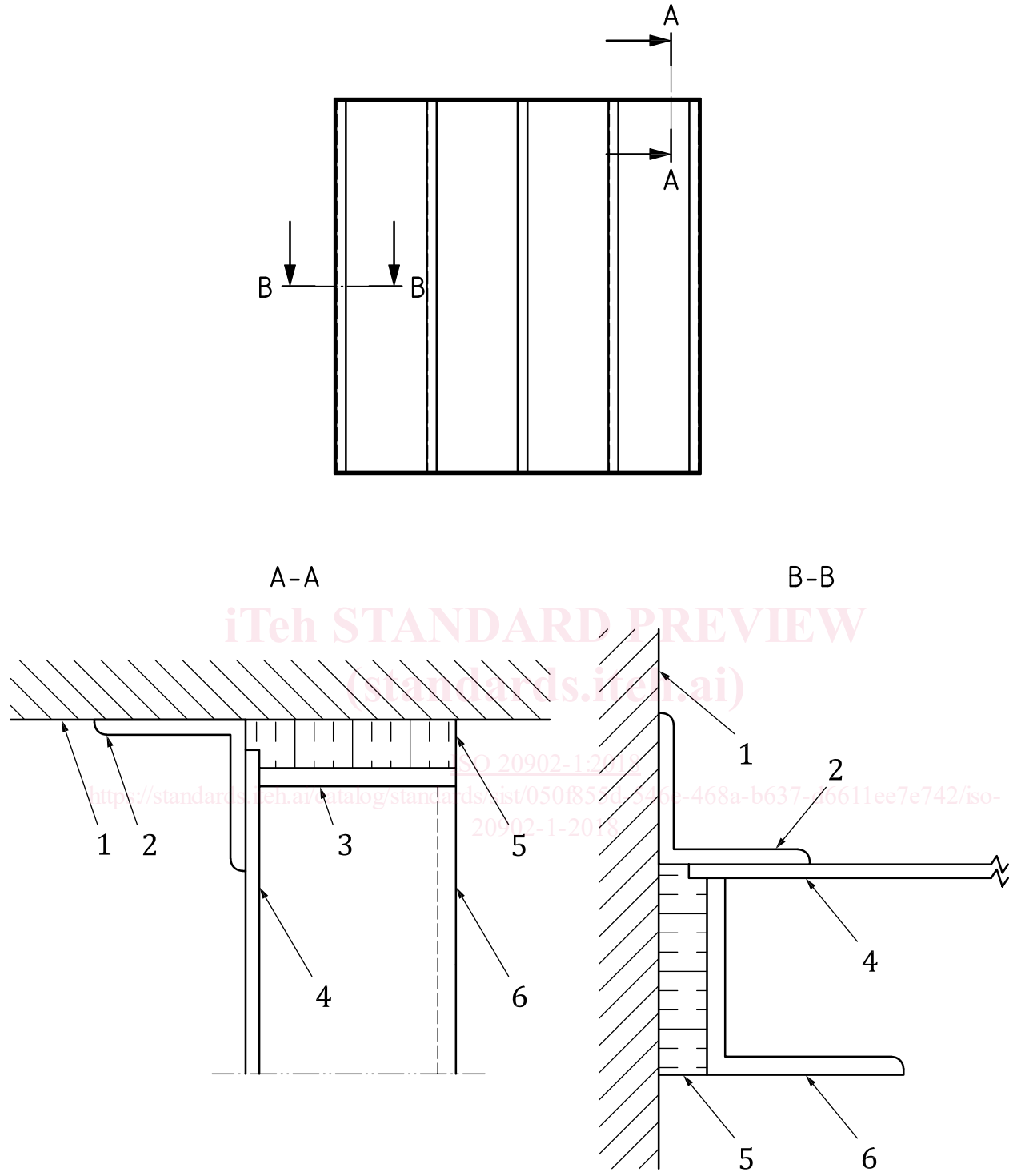
Flat bar of thickness 6 mm shall be welded across the edges of the structural core perpendicular to the stiffeners or the corrugation flute direction. The flat bars shall extend the full length and width of corrugation or stiffeners and shall not protrude beyond the extents of the structural core.

Structural cores constructed from flat plate with stiffeners may alternatively weld the flat bar across the top and bottom of the stiffeners. In this case, a minimum clearance of 16 mm shall be provided between the furnace and any stiffeners or flat bar.

Mineral wool packing shall be used to fill any clearance and gaps present.

The structural core shall be fixed to the furnace by means of L-shaped fixing cleats as shown in Figure 1. Cleats shall be fixed to the structural core by continuous weld, and fixed to the furnace frame by bolt or weld. Cleats shall be positioned adjacent to the ends of each stiffener if present, or at 1 000 mm spacing if stiffeners are not present.

Examples of test specimen construction are given in Annex A.



Key

1 furnace frame
2 fixing cleat, 50 mm × 50 mm × 5 mm L-shaped angle, 100 mm length, bolted or welded to frame
3 flat bar, 6 mm
4 structural core
5 mineral wool packing to fill clearance
6 stiffener (if present)

Figure 1 — Structural steel core for a vertical divisional element

5.3 Horizontal divisional element dimensions

The minimum overall dimensions of the test specimen, including the perimeter details at all the edges, are 2 440 mm width and 3 040 mm length. When the maximum dimensions in practice are less than that given above, the test specimen shall be of the maximum size to be used in practice and the tested dimensions shall be reported.

The overall dimensions of the structural core shall be 20 mm less in both the width and length than the overall dimensions of the specimen. Any joints in the plating shall be fully welded, at least from one side.

Flat bar of thickness 6 mm shall be welded across the edges of the structural core perpendicular to the stiffeners or the corrugation flute direction. The flat bars shall extend the full length and width of corrugation or stiffeners and shall not protrude beyond the extents of the structural core.

Structural cores constructed from flat plate with stiffeners may alternatively weld the flat bar across the top and bottom of the stiffeners. In this case, a minimum clearance of 16 mm shall be provided between the furnace and any stiffeners or flat bar.

Mineral wool packing shall be used to fill any clearance and gaps present.

The structural core shall be fixed to the furnace by means of L-shaped fixing cleats as shown in Figure 1. These shall be fixed to the structural core by continuous weld, and fixed to the furnace frame by bolt or weld. Cleats shall be positioned adjacent to the ends of each stiffener if present, or at 1 000 mm spacing if stiffeners are not present.

Examples of test specimen construction are given in Annex A.

5.4 Design

Where the construction incorporates panels, the specimen shall be constructed such that at least one of the panels is of full width and this, or these, shall be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

The overall dimensions of the panel insulation system, including the perimeter details at all the edges, shall be 20 mm greater in each direction than the equivalent dimensions of the structural core.

Where the insulation consists of blankets, the blankets shall be arranged so that not less than two transverse joints between blankets are included. The joints shall be located not less than 600 mm from the edges of the divisional element.

5.5 Description

The test sponsor shall provide full construction details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings shall include dimensions and details of the thicknesses of insulation used in way of the plating and the stiffeners, the method of securing the insulation system and details of the components used for this purpose, details of joints, detail of fittings, connections, air gaps and all other details.

5.6 Material specification

Prior to the test, all necessary information for each of the materials used in the construction of the test specimen shall be submitted to the laboratory by the applicant in accordance with ISO 834-1:1999, 7.5 [and where applicable, MSC 307 (88)].

5.7 Control measurements

5.7.1 Thickness

The thickness of each non-spray applied material and combination of non-spray applied materials shall be ±10 % of the value stated as the nominal thickness when measured by using a suitable gauge or callipers.

The thickness of a sprayed insulation material shall be measured using a suitable probe at positions adjacent to each of the unexposed-face thermocouples. Measurements should be taken by non-destructive methods such as ultrasonic or eddy current depth gauges. Equipment should be described in the report with the method of calibration. Care should be taken to ensure mesh reinforcement does not lead to a false reading. If necessary, the thickness may be measured by drilling a 1,5 mm hole and then using a depth gauge. For cementitious sprays, a thickness gauge may be used with the measurement needle penetrating the soft sprayed material.

For reactive coatings and other spray applied fire protection materials, the average primer thickness (if present) shall be measured first and subtracted from the total average primer and reactive coating thickness. The resulting permitted thickness tolerances, excluding primer and topcoat (assuming normal distribution of measured thickness), shall be as follows:

— a minimum of 68 % of readings shall be within ±20 % of the mean;

— a minimum of 95 % of readings shall be within ±30 % of the mean;

— all readings shall be within ±45 % of the mean.

If the thickness is outside these limits, the test specimens shall be adjusted to comply with the above requirements.

Authorities having jurisdiction may require more stringent thickness measurement position requirements and tolerances than those given in this clause. Such additional requirements, while not required for compliance with this document, should be considered compatible with this document.

The tolerances stated above are applicable to mineral-fibre based materials and epoxy intumescents. For other types of material or systems, alternative measurement control limits may be appropriate and these shall be agreed by the testing laboratory and the approval authorities under whose jurisdiction the system may fall when used in practice.

5.7.2 Density

The density of fibre-type materials, mineral wool or any similar compressible material shall be related to the nominal thickness and the density of each material used in the test specimen shall be ±10 % of the value stated as the nominal density.

5.8 Conditioning

5.8.1 General

The test specimen shall be protected against adverse environmental conditions until the time of the test. The requirements of ISO 834-1:1999, 7.4 shall be applied.

5.8.2 Verification

Where applicable, the condition of the test specimen can be monitored and verified by use of special samples for the determination of moisture content of constituent materials, as appropriate. These samples shall be so constructed as to represent the loss of water vapour from the specimen by having similar thicknesses and exposed faces. They shall have minimum linear dimensions of 300 mm by 300 mm and a minimum mass of 100 g. Constant weight shall be considered to be reached when two