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Procedure to assess the circuit integrity of optical fibres in a cable under resistance to fire testing

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National foreword

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English Version

Procedure to assess the circuit integrity of optical fibres in a cable under resistance to fire testing

Procédure d'évaluation de l'intégrité des circuits à fibres optiques dans un câble soumis à un essai de résistance au feu

Prüfung des Übertragungsverhaltens im Brandfall von Lichtwellenleiterkabeln für die Verwendung in Notstromkreisen bei ungeschützter Verlegung (Durchmesser kleiner oder gleich 20 mm)

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Contents

Page

European foreword

This document (EN 50582:2016) has been prepared by CLC/TC 86A “Optical fibres and optical fibre 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)	2017-06-27
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1 Scope

This European standard specifies the details for the point of failure, continuity checking arrangement, test sample, test procedure and test report relevant to optical fibre cables tested as described either in EN 50200 or in EN 50577.

The test determines the survival time for circuit integrity of the optical fibre cables when exposed to fire under the conditions either given in EN 50200 or given in EN 50577.

EN 50200 is limited to cables with an overall diameter not exceeding 20 mm.

This standard includes (Annex A) the field of direct application and rules for extended application of test results (EXAP). Details regarding P classification using data from the EN 50577 test and PH classification using data from the EN 50200 test are given in EN 13501-3. Information regarding classification is given in Annex B.

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 13501-3, *Fire classification of construction products and building elements — Part 3: Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers*

EN 50200, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

EN 50577, *Electric cables — Fire resistance test for unprotected electric cables (P classification)*

EN 60793-1-46, *Optical fibres — Part 1-46: Measurement methods and test procedures — Monitoring of changes in optical transmittance (IEC 60793-1-46)*

EN 60793-2*, Optical fibres — Part 2: Product specifications — General (IEC 60793-2)*

3 Circuit integrity (Continuity of signal supply)

The criteria that are used for defining fire resistant optical fibre cables are deemed to demonstrate the ability of the cable to maintain a reliable signal transmission when subjected to fire.

Circuit integrity is based upon continuity of optical signal supply.

This clause specifies characteristics that shall be used to define the continuity of signal supply / maintenance of circuit integrity (continuity) under fire conditions for optical fibre cables.

The circuit integrity i.e. continuity of optical signal supply is deemed to be maintained if the maximum increase in attenuation does not exceed the value given in Table 1 during the test duration.

Continuity of optical signal supply (see 4.4) can generally be performed by two methods:

(A) Monitor individual fibres for attenuation change;

(B) Loop-back measurements: this method splices the fibres under test to each other so that they are concatenated in a continuous length. The attenuation change is determined by dividing the attenuation change across all loop-back fibres under test by the number of loop-backed fibres.

For both method (A) and method (B), the resulting value shall not exceed the value given in Table 1 during the test duration when performed according to EN 50200 or when performed according to EN 50577.

Table 1 — Maximum allowed attenuation change during the test

Fibres in the cable	**EN 60793–2 class B single-mode fibre (1550 nm)**	**EN 60793–2 category A1 multimode fibre (1300 nm)**
Max allowed attenuation change (dB/meter of fibre under test)	1,0	2,0

The length of the fibre in the cable under test to be considered is equal to 1 m for the EN 50200 test method, i.e. the length mounted on the heat resisting wall.

For the EN 50577 test method the length to be considered is equal to the exposed length of the cable to the fire in the furnace considering also the exits (cable in the mineral wool).

4 Cable test procedure

4.1 Test equipment

When EN 50200 fire test method is used the test equipment consists of:

— a gas burner, a heat resisting wall, a shock producing device as described in EN 50200.

When EN 50577 fire test method is used the test equipment consists of:

— a furnace with advised minimum internal dimensions 3 m (l) × 1,5 m (d) × 2,5 m (h), suitable burners, a cable tray with suspensions and horizontal supports, in a “U” or “S” bend configuration as described in EN 50577.

In both the EN 50200 and EN 50577 fire test methods, the test equipment further consists of:

— a fibre optic attenuation measurement system according to EN 60793-1-46.

4.2 Sample preparation

The sample to be tested shall be a length of finished cable (between 20 m and 50 m, or more as required by the optical attenuation measuring system) sufficiently long that the two ends emerge from the test chamber.

NOTE This length of the test sample for optical fibre cables is different from the required length for power and control cables in EN 50200 or in EN 50577.

The test samples shall be mounted in accordance with either EN 50200 or EN 50577, taking into account the minimum bending radius of the cable in normal use. The approximate middle of the test sample shall be positioned in the flame for the EN 50200 test and in the furnace for the EN 50577 test.

The fibre or the fibres selected for the optical measurements as reported in Clause 3 shall be connected to the optical measuring apparatus.

4.3 Test procedure

The test shall be conducted as described either in EN 50200 or in EN 50577 together with the additional details for optical fibre cables given in this standard.

The number of fibres to be tested for continuity of optical signal supply shall be two (2) fibres for cables containing up to six (6) fibres; for fibre counts more than six (6), the number of fibres to be tested shall be six (6).

NOTE This prescription applies unless otherwise agreed upon between manufacturer and customer, but will not be the basis of classification.

The optical fibres under test shall be selected evenly distributed among the cable basic optical elements.

4.4 Optical measurements during fire

Connect the fibre(s) to an optical apparatus to monitor and/or measure the change in optical transmittance (optical attenuation) in accordance with EN 60793-1-46, method A or B.

The test shall be carried out at the nominal wavelength of operation of the fibre i.e. 1 550 nm for single-mode fibre or 1 300 nm for multimode fibre.

5 Duration of survival

The duration of survival is measured in minutes from the start of the test to the point of failure when the increase in attenuation exceeds the values given in Table 1; it shall be recorded for each cable tested up to a maximum survival time of 120 min.

By agreement between supplier of the cable and the test house the test duration may be extended but will not be the basis of classification.

6 Test report (optical fibre cables)

The test report shall include the following information:

1) full description of cable tested;

2) manufacturer of cable tested;

3) test laboratory;

4) test wavelength;

5) number of optical fibres under test;

6) optical test equipment or optical devices used;

7) type and disposition of clips supporting cable sample tested to EN 50200 or type of trays and plastic ties supporting cable sample tested to EN 50577;

8) the actual cable bending radius used for the test;

9) method used for temperature monitoring during the verification procedure;

10) the duration of survival achieved;

11) method of signal monitoring: (A) individual fibres; (B) concatenated fibres;

12) the number of this EN.

Annex A
(normative)

Field of direct application and extended application of test results

A.1 Terms and definitions

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

A.1.1
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.

A.1.2
classification
process defined in EN 13501, whereby the fire performance parameters obtained from the results of one test, or a set of tests, or from a process of extended application, are compared with limiting values for those parameters that are set as criteria for achieving a certain classification.

Note 1 to entry: The relevant classes and related criteria are specified in the following Commission Decisions: Commission Decision 2000/367/EC (OJ L 133 of 6.6.2000).

A.1.3
product (cable) family
range of cables within defined limits of constructional design (as defined by this Annex A)

A.1.4
extended application of test results
EXAP
outcome of a process (involving the application of defined rules that may incorporate calculation procedures) that attributes, for a cable family, a test result on the basis of one or more test results to the same test standard

A.2 Field of direct application

A.2.1 Orientation

Cables with PH-classification or with P-classification according to EN 13501-3 and tested in accordance with either EN 50200 or with EN 50577 together with the additional details for optical fibre cables given in this standard are suitable for both horizontal and vertical installation.

A.2.2 Bending radius

The bending radius of the cable in normal use shall not be smaller than the minimum bending radius specified by the manufacturer and tested.

A.3 Extended Application of test results (EXAP)

A.3.1 General

Clause A.3 gives guidance on the procedure and rules for extended application using test results obtained either from EN 50200 or from EN 50577 together with the additional details for optical fibre cables given in this standard in order to evaluate and classify the resistance to fire performance of optical-fibre cables.

A.3.2 Product families for EXAP

An EXAP is only possible when cables belong to a defined family.

For the application of these EXAP rules and procedure, a cable family shall be defined as follows:

A family of cables is a specific range of products of the same general construction (design elements) and varying only in number of optical fibres and number of units.

The cable family shall be produced by the same manufacturer using the same raw materials and the same design rules (for instance International standard, National standard, Company standard based on National or International standard).

The full constructional and material details for the family shall be submitted to the certification body prior to the EXAP being applied.

A.3.3 EXAP procedure

The following procedure shall be followed:

1) Choose the specific family of cables for which classification is required.

2) Demonstrate that the family complies with the definition of a product family given in the EXAP rules

3) Determine the smallest and largest number of optical fibres of the family of cables

4) Carry out the test according either to EN 50200 or to EN 50577 together with the additional details for optical fibre cables given in this standard on the two cables selected as per previous item 3.

5) The duration of survival, measured in minutes, to the point of failure shall be recorded for each test specimen up to a maximum survival time of 120 min.

6) The worst result (shortest duration of survival time) shall be used for the classification of the cable family

7) The classification shall be determined by reference to the classification standard for cables EN 13501-3.

8) The classification determined applies to the whole cable family.

Annex B
(informative)

Information regarding classification

B.1 General

The purpose of this annex is to provide information as to the derivation of the fire resistance classification (PH or P) for continuity of signal transmission from test data. The classification shall be determined by reference to EN 13501-3.

B.2 Functional requirement (PH or P) and Interpretation

The classification is based on the ability of electrical cables or optical fibre cables to maintain a reliable form of power supply or signal from the source to the safety installation(s) when exposed to fire.

The performance criterion is continuity of power and/or signal supply.

The PH classification refers to a constant temperature attack of a notional 842 °C.

The P classification refers to an exposure to fire under the conditions of the standard time/temperature curve as per EN 1363-1.

B.3 Classification

The following classes are defined in the Commission Decision 2000/367/EC:

— Classification PH 15, 30, 60, 90, 120;

— Classification P 15, 30, 60, 90, 120.

In accordance with the requirements of EN 13501-3, the number of tests on each cable sample for classification is two. The measured duration of survival of both tests shall be equal to or exceed the stated classification (i.e. 15 min, 30 min, 60 min, 90 min or 120 min).

Bibliography

EN 1363-1, *Fire resistance tests — Part 1: General Requirements*

EN 60793-2-10, *Optical fibres — Part 2-10: Product specifications — Sectional specification for category A1 multimode fibre (IEC 60793-2-10)*

EN 60793-2-50, *Optical fibres — Part 2-50: Product specifications — Sectional specification for class B single-mode fibres (IEC 60793-2-50)*

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