

Common test methods for cables under fire conditions -  
Heat release and smoke production measurement on  
cables during flame spread test - Test apparatus,  
procedures, results

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 50399:2022 sisaldab Euroopa standardi EN 50399:2022 ingliskeelset teksti.	This Estonian standard EVS-EN 50399:2022 consists of the English text of the European standard EN 50399:2022.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 16.09.2022.	Date of Availability of the European standard is 16.09.2022.
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## English Version

# Common test methods for cables under fire conditions - Heat release and smoke production measurement on cables during flame spread test - Test apparatus, procedures, results

Méthodes d'essai communes aux câbles soumis au feu -  
Mesure de la chaleur et de la fumée dégagées par les  
câbles au cours de l'essai de propagation de la flamme -  
Appareillage d'essai, procédure et résultats

Allgemeine Prüfverfahren für das Verhalten von Kabeln und  
isolierten Leitungen im Brandfall - Messung der  
Wärmefreisetzung und Raucherzeugung während der  
Prüfung der Flammenausbreitung - Prüfeinrichtung,  
Prüfverfahren und Prüfergebnis

This European Standard was approved by CENELEC on 2022-08-08. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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## European foreword

This document (EN 50399:2022) has been prepared by CLC/TC 20, "Electric cables".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-08-08
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2025-08-08

This document supersedes EN 50399:2011 and all of its amendments and corrigenda (if any).

EN 50399:2022 includes the following significant technical changes with respect to EN 50399:2011:

- inclusion of the detailed description of the test apparatus in this document, rather than by reference to EN 60332-3-10 (see 4.1).
- improvements in the test apparatus (see 4.2 to 4.7), including the mandatory use of mass flow controllers for the supply of gases to the burner.
- several improvements of the qualification of the test equipment, including guidance for a check of the flame shape (5.6) and a performance check of the test equipment (5.7).
- additions for testing of flat cables including mounting (see 6.4 and 6.5).
- new informative Annex K (Check of the flame shape for nominal heat output of 20,5 kW).
- new informative Annex L (Guidance on conducting performance checks of the test equipment).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.



## Introduction

EN 50399 specifies the test apparatus and test procedures for the assessment of the reaction to fire performance of cables to enable classification under the Construction Products Regulation [1, 2] to be achieved.

EN 50399 describes an intermediate scale fire test of multiple cables mounted on a vertical cable ladder and is carried out with a specified ignition source to evaluate the burning behaviour of such cables and enable a direct declaration of performance. The test provides data for the early stages of a cable fire from ignition of cables. It addresses the hazard of propagation of flames along the cable, the potential, by the measurement of the heat release rate, for the fire to affect areas adjacent to the compartment of origin, and the hazard, by the measurement of production of light obstructing smoke, of reduced visibility in the room of origin and surrounding enclosures.

The following parameters may be determined under defined conditions during the test:

- a) flame spread.
- b) heat release rate.
- c) total heat release.
- d) smoke production rate.
- e) total smoke production.
- f) fire growth rate index.
- g) occurrence of flaming droplets/particles.

The apparatus is derived from that of EN 60332-3-10 [3, 4] but with modifications and with additional instrumentation to measure heat release and smoke production during the test. It has been demonstrated [5] that the utilization of these additional measurement techniques, proven for other standard tests e.g. for other building products, are appropriate for assessing the reaction to fire performance of electric cables. These techniques include heat release and smoke production measurements. Compared with the test methods described in the EN 60332-3 series, they enable a more comprehensive assessment system, which is both more precise and sensitive, and enables a wider range of fire performance levels.

Care should be exercised in relating the parameters measured to different safety levels in actual cable installations as the actual installed configuration of the cables could be a major determinant in the level of flame spread, heat release and smoke production occurring in an actual fire. These parameters depend upon several features, such as:

- a) the volume of combustible material exposed to the fire and to any flaming or heat which could be produced by the combustion of the cables.
- b) the geometrical configuration of the cables and their relationship to an enclosure.
- c) the temperature at which it is possible to ignite the gases emitted from the cables.
- d) the quantity of combustible gas released from the cables for a given temperature rise.
- e) the volume of air passing through the cable installation.
- f) the construction of the cable e.g. armoured or unarmoured, multi- or single core.

All the foregoing assumes that the cables can be ignited when involved in an external fire.

The conditions of cable mounting, including volume of material exposed and geometrical configuration of the cables on the test ladder, and volume of airflow through the chamber have been chosen to be in accordance with that required by the Commission Decision 2006/751/EC [6]. CENELEC has not been

involved in the definition of these parameters. These standardized conditions provide the basis for classification, as detailed in EN 13501-6 [7] and EN 50575 [2], but do not necessarily correspond to conditions found in a particular cable installation.

EN 50399 gives the detailed description of the test apparatus and details of the test procedures, which are used.

## 1 Scope

This document specifies the apparatus and methods of test for the assessment of vertical flame spread, heat release, smoke production and occurrence of flaming droplets/particles of vertically mounted electric cables under defined conditions.

NOTE For the purpose of this document, the term “electric cable” covers all power, control and communication cables, including optical fibre cables and hybrid cables used for the conveyance of energy and/or signals.

This document details the apparatus for the fire propagation testing and the arrangement and calibration of the instrumentation to be installed to measure the heat release and the smoke production during the test. The combustion gases are collected in a hood above the test chamber and conveyed through an exhaust system, which allows the measurement of heat release rate and smoke production. Test procedures to be used for type approval testing for classification of cables in classes [2, 7] B1<sub>ca</sub>, B2<sub>ca</sub>, C<sub>ca</sub> and D<sub>ca</sub> are given. Cable installation on the test ladder and the volume of air passing through the chamber are in accordance with the Commission Decision 2006/751/EC [6], which is reflected in the requirements of this document.

## 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.

EN 60584-1, *Thermocouples - Part 1: EMF specifications and tolerances (IEC 60584-1)*

EN 60811-203, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 203: General tests - Measurement of overall dimensions (IEC 60811-203)*

EN ISO 13943, *Fire safety - Vocabulary (ISO 13943)*

## 3 Terms and definitions

For this document, the terms and definitions given in EN 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

#### heat release rate

##### **HRR**

thermal energy released per unit time by an item during combustion under specified conditions

### 3.2

#### total heat release

##### **THR**

integrated value of the heat release rate over a defined period

### 3.3

#### smoke production rate

##### **SPR**

smoke production per unit time

### 3.4

#### total smoke production

##### **TSP**

integrated value of the smoke production rate over a defined period