

BS EN 13501-6:2014



BSI Standards Publication

**Fire classification of
construction products and
building elements**
**Part 6: Classification using data from
reaction to fire tests on electric cables**

National foreword

This British Standard is the UK implementation of EN 13501-6:2014.

The UK participation in its preparation was entrusted to Technical Committee FSH/21/-/8, Reaction to fire tests - Classification and application of test results.

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

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ISBN 978 0 580 76561 2

ICS 13.220.50; 29.060.20

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 March 2014.

Amendments issued since publication

Date	Text affected
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13501-6

March 2014

ICS 13.220.50; 29.060.20

English Version

**Fire classification of construction products and building elements
- Part 6: Classification using data from reaction to fire tests on
electric cables**

Classement au feu des produits et éléments de construction
- Partie 6: Classement à partir des données d'essais de
réaction au feu sur câbles électriques

Klassifizierung von Bauprodukten und Bauarten zu ihrem
Brandverhalten - Teil 6: Klassifizierung mit den Ergebnissen
aus den Prüfungen zum Brandverhalten von elektrischen
Kabeln

This European Standard was approved by CEN on 20 December 2013.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 13501-6:2014) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2014, and conflicting national standards shall be withdrawn at the latest by September 2014.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of (EU) N°305/2011.

CEN, CENELEC and EOTA committees preparing technical specifications, which contain performance requirements against reaction to fire tests, should make reference to the reaction to fire classification given in this European Standard and not refer directly to any specific fire test method.

This document has been prepared in cooperation with CLC/TC 20 “Electric cables”, CLC/TC 46X “Communication cables” and CLC/TC 86A “Optical fibre cables”.

EN 13501 *Fire classification of construction products and building elements* consists of the following parts:

- *Part 1: Classification using data from reaction to fire tests;*
- *Part 2: Classification using data from fire resistance tests, excluding ventilation services;*
- *Part 3: Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers;*
- *Part 4: Classification using data from fire resistance tests on components of smoke control systems;*
- *Part 5: Classification using data from external fire exposure to roofs tests;*
- *Part 6: Classification using data from reaction to fire tests on electric cables.*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The aim of this European Standard is to define a harmonized procedure for the classification of reaction to fire of electric cables. This classification is based on the test procedures listed in Clause 5.

This European Standard has been prepared in support of the second essential requirement in the EC Construction Products Regulation (EU) N°305/2011 and as detailed in the Interpretative Document Number 2: Safety in case of fire (OJ C62 Vol. 37).

Background information on the Commission Decision regarding the classification of the reaction to fire performance of electric cables is given in Annex B.

There is a procedure by which certain products can be assigned a particular fire classification without the need for testing. Such products have well established reaction to fire performance and have been agreed by the Standing Committee on Construction. Agreements relating to such products which may be 'classified without further testing' (CWFT) are published in the Official Journal of the EC and are listed on the Nando-CPD database on the EC website (<http://europa.eu.int/comm/enterprise/construction>).

Part 1 of this European Standard covers classification resulting from reaction to fire tests for products other than electric cables.

Parts 2, 3 and 4 of this European Standard are concerned with classification resulting from fire resistance tests.

Part 5 covers classification resulting from tests for external fire exposure to roofs.

1 Scope

This European Standard provides the reaction to fire classification procedure for electric cables.

NOTE For the purpose of this European Standard the term “electric cables” covers all power, control and communication cables, including optical fibre cables.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50267-2-3, *Common test methods for cables under fire conditions — Tests on gases evolved during combustion of material from cables — Part 2-3: Procedures - Determination of degree of acidity of gases for cables by determination of the weighted average of pH and conductivity*

EN 50399, *Common test methods for cables under fire conditions — Heat release and smoke production measurement on cables during flame spread test — Test apparatus, procedures, results*

prEN 50575, *Power, control and communication cables — Cables for general applications in construction works subject to reaction to fire requirements*

CLC/FprTS 50576, *Electric cables, extended application of test results*

EN 60332-1-2:2004, *Tests on electric and optical fibre cables under fire conditions — Part 1-2: Test for vertical flame propagation for a single insulated wire or cable — Procedure for 1 kW pre-mixed flame (IEC 60332-1-2:2004)*

EN 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements (IEC 61034-2)*

EN ISO 1716, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716)*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

NOTE Where the definitions are identical to those in EN ISO 13943, this is indicated.

3.1.1

product

material, element or component about which information is required, in the context of this standard, the product is an electric cable about which information is required

3.1.2

material

single basic substance or uniformly dispersed mixture of substances

3.1.3

external component

external layer of the cable, i.e. the sheath

3.1.4

end use application

real application of a product, in relation to all aspects that influence the behaviour of that product under different fire situations

Note 1 to entry: It covers aspects such as its quantity, orientation, position in relation to other adjacent products, and its method of fixing.

3.1.5

fire performance

response of a test specimen when exposed to a specific fire

[SOURCE: EN ISO 13943]

3.1.6

reaction to fire

response of a test specimen when it is exposed to fire under specified conditions in a fire test

[SOURCE: EN ISO 13943]

3.1.7

fire scenario

qualitative description of the course of a fire with respect to time, identifying key events that characterize the studied fire and differentiate it from other possible fires

[SOURCE: EN ISO 13943]

3.1.8

reference scenario

hazard situation used as a reference for a given test method or classification system

3.1.9

fire situation

stage in the development of a fire, characterised by the nature, severity and size of the thermal attack on the products involved

3.1.10

combustion

exothermic reaction of a substance with an oxidizer

[SOURCE: EN ISO 13943]

Note 1 to entry: Combustion generally emits effluent accompanied by flames and/or visible light.

3.1.11

heat of combustion

thermal energy produced by combustion of unit of mass of a given substance

[SOURCE: EN ISO 13943]

Note 1 to entry: It is expressed in kilojoules per gram.

3.1.12**gross heat of combustion (PCS)**

heat of combustion of a substance when the combustion is complete and any produced water is entirely condensed under specified conditions

[SOURCE: EN ISO 13943]

3.1.13**net heat of combustion (PCI)**

heat of combustion of a substance when the combustion is complete and any produced water is in the vapour state under specified conditions

[SOURCE: EN ISO 13943]

3.1.14**contribution to fire**

energy released by a product influencing the fire growth both in pre- and post-flashover situations

3.1.15**heat release**

thermal energy produced by combustion

[SOURCE: EN ISO 13943]

3.1.16**vertical flame spread (FS)**

damaged length of the sample, as measured in the EN 50399 test

3.1.17**vertical flame spread (H)**

distance from the upper onset of charring (above the flame application point) to the lower onset of charring (below the flame application point) as measured in the EN 60332-1-2 test

3.1.18**fully developed fire**

state of total involvement of combustible materials in a fire

[SOURCE: EN ISO 13943]

3.1.19**flashover**

transition to a state of total surface involvement in a fire of combustible materials within an enclosure

[SOURCE: EN ISO 13943]

3.1.20**flaming droplets/particles**

material separating from the specimen during the fire test and continuing to flame for a minimum period as described by the test method

[SOURCE: EN 50399]

3.1.21**FIGRA**

fire growth rate index used for classification purposes for the classes B1_{ca}, B2_{ca}, C_{ca} and D_{ca}

Note 1 to entry: For the classification of cables, FIGRA means the maximum of the quotient of heat release rate from the specimen, excluding the contribution of ignition source, and the time of its occurrence using a THR threshold of 0,4 MJ and an HRR threshold of 3 kW.

Note 2 to entry: The *FIGRA* for cables is defined in more detail in EN 50399.

3.1.22

direct field of application

outcome of a process (involving the application of defined rules) whereby a test result is deemed to be equally valid for variations in one or more of the product properties and/or intended end use applications

3.1.23

extended field of application

outcome of a process (involving the application of defined rules that may incorporate calculation procedures) that, in the context of this standard, attributes for a cable family, a test result on the basis of one or more test results to the same test standard

3.1.24

extended application result

predicted result for performance parameter obtained following the process of extended field of application

3.1.25

extended application report

document reporting extended application results, including all details of the process leading to those results

3.2 Symbols and abbreviations

The symbols and notations correspond to those given in the appropriate test method.

<i>FIGRA</i>	fire growth rate index used for classification purposes [W/s]
<i>PCS</i>	gross heat of combustion [MJ/kg]
<i>THR</i> _{1200s}	total heat release (<i>HRR</i> _{sm30}) from test start until end of test, excluding contribution from ignition source [MJ]
<i>TSP</i> _{1200s}	total smoke production (<i>SPR</i> _{sm60}) from test start until end of test [m ²]
<i>Peak HRR</i>	= <i>HRR</i> = maximum value of heat release, excluding the burner output, determined during the whole burner application time, averaged over 30 s expressed in [kW]
<i>Peak SPR</i>	= <i>SPR</i> = maximum value of smoke production, determined during the whole burner application time, averaged over 60 s, expressed in [m ² /s]
<i>FS</i>	vertical flame spread [m] equals the damaged length of the sample
<i>H</i>	vertical flame spread [mm] as defined in 3.1.17
<i>m'</i>	mean value of the set of results of a continuous parameter determined in accordance with the relevant test method using the minimum number of tests as specified in the test method
<i>m</i>	mean value of the set of results of a continuous parameter determined in accordance with the procedure in 7.4 and used for classification

4 Classes of reaction to fire performance

The classes with their corresponding fire performance are given in Table 1.

Products classified in a given class are deemed to satisfy all the requirements of any lower class.

A classification can only be obtained by undertaking the tests for a particular product or product family.

5 Test methods

5.1 General

The following test methods are specified in relation to the envisaged reaction to fire classification. The relevant classification parameters are given in Table 1.

5.2 Heat of combustion test (EN ISO 1716)

This test determines the potential maximum total heat release of a product when completely burning, regardless of its end use.

The test is relevant for the class A_{ca} .

It allows the determination of both the gross heat of combustion (PCS) and the net heat of combustion (PCI).

5.3 Vertical flame spread of single cable (EN 60332-1-2)

This test evaluates the flame spread of a single cable under exposure to a small flame. The test is relevant for the classes $B1_{ca}$, $B2_{ca}$, C_{ca} , D_{ca} and E_{ca} .

5.4 Burning behaviour and smoke production of bunched cable – (EN 50399)

For smoke production, the test is relevant for $B1_{ca}$, $B2_{ca}$, C_{ca} and D_{ca} in association with the additional classification s.

This test evaluates the potential contribution of a cable, installed with other cables, to the development of a fire, under direct exposure to a flame source.

The test is relevant for the class $B1_{ca}$, using a 30 kW flame source and special mounting requirements.

The test is relevant for the classes $B2_{ca}$, C_{ca} and D_{ca} , using a 20,5 kW flame source.

5.5 Smoke production of burning cable (EN 61034-2)

This test evaluates the potential contribution of a cable to obscuration of vision when burning under static air conditions. The test is relevant for the classes $B1_{ca}$, $B2_{ca}$, C_{ca} and D_{ca} , in association with the additional classification s.

5.6 Acidity of gases produced by burning cables (EN 50267-2-3)

This test evaluates the potential contribution of burning cable materials to produce acidic gases. The test is relevant for the classes $B1_{ca}$, $B2_{ca}$, C_{ca} and D_{ca} in association with the additional classification a.

6 Principles for specimen preparation

Before testing, product specimens shall be prepared and conditioned and, where relevant, mounted in accordance with the relevant test methods.

Cables tested according to EN 50399 are mounted on a cable ladder. The number of cables, their spacing and other mounting details vary according to the cable diameter as described in EN 50399. It should be noted that cables applying for class D_{ca} , C_{ca} or $B2_{ca}$ are all mounted in a similar way while for cables applying for $B1_{ca}$ there is an additional requirement that a non-combustible calcium silicate board is mounted at the back of the cable ladder. Details are given in EN 50399.

7 Number of tests for classification

7.1 Minimum number of tests

The minimum number of tests given in the appropriate test method is as follows:

- a) the number of tests used for classification against EN 50399 is one;
- b) the number of tests used for classification against EN 50267-2-3 is three;
- c) the number of tests used for classification against EN 61034-2 is one;
- d) the number of tests used for classification against EN 60332-1-2 is one;
- e) the number of tests used for classification against EN ISO 1716 is three.

7.2 Additional tests

Two additional tests may be carried out only under the conditions given in 7.4 c), 7.4 d), 7.5, on request of the sponsor.

7.3 Criteria for classification

For a product to claim a particular classification all the relevant criteria, given in Table 1, shall comply with the stated requirements.

7.4 Continuous parameters

For each continuous parameter (*PCS*, *FIGRA*, *THR_{1200s}*, *Peak HRR*, *FS*, *TSP_{1200s}*, *Peak SPR*, transmittance, *pH* and conductivity) the selection of the class is based on the mean value (*m*) of the results of this parameter, (unless only one single test result is required), determined in accordance with the relevant test method, using the following procedure:

- a) calculate the mean value (*m'*) of the results for this parameter using the minimum number of tests;
- b) if *m'* lies within the limits for an envisaged class, the value *m* used for classification is *m'*;
- c) if *m'* does not lie within the limits for an envisaged class, two additional tests may be carried out;
- d) if two additional tests are carried out, the results for each parameter in these two tests shall be added to the results obtained in the minimum number of tests. The value *m*, used for classification, shall then be calculated as mean value using all results for each parameter.

7.5 Discontinuous parameters

For the discontinuous compliance parameter *H* and flaming droplets/particles, the selection of the class is based on the presence of a non-compliance result of this parameter, determined in accordance with the relevant test method, using the following procedure:

- a) If the results for this parameter do not contain a non-compliance, the result "compliant" shall be used for classification. If the results for this parameter contain a non-compliant result, two additional tests may be carried out.
- b) If the two additional tests are not carried out, then the result "non-compliant" shall be used for classification.

- c) If the two additional tests are carried out, and a further “non-compliant” is recorded, the result “non-compliant” shall be used for classification. If no further non-compliance results are recorded, then a result “compliant” shall be used for classification.

8 Testing of electric cables (see Table 1)

8.1 Class E_{ca}

A product applying for class E_{ca} shall be tested in accordance with EN 60332-1-2.

8.2 Classes D_{ca}, C_{ca}, B2_{ca}

A product applying for class D_{ca}, C_{ca} or B2_{ca} shall be tested in accordance with EN 60332-1-2.

Products satisfying the EN 60332-1-2 criteria, shall additionally be tested in accordance with EN 50399 (20,5 kW flame source).

8.3 Class B1_{ca}

A product applying for class B1_{ca} shall be tested in accordance with EN 60332-1-2.

Products satisfying the EN 60332-1-2 criteria, shall additionally be tested in accordance with EN 50399 (30 kW flame source).

8.4 Class A_{ca}

A product applying for class A_{ca} shall be tested in accordance with EN ISO 1716.

8.5 Additional classifications s1, s2, s3 for smoke production

Classifications s1, s2 and s3 are deduced from the measured data obtained from testing in accordance with EN 50399.

Additional classifications within class D_{ca}, C_{ca} or B2_{ca} shall originate from the test with the 20,5 kW flame source.

Additional classifications within class B1_{ca} shall originate from the test with the 30 kW flame source.

8.6 Additional classifications s1a, s1b for smoke production

Classifications s1a and s1b are deduced from the measured data obtained from testing in accordance with EN 61034-2.

8.7 Additional classifications d0, d1, d2 for flaming droplets/particles

Classifications d0, d1 and d2 are deduced from observations of flaming droplets and particles obtained from testing in accordance with EN 50399.

8.8 Additional classifications a1, a2, a3 for acidity

Classifications a1, a2 and a3 are deduced from measurements obtained from testing in accordance with EN 50267-2-3.

9 Classification criteria for electric cables (see Table 1)

9.1 General

Performance levels for each specific parameter are determined from the test methods.

a) continuous parameters

EN ISO 1716	<i>PCS</i>
EN 50399	<i>THR_{1200s}</i>
	<i>Peak HRR</i>
	<i>FIGRA</i>
	<i>FS</i>
	<i>TSP_{1200s}</i>
	<i>Peak SPR</i>
EN 61034-2	Transmittance
EN 50267-2-3	Conductivity and <i>pH</i>

b) discontinuous parameters

EN 50399	Flaming droplets/particles
EN 60332-1-2	<i>H</i>

9.2 Class F_{ca}

No performance criteria.

Class F_{ca} also applies if a product fails to obtain Class E_{ca} when tested to EN 60332-1-2.

9.3 Class E_{ca}

The product shall satisfy the following criterion:

EN 60332-1-2

Under conditions of surface flame attack, and with an exposure time in accordance with EN 60332-1-2:2004, Table 1, there shall be no flame spread (*H*) in excess of 425 mm before the test flame extinguishes.

9.4 Class D_{ca}

The product shall satisfy all of the following criteria:

a) EN 60332-1-2

Under conditions of surface flame attack, and with an exposure time in accordance with EN 60332-1-2:2004, Table 1, there shall be no flame spread (*H*) in excess of 425 mm before the test flame extinguishes.

b) EN 50399 with 20,5 kW flame source

$THR_{1200s} \leq 70 \text{ MJ}$

$Peak \text{ HRR} \leq 400 \text{ kW}$

$$FIGRA \leq 1\,300 \text{ W s}^{-1}$$

9.5 Class C_{ca}

The product shall satisfy all of the following criteria:

a) EN 60332-1-2

Under conditions of surface flame attack, and with an exposure time in accordance with EN 60332-1-2:2004, Table 1, there shall be no flame spread (*H*) in excess of 425 mm before the test flame extinguishes.

b) EN 50399 with 20,5 kW flame source

$$FS \leq 2,0 \text{ m}$$

$$THR_{1200s} \leq 30 \text{ MJ}$$

$$Peak \text{ HRR} \leq 60 \text{ kW}$$

$$FIGRA \leq 300 \text{ W s}^{-1}$$

9.6 Class B2_{ca}

The product shall satisfy all of the following criteria:

a) EN 60332-1-2

Under conditions of surface flame attack, and with an exposure time in accordance with EN 60332-1-2:2004, Table 1, there shall be no flame spread (*H*) in excess of 425 mm before the test flame extinguishes.

b) EN 50399 with 20,5 kW flame source

$$FS \leq 1,5 \text{ m}$$

$$THR_{1200s} \leq 15 \text{ MJ}$$

$$Peak \text{ HRR} \leq 30 \text{ kW}$$

$$FIGRA \leq 150 \text{ W s}^{-1}$$

9.7 Class B1_{ca}

The product shall satisfy all of the following criteria:

a) EN 60332-1-2

Under conditions of surface flame attack, and with an exposure time in accordance with EN 60332-1-2:2004, Table 1, there shall be no flame spread (*H*) in excess of 425 mm before the test flame extinguishes.

b) EN 50399 with 30 kW flame source

$$FS \leq 1,75 \text{ m}$$

$$THR_{1200s} \leq 10 \text{ MJ}$$

$$Peak \text{ HRR} \leq 20 \text{ kW}$$

$$FIGRA \leq 120 \text{ W s}^{-1}$$

9.8 Class A_{ca}

The product as a whole, excluding metallic materials, and any external component (i.e. sheath) of the product, shall achieve the criteria given in

EN ISO 1716

$$PCS \leq 2,0 \text{ MJ/kg}$$

9.9 Additional classifications s1, s1a, s1b, s2, s3 for smoke production

9.9.1 General

Products classified B1_{ca}, B2_{ca}, C_{ca}, D_{ca} obtain an additional classification of s1, s1a, s1b, s2 or s3 regarding the smoke production.

9.9.2 Additional classification s1

The product shall satisfy both of the following criteria:

- $TSP_{1200s} \leq 50 \text{ m}^2$;
- $Peak SPR \leq 0,25 \text{ m}^2/\text{s}$.

9.9.3 Additional classification s1a

The product shall satisfy both of the following criteria:

- Compliance with s1;
- Transmittance $\geq 80 \%$.

9.9.4 Additional classification s1b

The product shall satisfy both of the following criteria:

- Compliance with s1;
- Transmittance $\geq 60 \% < 80 \%$.

9.9.5 Additional classification s2

The product shall satisfy both of the following criteria:

- $TSP_{1200s} \leq 400 \text{ m}^2$;
- $Peak SPR \leq 1,5 \text{ m}^2/\text{s}$.

9.9.6 Additional classification s3

Products for which no performance is declared or which do not comply with the s1 and s2 criteria.

9.10 Additional classifications d0, d1, d2 for flaming droplets and/or particles

Products classified B1_{ca}, B2_{ca}, C_{ca}, D_{ca} obtain an additional classification of d0, d1 or d2 regarding the production of flaming droplets and/or particles:

- d0, if no flaming droplets/particles occur within 1 200 s;
- d1, if no flaming droplets/particles persisting longer than 10 s occur within 1 200 s;
- d2, products for which no performance is declared or which do not comply with the d0 and d1 criteria.

9.11 Additional classifications a1, a2, a3 for acidity

Products classified B1_{ca}, B2_{ca}, C_{ca}, D_{ca} obtain an additional classification a1, a2, a3 regarding acidity:

- a1, if a conductivity of $< 2,5 \mu\text{S}/\text{mm}$ and a $pH > 4,3$ are obtained when tested in accordance with EN 50267-2-3;
- a2, if a conductivity of $< 10 \mu\text{S}/\text{mm}$ and a $pH > 4,3$ are obtained when tested in accordance with EN 50267-2-3;
- a3, if no performance is declared, or if the product does not comply with the a1 and a2 classification criteria in EN 50267-2-3

10 Presentation of classification

The following classes for cables are covered by this standard:

A_{ca}

B1 _{ca} -s1a,d0,a1	B1 _{ca} -s1a,d1,a1,	B1 _{ca} -s1a,d2,a1
B1 _{ca} -s1a,d0,a2	B1 _{ca} -s1a,d1,a2	B1 _{ca} -s1a,d2,a2
B1 _{ca} -s1a,d0,a3	B1 _{ca} -s1a,d1,a3	B1 _{ca} -s1a,d2,a3
B1 _{ca} -s1b,d0,a1	B1 _{ca} -s1b,d1,a1	B1 _{ca} -s1b,d2,a1
B1 _{ca} -s1b,d0,a2	B1 _{ca} -s1b,d1,a2	B1 _{ca} -s1b,d2,a2
B1 _{ca} -s1b,d0,a3	B1 _{ca} -s1b,d1,a3	B1 _{ca} -s1b,d2,a3
B1 _{ca} -s1,d0,a1	B1 _{ca} -s1,d1,a1	B1 _{ca} -s1,d2,a1
B1 _{ca} -s1,d0,a2	B1 _{ca} -s1,d1,a2	B1 _{ca} -s1,d2,a2
B1 _{ca} -s1,d0,a3	B1 _{ca} -s1,d1,a3	B1 _{ca} -s1,d2,a3
B1 _{ca} -s2,d0,a1	B1 _{ca} -s2,d1,a1	B1 _{ca} -s2,d2,a1
B1 _{ca} -s2,d0,a2	B1 _{ca} -s2,d1,a2	B1 _{ca} -s2,d2,a2
B1 _{ca} -s2,d0,a3	B1 _{ca} -s2,d1,a3	B1 _{ca} -s2,d2,a3

B1 _{ca} -s3,d0,a1	B1 _{ca} -s3,d1,a1	B1 _{ca} -s3,d2,a1
B1 _{ca} -s3,d0,a2	B1 _{ca} -s3,d1,a2	B1 _{ca} -s3,d2,a2
B1 _{ca} -s3,d0,a3	B1 _{ca} -s3,d1,a3	B1 _{ca} -s3,d2,a3
B2 _{ca} -s1a,d0,a1	B2 _{ca} -s1a,d1,a1	B2 _{ca} -s1a,d2,a1
B2 _{ca} -s1a,d0,a2	B2 _{ca} -s1a,d1,a2	B2 _{ca} -s1a,d2,a2
B2 _{ca} -s1a,d0,a3	B2 _{ca} -s1a,d1,a3	B2 _{ca} -s1a,d2,a3
B2 _{ca} -s1b,d0,a1	B2 _{ca} -s1b,d1,a1	B2 _{ca} -s1b,d2,a1
B2 _{ca} -s1b,d0,a2	B2 _{ca} -s1b,d1,a2	B2 _{ca} -s1b,d2,a2
B2 _{ca} -s1b,d0,a3	B2 _{ca} -s1b,d1,a3	B2 _{ca} -s1b,d2,a3
B2 _{ca} -s1,d0,a1	B2 _{ca} -s1,d1,a1	B2 _{ca} -s1,d2,a1
B2 _{ca} -s1,d0,a2	B2 _{ca} -s1,d1,a2	B2 _{ca} -s1,d2,a2
B2 _{ca} -s1,d0,a3	B2 _{ca} -s1,d1,a3	B2 _{ca} -s1,d2,a3
B2 _{ca} -s2,d0,a1	B2 _{ca} -s2,d1,a1	B2 _{ca} -s2,d2,a1
B2 _{ca} -s2,d0,a2	B2 _{ca} -s2,d1,a2	B2 _{ca} -s2,d2,a2
B2 _{ca} -s2,d0,a3	B2 _{ca} -s2,d1,a3	B2 _{ca} -s2,d2,a3
B2 _{ca} -s3,d0,a1	B2 _{ca} -s3,d1,a1	B2 _{ca} -s3,d2,a1
B2 _{ca} -s3d0,a2	B2 _{ca} -s3,d1,a2	B2 _{ca} -s3,d2,a2
B2 _{ca} -s3,d0,a3	B2 _{ca} -s3,d1,a3	B2 _{ca} -s3,d2,a3
C _{ca} -s1a,d0,a1	C _{ca} -s1a,d1,a1	C _{ca} -s1a,d2,a1
C _{ca} -s1a,d0,a2	C _{ca} -s1a,d1,a2	C _{ca} -s1a,d2,a2
C _{ca} -s1a,d0,a3	C _{ca} -s1a,d1,a3	C _{ca} -s1a,d2,a3
C _{ca} -s1b,d0,a1	C _{ca} -s1b,d1,a1	C _{ca} -s1b,d2,a1
C _{ca} -s1b,d0,a2	C _{ca} -s1b,d1,a2	C _{ca} -s1b,d2,a2
C _{ca} -s1b,d0,a3	C _{ca} -s1b,d1,a3	C _{ca} -s1b,d2,a3
C _{ca} -s1,d0,a1	C _{ca} -s1,d1,a1	C _{ca} -s1,d2,a1
C _{ca} -s1,d0,a2	C _{ca} -s1,d1,a2	C _{ca} -s1,d2,a2
C _{ca} -s1,d0,a3	C _{ca} -s1,d1,a3	C _{ca} -s1,d2,a3

C _{ca} -s2,d0,a1	C _{ca} -s2, d1,a1	C _{ca} -s2,d2,a1
C _{ca} -s2,d0,a2	C _{ca} -s2,d1,a2	C _{ca} -s2,,d2,a2
C _{ca} -s2,d0,a3	C _{ca} -s2,d1,a3	C _{ca} -s2,d2,a3
C _{ca} -s3,d0,a1	C _{ca} -s3,d1,a1	C _{ca} -s3,d2,a1
C _{ca} -s3,d0,a2	C _{ca} -s3,d1,a2	C _{ca} -s3,d2,a2
C _{ca} -s3,d0,a3	C _{ca} -s3,d1,a3	C _{ca} -s3,d2,a3
D _{ca} -s1a,d0,a1	D _{ca} -s1a,d1,a1	D _{ca} -s1a,d2,a1
D _{ca} -s1a,d0,a2	D _{ca} -s1a,d1,a2	D _{ca} -s1a,d2,a2
D _{ca} -s1a,d0,a3	D _{ca} -s1a,d1,a3	D _{ca} -s1a,d2,a3
D _{ca} -s1b,d0,a1	D _{ca} -s1b,d1,a1	D _{ca} -s1b,d2,a1
D _{ca} -s1b,d0,a2	D _{ca} -s1b,d1,a2	D _{ca} -s1bd2,a2
D _{ca} -s1b,d0,a3	D _{ca} -s1b,d1,a3	D _{ca} -s1b,d2,a3
D _{ca} -s1,d0,a1	D _{ca} -s1,d1,a1	D _{ca} -s1,d2,a1
D _{ca} -s1,d0,a2	D _{ca} -s1,d1,a2	D _{ca} -s1,d2,a2
D _{ca} -s1,d0,a3	D _{ca} -s1,d1,a3	D _{ca} -s1,d2,a3
D _{ca} -s2,d0,a1	D _{ca} -s2,d1,a1	D _{ca} -s2,d2,a1
D _{ca} -s2,d0,a2	D _{ca} -s2,d1,a2	D _{ca} -s2,d2,a2
D _{ca} -s2,d0,a3	D _{ca} -s2,d1,a3	D _{ca} -s2d2,a3
D _{ca} -s3,d0,a1	D _{ca} -s3,d1,a1	D _{ca} -s3,d2,a1
D _{ca} -s3,d0,a2	D _{ca} -s3,d1,a2	D _{ca} -s3,d2,a2
D _{ca} -s3,d0,a3	D _{ca} -s3,d1,a3	D _{ca} -s3,d2,a3
E _{ca}		
F _{ca}		

NOTE 1 When a classification includes s3 and/or d2, this means that there is no limit set for smoke production and/or flaming droplets/particles.

NOTE 2 There is no obligation to declare a3 if acidity is not determined.

11 Field of application of the classification

The reaction to fire classification for electric cables is valid for the product as tested.

The reaction to fire classification may be valid for products within the same family, where family is defined as a range of products within defined limits of variability of its parameters, for which the reaction to fire classification is proven to be unchanged.

Extension of the field of application can only be done in accordance with the relevant extended application standard CLC/FprTS 50576.

12 Classification report

12.1 General

The aim of the classification report is to provide a harmonized way of presenting the classification of a product, based on results obtained during tests in accordance with the reaction to fire test methods for electric cables.

A classification report is expected to detail the basis and the results of the classification process.

12.2 Content and format

The classification report shall have the following content and format (see Annex A):

- a) identification number and date of the classification report;
- b) identification of the owner of the classification report;
- c) identification of the organization issuing the classification report;
- d) details of the nature and use of the product under classification, including its commercial name(s);
- e) detailed description of the product;

Reference is made to a detailed description of the product as available in one of the test reports in support of this classification, or a detailed description is reproduced in this classification report. The detailed description shall include a full description and identification of all relevant components and the method of assembly etc. If generic products are used a general description is sufficient. It shall also include relevant product specifications applicable to the whole or parts of the classified product.

- f) test(s) carried out;
 - 1) each test report used in support of this classification is identified by:
 - i) the name of the laboratory carrying out the tests;
 - ii) the name of the sponsor;
 - iii) the test report identification number;
 - 2) identification of the tests carried out in accordance with the standard and the envisaged field of application;
 - 3) summary of test results for each specimen tested;
- g) classification and field of application;
 - 1) reference to the relevant classification procedure in this European Standard;

- 2) conclusion: classification of the product;
- 3) detailed description of the field of application;
- h) additional statements;

The classification report shall include:

- 1) any restrictions on the duration of the validity of this classification report;
- 2) a warning 'This document does not represent type approval or certification of the product';
- i) name and signature of the person(s) responsible for the classification report.

Table 1 — Classes of reaction to fire performance for electric cables

Class	Test method(s)	Classification criteria	Additional classification
A _{ca}	EN ISO 1716	$PCS \leq 2,0 \text{ MJ/kg}^{(1)}$	
B1 _{ca}	EN 50399 (30 kW flame source) and	$FS \leq 1,75 \text{ m and}$ $THR_{1200s} \leq 10 \text{ MJ and}$ $Peak HRR \leq 20 \text{ kW and}$ $FIGRA \leq 120 \text{ W s}^{-1}$	Smoke production ^(2,5) and Flaming droplets/particles ⁽³⁾ and Acidity ⁽⁴⁾
	EN 60332-1-2	$H \leq 425 \text{ mm}$	
B2 _{ca}	EN 50399 (20,5 kW flame source) and	$FS \leq 1,5 \text{ m; and}$ $THR_{1200s} \leq 15 \text{ MJ; and}$ $Peak HRR \leq 30 \text{ kW; and}$ $FIGRA \leq 150 \text{ W s}^{-1}$	Smoke production ^(2,6) and Flaming droplets/particles ⁽³⁾ and Acidity ⁽⁴⁾
	EN 60332-1-2	$H \leq 425 \text{ mm}$	
C _{ca}	EN 50399 (20,5 kW flame source) and	$FS \leq 2.0 \text{ m; and}$ $THR_{1200s} \leq 30 \text{ MJ; and}$ $Peak HRR \leq 60 \text{ kW; and}$ $FIGRA \leq 300 \text{ W s}^{-1}$	Smoke production ^(2,6) and Flaming droplets/particles ⁽³⁾ and Acidity ⁽⁴⁾
	EN 60332-1-2	$H \leq 425 \text{ mm}$	
D _{ca}	EN 50399 (20,5 kW flame source) and	$THR_{1200s} \leq 70 \text{ MJ; and}$ $Peak HRR \leq 400 \text{ kW; and}$ $FIGRA \leq 1\,300 \text{ W s}^{-1}$	Smoke production ^(2,6) and Flaming droplets/particles ⁽³⁾ and Acidity ⁽⁴⁾
	EN 60332-1-2	$H \leq 425 \text{ mm}$	
E _{ca}	EN 60332-1-2	$H \leq 425 \text{ mm}$	
F _{ca}	No performance determined		

Class	Test method(s)	Classification criteria	Additional classification
<p>(1) For the product as a whole, excluding metallic materials, and for any external component (i.e. sheath) of the product.</p> <p>(2) s1 = $TSP_{1200s} \leq 50 \text{ m}^2$ and <i>Peak SPR</i> $\leq 0.25 \text{ m}^2/\text{s}$</p> <p>s1a = s1 and transmittance in accordance with EN 61034-2 $\geq 80 \%$</p> <p>s1b = s1 and transmittance in accordance with EN 61034-2 $\geq 60 \%$ < 80 %</p> <p>s2 = $TSP_{1200s} \leq 400 \text{ m}^2$ and <i>Peak SPR</i> $\leq 1,5 \text{ m}^2/\text{s}$</p> <p>s3 = not s1 or s2</p> <p>(3) d0 = No flaming droplets/particles within 1200 s; d1 = No flaming droplets/ particles persisting longer than 10 s within 1200 s; d2 = not d0 or d1.</p> <p>(4) EN 50267-2-3: a1 = conductivity < 2,5 $\mu\text{S}/\text{mm}$ and <i>pH</i> > 4,3; a2 = conductivity < 10 $\mu\text{S}/\text{mm}$ and <i>pH</i> > 4,3; a3 = not a1 or a2. No declaration = No Performance Determined.</p> <p>(5) The smoke class declared for class B1_{ca} cables shall originate from the test according to EN 50399 (30 kW flame source)</p> <p>(6) The smoke class declared for class B2_{ca}, C_{ca}, D_{ca} cables shall originate from the test according to EN 50399 (20,5 kW flame source)</p>			

Annex A
(normative)

Reaction to fire classification report for electric cables

The following shows the layout and the format of the classification report:

A.1 Introduction

This classification report defines the classification assigned to *product name (as described by the sponsor)* in accordance with the procedures given in EN 13501-6

Logo of body issuing
classification report

(Text/information to be provided by the author of the classification report (Notified Body*) is indicated in *italic text*)

CLASSIFICATION OF REACTION TO FIRE
FOR ELECTRIC CABLES
IN ACCORDANCE WITH EN 13501-6

Sponsor: *name and address of sponsor*
Prepared by: *name and address of Notified* Body issuing classification report*
Notified Body No: *number of Notified Body which prepared classification**
Product name: *as described by the sponsor*
Classification report No.: *number of classification report*
Issue number: *issue number*
Date of issue: *date of issue*

This classification report consists of *n* pages and may only be used or reproduced in its entirety.

* To be used for CE marking only

A.2 Details of classified product

A.2.1 General

The product, *product name (as described by the sponsor)*, is defined as a *type of product (according to prEN 50575*)*.

* To be used for CE marking

A.2.2 Product description

The product, *product name (as described by the sponsor)*, is described below or is described in the reports provided in support of classification listed in A.3.1.

Product description:

Insert product description here.
(Use tabulated data templates wherever possible)

A.3 Reports and results in support of this classification

A.3.1 Reports

Enter details of reports here as applicable

Name of Laboratory	Name of sponsor	Report ref. no.	Test method and date/field of application rules and date
<i>Name of test laboratory</i>	<i>Name of sponsor</i>	<i>Report No</i>	<i>Test</i>
<i>Name of test laboratory</i>	<i>Name of sponsor</i>	<i>Report No</i>	<i>Test</i>
<i>Name of test laboratory</i>	<i>Name of sponsor</i>	<i>Report No</i>	<i>Test</i>

A.3.2 Results

Test method and test number	Parameter	No. Tests	Results	
			Continuous parameter - mean <i>m</i>	Compliance with parameters
<i>first test method</i>	<i>parameter 1</i>	<i>number of tests</i>	<i>result 1</i>	<i>Compliant or non-compliant</i>
	<i>parameter 2</i>		<i>result 2</i>	<i>Compliant or non-compliant</i>
	<i>parameter 3</i>		<i>result 3</i>	<i>Compliant or non-compliant</i>
<i>second test method (if appropriate)</i>	<i>parameter 1</i>	<i>number of tests</i>	<i>result 1</i>	<i>Compliant or non-compliant</i>
	<i>parameter 2</i>		<i>result 2</i>	<i>Compliant or non-compliant</i>

A.4 Classification and field of application

A.4.1 Reference of classification

This classification has been carried out in accordance with EN 13501-6.

A.4.2 Classification

The product, *product name (as described by the sponsor)*, in relation to its reaction to fire behaviour is classified:

A_{ca} to F_{ca} (as applicable)

The additional classification in relation to smoke production is:

s1,s1a, s1b, s2, s3 (as applicable)

The additional classification in relation to flaming droplets / particles is:

d0, d1, d2 (as applicable)

The additional classification in relation to acidity is:

a1, a2, a3 (as applicable)

The format of the reaction to fire classification for electric cables is:

Fire behaviour		Smoke production		Flaming droplets		Acidity	
A _{ca} to F _{ca} (as applicable)	-	s	1 (or 1a or 1b), 2 or 3 (as applicable)	,	d	0, 1 or 2 (as applicable)	, a 1, 2 or 3 (as applicable)

i.e. A_{ca} to F_{ca} (as applicable) – s1 (or s1a or s1b), s2 or s3 (as applicable), d0, d1 or d2 (as applicable), a1, a2 or a3 (as applicable)

A.4.3 Field of application

This classification is valid for the following product parameters as determined in the extended application process according CLC/FprTS 50576:

- product parameter 1*
product parameter 2
product parameter 3
product parameter 4
product parameter x etc.
- Variation in *product parameter 1*
Variation in *product parameter 2*
Variation in *product parameter 3*
Variation in *product parameter 4*
Variation in *product parameter x etc.*

The classification is valid for all end use applications.

A.5 Limitations

This classification document does not represent type approval or certification of the product.

Include the following statement when the product is being CE marked under attestation of conformity system 3:

“The classification assigned to the product in this report is appropriate to a declaration of conformity by the manufacturer within the context of system 3 attestation of conformity and CE marking under the Construction Products Regulation.

The test laboratory has, therefore, played no part in sampling the product for the test, although it holds appropriate references, supplied by the manufacturer, to provide for traceability of the samples tested.”

SIGNED

signature of person undertaking classification

.....

APPROVED

signature of person authorising this report

.....

Annex B

(informative)

Background information as regards the reaction to fire performance of cables

B.1 General

This annex provides background information concerning the reaction to fire of a product that, in its end-use application, can contribute to the generation and spread of fire and smoke within the room of origin or in a given area.

B.2 Assumptions

B.2.1 For all construction products, the consideration is of a fire, initiated in a room, which can grow and eventually reach flashover. This scenario includes three fire situations corresponding to three stages in the development of a fire.

- a) The first stage includes initiation of the fire by ignition of a product, with a small flame, on a limited area of a product.
- b) The second stage addresses fire growth. It is simulated by fire initiated on cables mounted on a vertical ladder.
- c) In the post-flashover phase all combustible products contribute to the fire load.

B.2.2 The validation of the classification of products in terms of their contribution to fire growth is based on large scale scenarios. It is assumed that this classification is representative of other scenarios.

A similar simplifying assumption is made to apply the same classification to different orientations and geometries.

B.2.3 There is no unequivocal relationship between different behavioural characteristics, or between similar characteristics under different fire exposures valid for all products. Different classes address to a certain extent different exposures and different behavioural characteristics. Nevertheless, a higher classification should not only represent at least the same performance in each relevant characteristic, but should also represent a better performance, if all behavioural aspects relevant for the given class are considered.

B.2.4 The assumption is that products classified as A_{ca} make no contribution to fire growth or to the fully developed fire. A product classified as A_{ca} is assumed to present no smoke hazard.

B.3 Reference scenario and fire situations for cables

EN 50399 came from work done in the large project funded by the EU called FIPEC, fire performance of electric cables [1]. This was developed by CLC/TC 20/WG 10 and was the basis of the Extended application work developed in the CEMAC project [2].

In the same way as for other product groups, see EN 13501-1, reference scenarios were used to identify the class limits. In this case, there were two reference scenarios, a horizontal and a vertical.

B.3.1 The horizontal reference scenario comprises three cable ladders mounted horizontally on top of each other. They are ignited in one end with a burner giving 40 kW for 5 min, then 100 kW for another 10 min and finally 300 kW for 10 min. The supply of air is by natural ventilation.

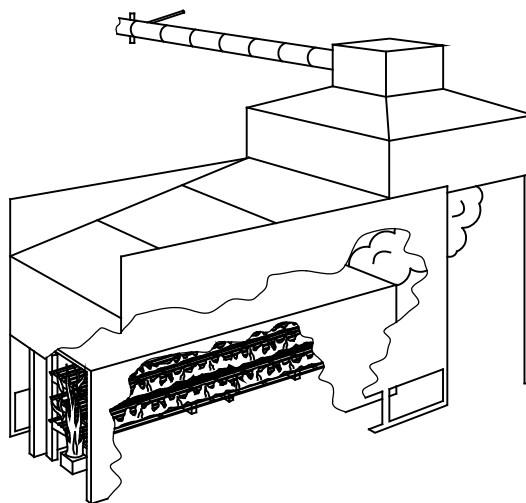


Figure B.1 — Horizontal reference scenario for cables, from the FIPEC project [2]

B.3.2 In the vertical scenario, a cable ladder is mounted in a corner. The heat output from the burner is the same as for the horizontal scenario.

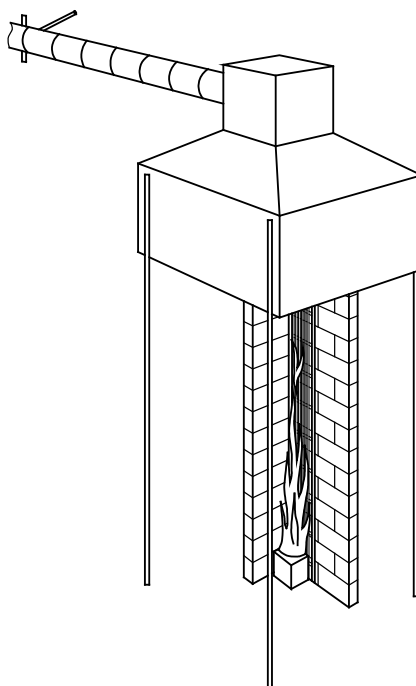


Figure B.2 — Vertical reference scenario for cables, from the FIPEC project [2]

B.3.3 The performances of the different classes are approximately as follows.

Class A_{ca}

Level of highest performance corresponding to products that practically cannot burn, i.e. ceramic products.

Class B1_{ca}

Products that are combustible but show no or very little burning when exposed to both the reference scenario tests and the classification test procedure EN 50399 (30 kW flame source).

Class B2_{ca} and Class C_{ca}

Products that do not give a continuous flame spread when exposed to the 40 kW - 100 kW ignition source in the horizontal reference scenario; and that do not give a continuous flame spread, show a limited fire growth rate and show a limited heat release rate when tested according to EN 50399 (20,5 kW flame source).

Class D_{ca}

Products that show a fire performance approximately like wood when tested in the reference scenarios. When tested according to EN 50399 (20,5 kW flame source) the products show a continuous flame spread, a moderate fire growth rate, and a moderate heat release rate.

Class E_{ca}

Products where a small flame attack is not causing large flame spread.

B.3.4 Figure B.3 shows data from a large number of tests illustrating the positioning of some of the classes.

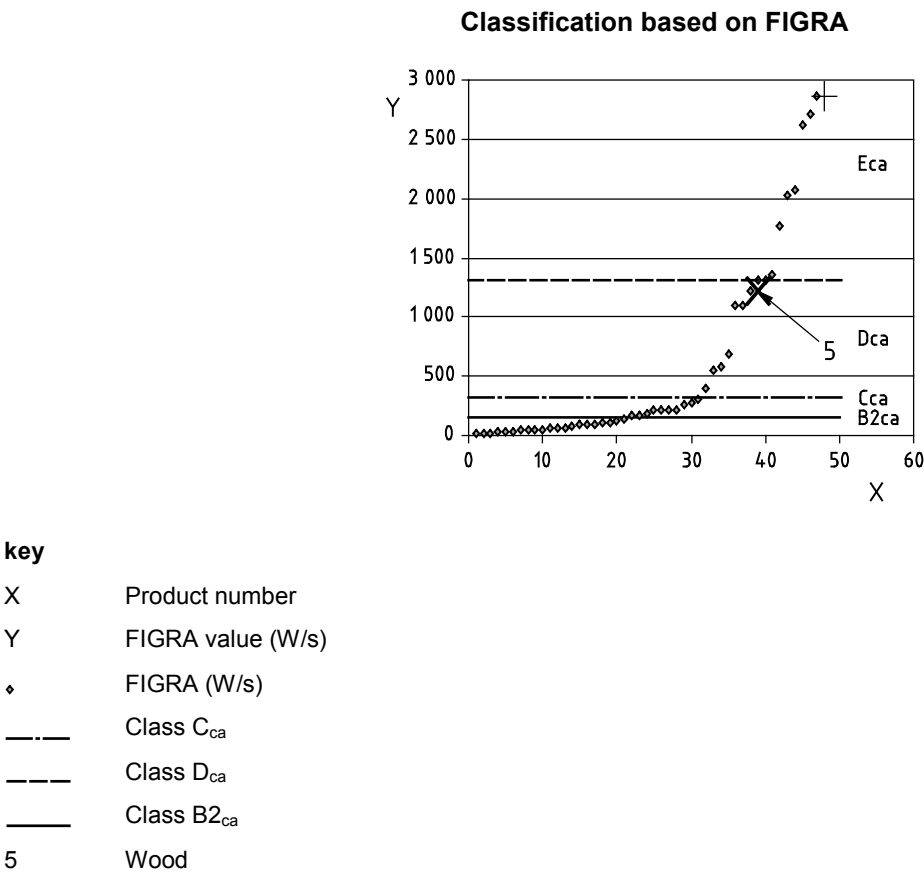


Figure B.3 — The class limits for FIGRA for the classes B2_{ca}, C_{ca} and D_{ca} compared to data from 50 products

Bibliography

- [1] GRAYSON, Stephen, VAN HEES, Patrick, VERCELLOTTI, Uberto, BREULET, Hervé and GREEN, Andrew *"Fire Performance of Electric Cables - new test methods and measurement techniques, Final report of EU SMT project SMT4-CT96-2059, ISBN 0 9532312 5 9 published by Interscience Communications UK*
- [2] CEMAC – CE-marking of cables – SP Report 2012:27, ISBN 978-91-86319-65-6
- [3] EN ISO 13943:2010, *Fire safety - Vocabulary (ISO 13943:2008)*

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Useful Contacts:

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK



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