BS ISO 15541:2016

BSI Standards Publication

Ships and marine technology — Fire resistance of non-metallic hose assemblies and non-metallic compensators — Requirements for the test bench

National foreword

This British Standard is the UK implementation of ISO 15541:2016. It supersedes BS EN ISO 15541:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SME/32, Ships and marine technology - Steering committee.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 89060 4

ICS 13.220.40; 47.020.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2016.

Amendments issued since publication

Date	Text affected

BS ISO 15541:2016

INTERNATIONAL STANDARD

ISO 15541

Second edition
2016-07-15

Ships and marine technology — Fire resistance of non-metallic hose assemblies and non-metallic compensators — Requirements for the test bench

Navires et technologie maritime — Résistance au feu des flexibles et des compensateurs non métalliques — Exigences pour le banc d'essai

Reference number
ISO 15541:2016(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

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 on 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.

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

This second edition cancels and replaces the first edition (ISO 15541:1999), which has been technically revised.

The most significant change in this second edition is the inclusion of non-metallic compensators to the fire test procedures outlined in this document. The first edition of this document applied primarily to non-metallic hose assemblies. Because the compensators are used in common piping systems and may have similar materials to hose assemblies, the applicability of the test procedures was expanded to include compensators.

Introduction

The main objective of the test using the test bench described in this document is to determine whether and for a safety period a non-metallic hose assembly or non-metallic compensator can be exposed to fire, without becoming inoperable, when subjected to the envisaged working pressure. Despite the fact that the attacking fire is simulated so as to correspond to a fire occurring in practice, it cannot be assumed that the duration of resistance to fire as recorded during that test will also occur in the event of an actual fire, as the conditions of installation, which essentially affect to the duration of resistance to fire, may vary from case to case.

Tests carried out using the test bench specified in this document are intended to lead to results capable of being reproduced.

INTERNATIONAL STANDARD ISO 15541:2016(E)

Ships and marine technology — Fire resistance of non-metallic hose assemblies and non-metallic compensators — Requirements for the test bench

1 Scope

This document specifies requirements for a test bench to determine the fire resistance of non-metallic hose assemblies and non-metallic compensators with nominal diameter up to 150 mm. It may be used for bigger sizes provided proper test bench conditions are obtained. During the exposure to flames, there are possible working pressures of up to 16 bar.

The flame spread ability of non-metallic hose assemblies or non-metallic compensators cannot be tested with the test bench specified in this document.

Only water is permitted as a test medium. With a view to ensuring maximum safety for both the operating personnel and the test bench in the event of damage of the non-metallic hose assembly or non-metallic compensator during the test, the use of combustible test media is excluded.

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 15540:2016, *Ships and marine technology — Fire resistance of non-metallic hose assemblies and non-metallic compensators — Test methods*

IEC 60051-1:1997, *Direct acting indicating analogue electrical measuring instruments and their accessories — Part 1: Definitions and general requirements common to all parts*

3 Terms and definitions

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

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

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

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

3.1
fire resistance
ability of an element of building construction, component or structure, to fulfil for a stated period of time the required stability, integrity, thermal insulation and/or other expected duty specified, in a standard fire resistance test

4 Requirements

4.1 Components of test bench

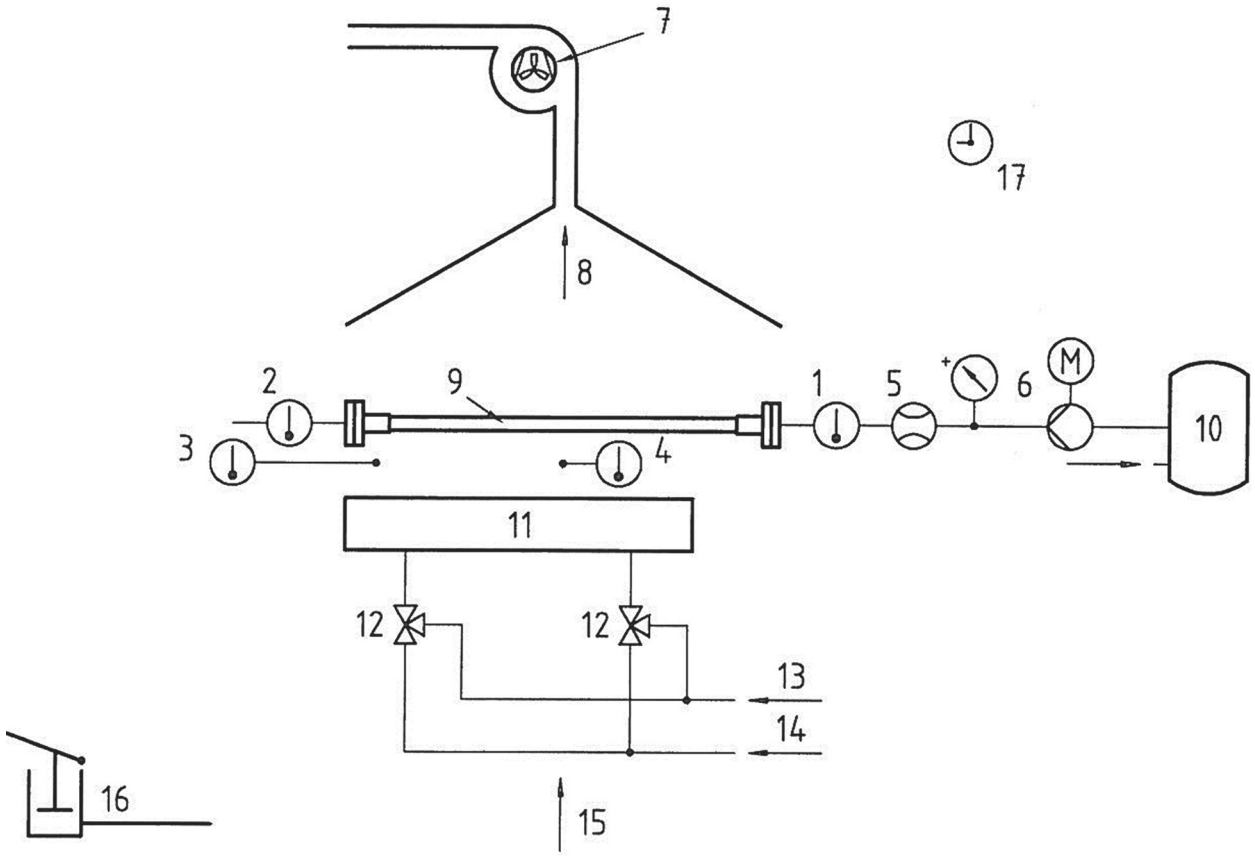
The test bench shall consist of the following parts (see Figure 1):

— burner chamber with connecting device for the test specimens, burner and exhaust gas trunk (refer to parameters 4.2);

— aggregate box with equipment for conditioning and controlling the test medium (see 4.3);

— equipment for monitoring and recording the test procedure (see 4.4);

— pressure-producing equipment which can load the test specimen at the end of flame application with the test pressure as specified in the technical specification (see 4.5).



Key

Indication, measurement, recording, control and adjustments

1	measuring point water temperature of test medium, inlet	10	water tank with heating/cooling
2	measuring point water temperature of test medium, outlet	11	sectional area burner
3	measuring point flame temperature below test specimen outlet	12	mixing valve
4	measuring point flame temperature below centre of test specimen	13	gas
5	flow rate of water	14	combustion air
6	working pressure during test	15	air supply
7	fan	16	pump for pressure test
8	exhaust gas	17	test duration
9	test specimen		

Figure 1 — Diagram of test bench

4.2 Burner chamber

4.2.1 General

The connections of the test specimen shall be arranged to an operating height (e.g. 1 000 mm). They shall enable testing of hose assemblies with a free length of hose of 500 mm minimum and non-metallic compensators of varying length and shapes. A steady air flow upwards shall be provided. The base area of the air supply shall be approximately 0,6 m^2.

An example of an arrangement of a burner chamber is shown in Figures A.1 and A.2.

4.2.2 Burner

The total sectional area of the burner shall be 150 mm × 500 mm minimum. The sectional area can consist of several single-area burner units. The burner shall be sized to cover both end fittings of non-metallic compensators as required by ISO 15540:2016, 8.1.

Burners with a minimum of 20 nozzles per square decimetre shall be used. Burners shall be of the fan type or atmospheric type.

Each single area burner unit shall be provided with a mixing valve for mixing the gas and the combustion air, creating a flame of (800 ± 50) °C, at measuring points 3 and 4 of Figure 1. Flame appearance shall be according to Figures A.1 and A.2.

The burner should be movable to avoid exposing the test specimen to the flames during adjustment of the flame.

The burner shall be variable in height in order that the flame can envelop test specimens of all possible nominal diameters. Temperatures measured, (15^{+5}_{0}) mm directly under the test specimen shall be (800 ± 50) °C.

4.2.3 Exhaust trunk

The exhaust gas shall be drawn off upwards by means of an exhaust fan. The fan shall be infinitely variable. The upward air flow shall produce a directed flame.

Environmental restrictions according to local law shall be taken into consideration.

4.2.4 Coolant circuit

For controlling the coolant circuit, shut-off valves and measuring instruments shall be provided in the coolant supply and drain line.

4.3 Aggregate box

Heating and cooling arrangements shall be provided for supplying the test specimen with water of (80 ± 2) °C at the test specimen inlet.

The installation shall provide an adjustable water velocity of at least 0,1 m/s in the test specimen and constant pressure of at least (5 ± 0,2) bars up to the maximum allowable working pressure (M.A.W.P.) of the test specimen.

4.4 Monitoring and recording

4.4.1 Control and adjustments

The parameters listed in Figure 1 and Table 1 shall be controllable/adjustable in the given range by means of suitable measurements.

Table 1 — Parameter control and adjustment ranges

Number according to Figure 1	Parameter	Range	Remarks
1	Water temperature at inlet	+80 °C Deviation: ± 2 °C	—
3 and 4	Flame temperature below test specimen	(800 ± 50) °C	Temperature 15 mm to 20 mm below test specimen.
5	Flow rate of water	Velocity of flow minimum 0,1 m/s.	The velocity of flow shall be adequate for the requirements in respect of the inlet temperature of the test medium.
6	Working pressure of water	5 bar up to 16 bar Deviation: ± 0,2 bar	Applicable working pressure depends on design of the test bench.
17	Test duration	max. 9 999 s	Stop at end of test or interruption.

4.4.2 Measurements, recording and indication

Test parameters shall be measured, recorded and indicated at least once within 2 min as detailed in Table 2.

Table 2 — Parameter-recording requirements

Number according to Figure 1	Parameter	Measurement, indication and recording
1	Water temperature at test specimen, inlet	X
2	Water temperature at test specimen, outlet	X
3	Flame temperature below test specimen outlet	X
4	Flame temperature below centre of test specimen	X
5	Volume flow rate of water	X
6	Working pressure during test	X
17	Test duration	X
NOTE Additional warning lights may be provided for exceeding or falling below permissible temperatures, pressures, etc.		

The instruments shall correspond to the following precision classes, or have the following tolerances:

Pressure gauges: ±1,0 % of max. scale value

Electrical measuring instruments: Class 1 according to IEC 60051-1:1997

Non-electrical measuring instruments: ±1,0 % of max. scale value

Flow meter: ± 1,0 % of max. scale value

The survey of the testing equipment shall be carried out according to a recognized quality control system, for example, based on International Standards from the ISO 9000 series.[2] [3] [4]

4.4.3 Safety facilities

4.4.3.1 Requirements

The following requirements apply to the test bench setup:

a) the gas supply to the burner shall be protected by a thermo-electrical ignition safety feature. The gas supply to the burner shall automatically be switched off when

   — the flame goes out by itself,

   — the pressure drops in the test specimen,

   — the pressure or flow drops in the test specimen,

   — the test box is opened,

   — the gas exhaust is insufficient, and

   — an emergency stop occurs;

b) in the case of switching off for safety reasons, quick-closing valves shall cut off at the test specimen inlet and outlet. The circuit shall be pressure-released,

c) in case the test specimen is destroyed, the evacuation of leakage water from the burner shall be ensured,

d) the working pressure in the water circuit shall be limited to 1,1 times by a safety valve,

e) it shall be ensured that the heating for warming up to the water can only be switched on when the circulation pump is working. Additionally, a thermostatic limitation of the maximum admissible temperature in the boiler shall be provided.

4.4.3.2 Tests

The conditions specified in 4.4.3.1 a) for a switch-off of the gas supply shall be set. The gas supply shall be disconnected.

After switching off according to 4.4.3.1 a), proof shall be established that the requirements according to 4.4.3.1 b) are met.

The burner shall be flooded once, while the gas supply is switched off. Proof shall be established that the water is evacuated as required by 4.4.3.1 c).

Proof shall be established that the safety valve limits the working pressure in the system to 1,1 times as required by 4.4.3.1 d). This shall be checked by a pressure test of the entire piping system.

Proof shall be established that is not possible to switch on the heating while the circulation pump is switched off, as described in 4.4.3.1 e). Additionally, proof shall also be established that the water temperature in the boiler does not exceed the maximum admissible temperature.

4.5 Pressure-producing equipment

Pressure-producing equipment shall be provided, which can load the test specimen with an internal working pressure up to its test pressure according to standard or other specification at the end of the flame application.

This pressure-producing equipment can be arranged outside the actual test bench.

Annex A
(informative)

Flame appearance

Figure A.1 — Arrangement of a burner chamber

Figure A.2 — Arrangement of a burner chamber

Bibliography

[1] ISO 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

[2] ISO 9000, *Quality management systems — Fundamentals and vocabulary*

[3] ISO 9001, *Quality management systems — Requirements*

[4] ISO 9004, *Managing for the sustained success of an organization — A quality management approach*

[5] ISO/IEC 90003, *Software engineering — Guidelines for the application of ISO 9001:2000 to computer software*

ICS 47.020.30; 83.140.40

Price based on 9 pages

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.