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

Part 2: Additional procedures for pipe penetration and cable transit sealing systems

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

Partie 2: Modes opératoires supplémentaires pour les systèmes de calfeutrement de traversées de câbles et de trémies de tuyaux

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

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

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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 will 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 the International Maritime Organisation (IMO) and Safety of Life and Sea (SOLAS) convention] is primarily undertaken in accordance with classification society procedures through testing to the fire test procedures (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 FTP codes IMO resolution MSC 307(88) where relevant, allowing the use of 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 2: Additional procedures for pipe penetration and cable transit sealing systems

1 Scope

ISO 20902-1 specifies a test methodology for determining the fire resistance of divisional elements with a fire protection system when subjected to cellulosic or hydrocarbon-pool type fire exposure conditions. This document describes additional test procedures for penetration and cable transit sealing systems intended for non-marine applications but suitable for offshore fixed and mobile installations. The test data thus obtained enables subsequent classification on the basis of the duration for which the performance of the divisional element under these conditions satisfies 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, *Fire-resistance tests — Elements of building construction — Part 1: General requirements*

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

3 Terms and definitions

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

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

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

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

3.1
penetration
aperture within a fire separating element usually present to accommodate the passage of a service through that element

[SOURCE: ISO 10295-1:2007, 3.2]

3.2
penetration seal
single component or system used to maintain the fire resistance of the fire-separating element at the position where services pass through the element

[SOURCE: ISO 10295-1:2007, 3.4]

3.3
penetration sealing system
assembly for test consisting of the penetrating service or services and the penetration seal, materials or devices, together with any service support construction, designed to maintain the integrity and insulation performance of the separating element for the duration of the fire test

[SOURCE: ISO 10295-1:2007, 3.5]

3.4
blank penetration seal
system where an aperture of specified size in the fire separating element is sealed or closed by the specified seal without incorporation of penetrating services

[SOURCE: ISO 10295-1:2007, 3.7]

3.5
test construction
complete assembly, consisting of the separating element and penetration sealing system

[SOURCE: ISO 10295-1:2007, 3.8]

3.6
bulkhead
vertical divisional element typically used in the marine industry

[SOURCE: ISO 20902-1:2018, 3.1]

3.7
deck
horizontal divisional element typically used in the marine industry

[SOURCE: ISO 20902-1:2018, 3.2]

3.8
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

[SOURCE: ISO 20902-1:2018, 3.3]

3.9
hot spot
location on the back of the test specimen, within the permitted measurement area, where the highest temperature is recorded

3.10
structural core
the 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.

[SOURCE: ISO 20902-1:2018, 3.5]

3.11
cable filling ratio
ratio between a cross-section area of cables and a cross-section area of the transit

3.12
coaming
raised edge around an opening in a division, which can be an integral part of the division or a frame attached to the division

3.13
symmetrical system
system that is identical on the fire-exposed and non-fire-exposed sides of the division

3.14
asymmetrical system
system differing on the fire-exposed and non-fire-exposed sides of the division

3.15
transit system
system consisting of a frame, box or coaming, a sealant system or materials and cables and/or small bore pipework used to create a gas-, smoke-, water-, fire- and blast-resistant seal around the cables and/or pipes as they pass through openings in walls, floors, bulkheads or decks

Note 1 to entry: The system may be uninsulated, partially insulated or fully insulated.

4 Principle

The method provides supplementary procedures to ISO 20902-1 for the purpose of standardizing testing of divisional elements containing some form of penetration. For the purpose of this document, a penetration is considered as any breach of the integrity of an otherwise continuous divisional element. Examples of penetrations include pipe and duct penetration seals and cable transits. To maintain compatibility with both prescriptive regulations and risk-analysis-derived, performance-based requirements, this document is non-prescriptive in terms of failure criteria and thermal loads. Classification procedures are given to facilitate correct interpretation of tests results derived in accordance with this document.

5 Test equipment

Equipment employed in the conduct of this test consists of a furnace, restraint and support frames and instrumentation as specified in ISO 20902-1.

In addition to the requirements of ISO 20902-1, the internal dimensions of the test furnace shall be such that a distance of at least 200 mm exists between any point of the periphery of any penetration seal and the wall of the furnace.

6 Test conditions

6.1 Preconditioning

Specimens shall be subject to a conditioning procedure in accordance with ISO 834-1.

6.2 General

All test conditions shall conform to those given in ISO 20902-1, except where directly modified by clauses within this document.

Where a penetration sealing system is intended for use in both horizontal and vertical separating elements, then each orientation shall be tested.

A pressure of (20 ± 2) Pa shall be established at the bottom of the lowest penetration in a vertical assembly.

For horizontal elements, a static pressure of (20 ± 2) Pa in the horizontal plane at (100 ± 10) mm below the underside of the separating element shall exist.

NOTE Backwards compatibility with the pressure control requirements of the FTP codes (2010) is intended. The FTP codes met the pressure criteria above implicitly through control of specimen position and minimum dimensions. The move to explicit control of pressure is intended to provide greater flexibility regarding the number of specimens tested simultaneously.

7 Instrumentation

7.1 General

The control, monitoring and recording equipment necessary to carry out tests in accordance with this document shall be as described in ISO 20902-1, subject to the additional requirements in this clause.

The measurement and control of furnace temperature shall be measured using plate thermometers, in accordance with ISO 834-1, uniformly distributed so as to give a reliable indication of the average gas temperature in the vicinity of the heated face of the test construction. The hot junctions shall be located initially in a plane (100 ± 10) mm from the exposed face of the separating element. In addition, no junction shall be closer than 100 mm to any projecting part of the seal, a penetrating service, or any part of the furnace at the start of the test. At least one plate thermometer shall be provided for every 1,5 m^2 of the heated area of the test construction, subject to a minimum number of four plate thermometers for each test construction.

Unexposed face temperature measurement shall be made using thermocouples in accordance with ISO 834-1. In the case of non-planar surfaces, the disc and pad shall be deformed to follow the surface profile. If there is difficulty in fixing the standard pad, the size of the pad shall be reduced in size subject to a minimum dimension of 12 mm.

7.2 Roving thermocouple

The information obtained on unexposed face surface temperatures shall be supplemented by additional data derived from measurements obtained using a roving thermocouple as specified in ISO 20902-1, applied to identify any local “hot spots” or where temperatures measured by the fixed thermocouples are not reliable.

7.3 Integrity measurements

Where difficulties arise in attempting to use the cotton pad for the assessment of loss of integrity in accordance with ISO 834-1 when the penetration carries a high density of services, the size of the cotton pad shall be reduced to (20 × 20 × 20) mm. The wire supporting frame described in ISO 834-1 shall be adapted to the small pad size but still maintain the 30 mm clearance required from adjacent surfaces. Gap gauges should not be used for the determination of integrity loss.

The use of cotton pads may be discontinued when the temperature of the separating element exceeds 300 °C within 70 mm of the penetration seal, measured to the edge of the cotton pad.

7.4 Infrared camera

The provisions relating to use of an infrared (IR) camera in ISO 20902-1 shall apply. The use of an IR camera may be omitted for separating elements that are uninsulated on the fire and non-fire side and that are without insulation performance criteria.

NOTE The IR camera is not used for the determination of temperatures but for guiding the placement of the roving thermocouple, as described in ISO 20902-1:2018, 6.10.

8 Test requirements

8.1 General

All penetrations shall be part of a division constructed of materials corresponding to the actual construction.

The division structural core and edge frames shall be constructed in accordance with ISO 20902-1:2018, Clause 5, so far as is practicable.

The penetration, any associated fittings (if applicable), and any associated framework, shall be constructed of a material corresponding to the actual construction and insulated as necessary to achieve the desired standard of insulation.

The method of fixing the penetration or transit frame into the division shall be the same as that used in practice. If the method of fixing the penetration in a test is made by bolts, full welding shall be considered an acceptable alternative method of fixing the penetration or cable transit frame without further tests.

Penetrations shall be fixed or mounted into the structural core such that the side expected to give the inferior performance is exposed to the heating conditions of the test.

Any auxiliary means of maintaining a minimum spacing (as specified by the manufacturer and as tested) between individual cables/pipes and between the cables/pipes and the frame of the penetration, or any auxiliary sealing system necessary to achieve tightness capability, where required, shall be part of the penetration during the fire test. Examples of auxiliary means are:

— packing material/insulating compounds;

— putty;

— intermediate layers of all kinds;

— expansion elements.

8.2 Minimum number of test specimens

Rectangular and circular penetrations shall be tested separately.

The maximum and minimum dimensions shall be tested.

Penetrations intended for use in divisions with an insulation (I) classification shall be installed in divisions which are insulated to achieve a classification rating equal to the classification rating sought for the penetration specimen. The specimen shall be insulated on the non-exposed face in cases of vertical divisions, and the fire-exposed face in the case of horizontal divisions.

Penetrations intended for use in divisions without an insulation (I) classification shall be installed in divisions which are uninsulated.

Uninsulated divisions without an insulation (I) classification should not be assumed to maintain their insulation and integrity classification following the addition of insulation.

In the case of asymmetrical systems in a vertical separating element, normally two tests shall be carried out: one from each direction of exposure. Where it can be established clearly in an asymmetrical system in a vertical separating element that there is a weaker direction of exposure, it is required to test only the weaker direction. A full justification for the procedure adopted shall be included in the report. Where the penetration sealing system is fully symmetrical, only one specimen is required to be tested with either face exposed to the heating regime.

In the case of horizontal elements, the test specimen shall be exposed to heating from the underside. When a horizontal system is fitted on an exposed side or is fitted symmetrically, the test shall also be