IEC 60794-1-402

Edition 1.0 2021-07

INTERNATIONAL STANDARD

Optical fibre cables –
Part 1-402: Generic specification – Basic optical cable test procedures – Electrical test methods – Lightning test (for OPGW, OPPC and OPAC), Method H2

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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OPTICAL FIBRE CABLES –

Part 1-402: Generic specification – Basic optical cable test procedures – Electrical test methods – Lightning test (for OPGW, OPPC and OPAC), Method H2

FOREWORD

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IEC 60794-1-402 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics. It is an International Standard.

This first edition cancels and replaces the first edition of IEC 60794-1-24 published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) OPPC cables are included.

The text of this International Standard is based on the following documents:

Draft	Report on voting
86A/2045/CDV	86A/2128/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all the parts in the IEC 60794 series, published under the general title *Optical fibre cables*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The electrical tests contained in IEC 60794-1-24:2014 will now be individually numbered in the IEC 60794-1-4xx series. Each test method is now considered to be an individual document rather than part of a multi-test method compendium. Full cross-reference details are given in IEC 60794-1-2.

OPTICAL FIBRE CABLES –

Part 1-402: Generic specification – Basic optical cable test procedures – Electrical test methods – Lightning test (for OPGW, OPPC and OPAC), Method H2

1 Scope

This part of IEC 60794 applies to the test intended to evaluate the impact of a lightning strike on an optical ground wire (OPGW), optical phase conductor (OPPC) or optical attached cable (OPAC).

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.

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

IEC 60794-1-1, *Optical fibre cables – Part 1-1: Generic specification – General*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the definitions given in IEC 60794-1-1 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

3.2 Abbreviated terms

EDS everyday stress

OPAC optical attached cable

OPGW optical ground wire

OPPC optical phase conductor

RTS rated tensile strength

4 General

The lightning test should be carried out only for comparison between different cable designs.

In the case of an OPAC, the cable shall be installed on the messenger in order to simulate as closely as possible a real installation, and the lightning test should be carried out to determine that the sheath is not severely damaged.

5 Sample

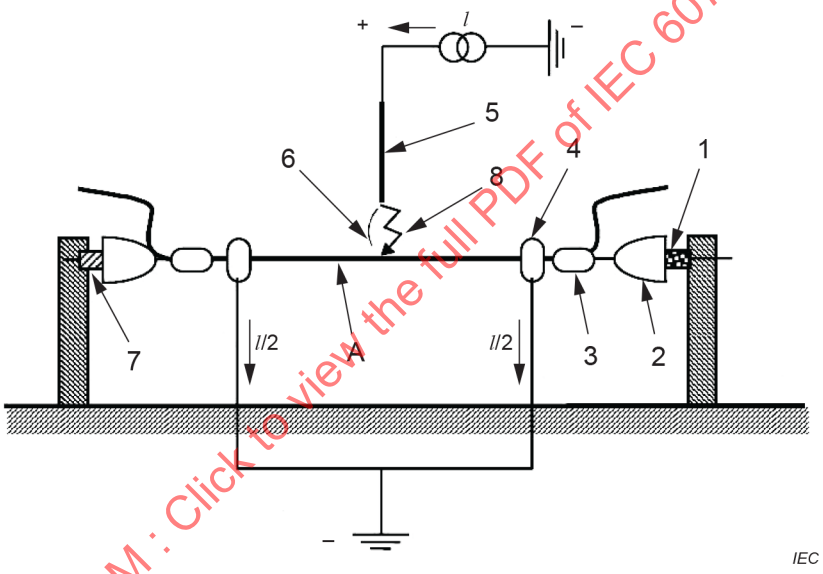
The test shall be performed on the mid-point of an OPGW sample, an OPPC sample or an OPAC sample attached to the agreed messenger.

The sample shall be at least 10 m long between the anchoring clamps.

Optical attenuation of monitored fibres shall be measured according IEC 60793-1-46. The test length of the optical fibre shall be longer than 100 m. In order to detect damage to any of fibre units (tubes) in the cable due to simulated lightning strike, the test loop shall preferably include at least 24 fibres (fibre concatenation shall be used), or all the fibres in the cable when their count is lower. If the OPGW/OPPC/OPAC under test comprises multiple units (tubes) with optical fibres, the measured fibres shall be taken from all units in equal numbers.

6 Apparatus

A typical test arrangement which can be used for the lightning test is shown in Figure 1.



Key

1 thermocouple
2 insulator
3 anchoring clamps
4 symmetric earthing connectors
5 electrode with plane surface preferably in Wolfram-Copper
6 metal fuse for ignition
7 tension meter
8 gap between electrode and cable surface = 6 cm
A test sample (including OPAC messenger wire, if applicable)

Figure 1 – Lightning test arrangement

The electrode, consisting of a copper or iron rod, shall be positioned above the metallic cable. The electrode and metallic cable shall be connected between themselves by metal fuse. The applied tensile load on the metallic cable sample shall be everyday stress (EDS), 15 % ± 5 % of the rated tensile stress (RTS). If mutually agreed between the customer and supplier, other tension loads may be applied.

When testing an OPAC, a metal fuse shall be connected as closely as possible to a point where the OPAC and, where applicable, the lashing binder is in contact with the messenger.

7 Procedure

The sample shall be subjected to a simulated lightning strike, which causes melting effects.

Table 1 – Test parameters

	Class 0	Class 1	Class 2	Class 3
Current (A)	100	200	300	400
Duration (s)	0,5	0,5	0,5	0,5
Charge transfer (C)	50	100	150	200

The test parameters are chosen between class 0 and class 3 according to Table 1 or can be agreed between the customer and the supplier, depending on the construction characteristics.

The initial temperature of the cable should be about +23 °C ± 5 °C but other values may be used if mutually agreed between customer and supplier. The test shall be repeated 5 times under the same conditions on different samples or different sections of the same sample if wires are undamaged. The tolerance on the charge transference is ±10 %. A charge exceeding 110 % of the target value may also be acceptable. The average of the five (5) charge transfers shall exceed 95 % of the target.

8 Requirements

On completion of the test, the following criteria shall be considered:

a) Any permanent or temporary increase in optical attenuation greater than the specified value shall constitute a failure (OPGW/OPPC/OPAC).

b) For OPGW or OPPC, the residual strength of the cable shall be calculated from the sum of the tensile strength of the individual wires of the cable sample submitted to the lightning strike. If the calculated residual strength is less than 75 % of the original declared RTS, then this shall constitute a failure.

9 Details to be specified

For details to be specified and reported in the test report, see Table 2.

Table 2 – Details to be specified for each lightning strike

Description	Units
Test conditions	Class 0, 1, 2 or 3
Mean direct current level of each applied electrical impact	A
Time of each applied electrical impact	s
Resultant calculated charge for each electrical impact	Coulomb
Polarity of discharge from electrode to cable sample	(+) if not otherwise agreed
Maximum observed current variation during electrical impact	% (average current)
Gap distance between electrode and cable sample	mm
Mechanical load applied on cable sample during test	N
Considerations for charge amount used for electrical fuse melting if considered as part of the results calculation	Coulomb
Material and dimensions of electrode and electrical fuse	—
Minimum existing distance between electrical fuse and any point of the structure used to fix the electrode and cable sample.	mm
Environmental temperature under which the lightning test was performed	°C
Description of fittings used to fix the cable sample	—
Number and type of broken wires (if any) after each electrical impact	—
Estimated residual breaking strength of the cable	% RTS