TECHNICAL SPECIFICATION

ISO/TS 5660-4

First edition
2016-12-15

Reaction-to-fire tests — Heat release, smoke production and mass loss rate —

Part 4: Measurement of low levels of heat release

Essais de réaction au feu — Débit calorifique, taux de dégagement de fumée et taux de perte de masse —

Partie 4: Mesurage du débit calorifique pour la détermination des bas niveaux de combustibilité

Reference number
ISO/TS 5660-4:2016(E)

© ISO 2016

This document is a preview generated by EVS

This document is a preview generated by EVS

COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

 © ISO 2016 – All rights reserved

Contents

Page

Foreword ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
4 Symbols and units **3**
5 Principle **4**
6 Apparatus **4**
6.1 General 4
6.2 Cone-shaped radiant electrical heater 6
6.3 Radiation shield 6
6.4 Irradiance control 6
6.5 Weighing device 6
6.6 Specimen holder 6
6.7 Retainer frame 7
6.8 Exhaust gas system with flow measuring instrumentation 8
6.9 Gas sampling apparatus 10
6.10 Ignition circuit 10
6.11 Ignition timer 10
6.12 Oxygen analyser 11
6.13 Heat flux meters 11
6.14 Calibration burner 11
6.15 Data collection and analysis system 11
6.16 Optional side screens 11
7 Suitability of a product for testing **12**
7.1 Surface characteristics 12
7.2 Asymmetrical products 12
7.3 Materials of short burning time 12
7.4 Composite specimens 12
7.5 Products with unknown burning behaviour 12
8 Specimen construction and preparation **13**
8.1 Specimens 13
8.2 Conditioning of specimens 13
8.3 Preparation 13
8.3.1 Specimen wrapping 13
8.3.2 Specimen preparation 14
9 Test environment **14**
10 Calibration **14**
10.1 Initial calibrations 14
10.1.1 General 14
10.1.2 Weighing device response time 15
10.1.3 Weighing device output drift 15
10.1.4 Oxygen analyser delay and response times 15
10.1.5 Oxygen analyser output noise and drift 15
10.2 Operating calibrations 16
10.2.1 General 16
10.2.2 Weighing device accuracy 16
10.2.3 Oxygen analyser 16
10.2.4 Heat release rate calibration 16
10.2.5 Heater calibration 17
10.3 Less frequent calibrations 17
10.3.1 Working-standard heat flux meter calibration 17

This document is a preview generated by EVS

© ISO 2016 – All rights reserved

10.3.2 Linearity of heat release rate measurements ... 17
10.3.3 Accuracy of calibration burner flow meter ... 17

11 Test procedure ... 17
11.1 General precautions ... 17
11.2 Initial preparation ... 18
11.3 Test procedure ... 18

12 Test data limitations ... 19

13 Calculations ... 19
13.1 General ... 19
13.2 Calibration constant for oxygen consumption analysis ... 19
13.3 Heat release rate ... 20
13.4 Exhaust duct mass flow rate ... 20
13.5 Mass loss rate ... 21

14 Test report ... 21

Annex A (informative) **Overview ... 23**

Annex B (informative) **Calibration of the working heat flux meter ... 26**

Annex C (informative) **Calculation of heat release with additional gas analysis ... 27**

Annex D (informative) **Data obtained in initial round robin ... 31**

Bibliography ... 34

This document is a preview generated by EVS

 © ISO 2016 – All rights reserved

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 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

A list of all parts in the ISO 5660 series can be found on the ISO website.

This document is a preview generated by EVS

© ISO 2016 – All rights reserved

This document is a preview generated by EVS

Reaction-to-fire tests — Heat release, smoke production and mass loss rate —

Part 4: Measurement of low levels of heat release

WARNING — The test procedures involve high temperatures and combustion processes. Therefore, hazards can exist for burns, ignition of extraneous objects or clothing, and for inhalation of combustion products. The operator should use protective gloves for insertion and removal of test specimens. Neither the cone heater nor the associated fixtures should be touched while hot except with the use of protective gloves.

Materials containing volatile organic substances or decomposition products, or large amounts of moisture may produce violent releases of combustible gases or water vapour during testing.

Materials with high release rates normally tested in ISO 5660-1 **would give dangerous conditions if tested in this apparatus. To ensure this does not happen, specimens shall first be tested at the smaller 100 × 100 mm** ISO 5660-1 **specimen size to check approximate heat release rates before proceeding.**

1 Scope

This document specifies a method for evaluating materials and products that produce low levels of heat release when exposed to high irradiance levels typical of fully developed fires. It differs from ISO 5660-1 by prescribing items such as specific specimen size, specimen holder, specimen orientation, volumetric flow rate for O_2 analyses and irradiance levels at which testing is conducted.

The test method described in this document is intended for use on products and materials that contain only small amounts of combustible elements, e.g. test specimens that yield a total heat release of 0,75 MJ/m^2 to 15 MJ/m^2.

NOTE 1 The test method for specimens that yield moderate to high total heat release is described in ISO 5660-1. The information obtained from this test method in this document can also be used for fire safety engineering purposes.

NOTE 2 As in ISO 5660-1, the heat release rates are not measured directly and absolute but are theoretically calculated using the empirically derived constant of proportionality that links heat released and measured oxygen consumed.

2 Normative references

The following documents are referred to in 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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

ISO 5660-1:2015, *Reaction-to-fire tests — Heat release, smoke production and mass loss rate — Part 1: Heat release rate (cone calorimeter method)*

ISO 5660-3, *Reaction-to-fire tests — Heat release, smoke production and mass loss rate — Part 3: Guidance on measurement*

This document is a preview generated by EVS

© ISO 2016 – All rights reserved

ISO/TR 14697, *Reaction-to-fire tests — Guidance on the choice of substrates for building and transport products*

ISO 14934-2, *Fire tests — Calibration and use of heat flux meters — Part 2: Primary calibration methods*

ISO 14934-3:2012, *Fire tests — Calibration and use of heat flux meters — Part 3: Secondary calibration method*

3 Terms and definitions

For the purposes of this document, the terms and definitions given 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 http://www.electropedia.org/

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

3.1
emissivity
ratio of the radiation emitted by a radiant source to the radiation that would be emitted by a black body radiant source at the same temperature

Note 1 to entry: Emissivity is dimensionless.

[SOURCE: ISO 13943:2008, 4.75]

3.2
flashing
existence of flame on or over the surface of the specimen for periods of less than 1 s

3.3
ignition
onset of *sustained flaming* (3.10)

3.4
irradiance
<at a point on a surface> quotient of the radiant flux incident on an infinitesimal element of surface containing the point, and the area of that element

Note 1 to entry: Convective heating is minimized in the horizontal specimen orientation. For this reason, the term “irradiance” is used instead of “heat flux” throughout this document as it best indicates the essentially radiative mode of heat transfer.

3.5
material
single substance or uniformly dispersed mixture

EXAMPLE Metal, stone, timber, concrete, mineral fibre and polymers.

3.6
orientation
plane in which the exposed face of the specimen is located during testing

3.7
oxygen consumption principle
proportional relationship between the mass of oxygen consumed during combustion and the heat released

3.8
product
material, composite or assembly about which information is required

This document is a preview generated by EVS

 © ISO 2016 – All rights reserved