

INTERNATIONAL STANDARD



**Optical fibre cables –
Part 1-24: Generic specification – Basic optical cable test procedures – Electrical
test methods**

IECNORM.COM : Click to view the full PDF of IEC 60794-1-24:2014



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IECNORM.COM : Click to view the full document IEC 6004-1-24:2014



INTERNATIONAL STANDARD



**Optical fibre cables –
Part 1-24: Generic specification – Basic optical cable test procedures – Electrical
test methods**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

M

ICS 33.180.10

ISBN 978-2-8322-1576-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Method H1: Short-circuit test (for OPGW and OPAC).....	5
3.1 Object.....	5
3.2 Sample	5
3.2.1 OPGW testing.....	5
3.2.2 OPAC testing.....	6
3.3 Apparatus	6
3.4 Procedure.....	7
3.4.1 OPGW testing.....	7
3.4.2 OPAC testing.....	7
3.4.3 Common procedure for OPGW and OPAC	8
3.5 Requirements	8
3.6 Details to be specified.....	8
3.6.1 OPGW testing.....	8
3.6.2 OPAC testing.....	8
4 Method H2: Lightning test method for optical aerial cables along electric power lines (OPGW and OPAC).....	8
4.1 Object.....	8
4.2 General.....	9
4.3 Sample	9
4.4 Apparatus	9
4.5 Procedure	10
4.6 Requirements	10
4.7 Details to be specified.....	10
5 Method H3 – Electrical continuity test of cable metallic elements.....	10
5.1 Object.....	10
5.2 Sample	10
5.3 Apparatus.....	10
5.4 Procedure.....	11
5.5 Requirements	11
5.6 Details to be specified.....	11
Bibliography.....	12
Figure 1 – OPGW short-circuit test arrangement.....	6
Figure 2 – OPAC short-circuit test arrangement.....	7
Figure 3 – Lightning test arrangement.....	9
Table 1 – Test parameters	10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

**Part 1-24: Generic specification –
Basic optical cable test procedures –
Electrical test methods**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60794-1-24 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This edition of IEC 60794-1-24 cancels and replaces the electrical tests methods section of the second edition of IEC 60794-1-2, published in 2003 (and subsequently replaced by the third edition). It constitutes a technical revision.

It has been decided to split the second edition of IEC 60794-1-2 into six new documents:

- IEC 60794-1-2 : Cross reference table
- IEC 60794-1-20 : General and definitions
- IEC 60794-1-21 : Mechanical tests
- IEC 60794-1-22 : Environmental tests

- IEC 60794-1-23 : Cable elements
- IEC 60794-1-24 : Electrical tests

The text of this standard is based on the following documents:

FDIS	Report on voting
86A/1591/FDIS	86A/1606/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

OPTICAL FIBRE CABLES –

Part 1-24: Generic specification – Basic optical cable test procedures – Electrical test methods

1 Scope

This part of IEC 60794 applies to optical fibre cables for use with telecommunication equipment and devices employing similar techniques, and to cables having a combination of both optical fibres and electrical conductors.

The object of this standard is to define test procedures to be used in establishing uniform requirements for electrical requirements.

Throughout the standard the wording “optical cable” may also include optical fibre units, microduct fibre units, etc.

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.

Void.

3 Method H1: Short-circuit test (for OPGW and OPAC)

3.1 Object

The short-circuit test is intended to assess the performance of the OPGW (optical ground wire) under typical short-circuit, or the impact on the performance of OPAC (optical attached cable) under short-circuit current on the messenger wire.

3.2 Sample

3.2.1 OPGW testing

3.2.1.1 Two samples test method

A typical arrangement using two test samples is shown in Figure 1.

Two samples, each being at least 10 m long, shall be terminated at each end with suitable fittings. In sample A, one or more thermocouples shall be inserted into holes drilled into the optical unit to monitor the optical unit temperature. In sample B, one or more thermocouples shall be attached to the wires of the OPGW to monitor the OPGW temperature. Fibre optical attenuation shall be measured using a light source and power meter connected to each end of the test fibre of sample B. The test length of the optical fibre shall be a minimum of 100 m (when the sample is shorter than 100 m, concatenation shall be used).

3.2.1.2 One sample test method

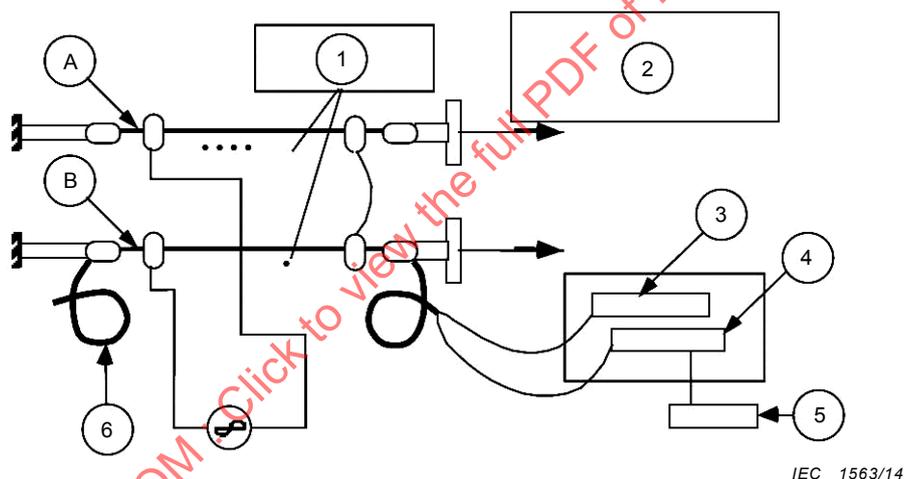
The sample, at least 10 m long, shall be terminated at each end with suitable fittings. One or more thermocouples shall be inserted through the strands of the OPGW onto the surface of the optical unit to monitor the optical unit temperature. One or more thermocouples shall be attached to the wires of the OPGW to monitor the OPGW temperature. Fibre optical attenuation shall be measured using a light source and power meter connected to each end of the test fibre. The test length of the optical fibre shall be a minimum of 100 m. (when the sample is shorter than 100 m, concatenation shall be used).

3.2.2 OPAC testing

A typical arrangement for testing OPAC is shown in Figure 2.

The OPAC test sample, at least 10 m long, is attached to the agreed messenger wire with suitable fittings. Thermocouples shall be attached to the messenger wire to record the temperature achieved during the test. In addition, a light source and power meter shall be connected to each end of the test fibre in the OPAC to measure the relative attenuation level. The test length of optical fibre shall be a minimum of 100 m (when the sample is shorter than 100 m, concatenation shall be used).

3.3 Apparatus



Key

- | | |
|--|-------------------|
| 1 thermocouples | 5 recorder |
| - armour temperature is measured | 6 fibre looped |
| - optical core temperature is measured | A, B test samples |
| 2 thermocouple recorder | |
| 3 light source | |
| 4 power meter | |

Figure 1 – OPGW short-circuit test arrangement

- Fault current duration: refer to customer specification
- Number of pulses: 3 minimum
- Waveform: to be symmetrical after the 3rd cycle

The initial messenger wire temperature shall be mutually agreed between the customer and the supplier. The current pulses shall be applied with the messenger wire being allowed to cool down to within 5 °C of the initial temperature between each pulse.

Optical attenuation of the test fibres shall be monitored continuously from at least 2 min before, until at least 5 min after each current pulse. The temperature of the messenger wire shall also be monitored.

3.4.3 Common procedure for OPGW and OPAC

The OPGW and OPAC shall be dismantled after the short-circuit current test. Each component of the cable shall be separated and inspected for excessive wear, discoloration, deformation or signs of breakdown. Attention should be made to the sections of the cable nearest to the terminating hardware and at mid-point of the span.

3.5 Requirements

The acceptance criteria for the test shall be as stated in the detail specification.

On completion, the maximum temperature reached by any component in the OPGW shall be within the allowed temperature range specified by the supplier for this component.

During the test the messenger wire that the OPAC is attached to should attain the temperature lower than the maximum specified by the customer.

Excessive wear, discoloration, deformation or breakdown shall not be observed by the inspection after the exposure to the current pulse.

3.6 Details to be specified

3.6.1 OPGW testing

- Procedure used (one sample or two samples test method)
- Initial sample temperature
- Fault current intensity
- Fault current duration
- Number of pulses

3.6.2 OPAC testing

- Messenger tensile load
- Initial sample temperature
- Maximum temperature to be reached by the messenger wire
- Fault current duration
- Number of pulses

4 Method H2: Lightning test method for optical aerial cables along electric power lines (OPGW and OPAC)

4.1 Object

This test is intended to evaluate the impact of a lightning strike on an OPGW or OPAC.

4.2 General

Lightning test should be carried out only for comparison between different OPGW designs.

In the case of OPAC cables, the cable shall be installed on the messenger so as 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.

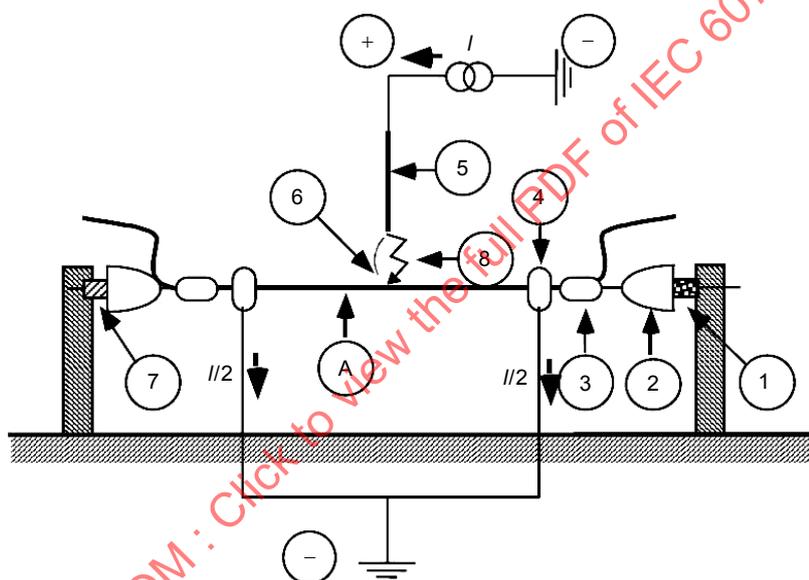
4.3 Sample

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

The sample shall be at least 1 m long between the anchoring clamps.

4.4 Apparatus

A typical test arrangement which can be used for the lightning test is shown in Figure 3.



Key

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

Figure 3 – 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 EDS (every day stress), 15 % to 25 % of the RTS (rated tensile stress). 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.

4.5 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 $+23\text{ °C} \pm 5\text{ °C}$. The test shall be repeated 5 times under the same conditions on different samples.

4.6 Requirements

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

- Any permanent or temporary increase in optical attenuation greater than the specified value shall constitute a failure (OPGW/OPAC).
- For OPGW, if any wires are found to be broken, then the residual strength of the OPGW shall be calculated for the remaining unbroken wires. If the calculated residual strength is less than 75 % of the original declared RTS, then this shall constitute a failure.

4.7 Details to be specified

Test conditions: Class 0, Class 1, Class 2, or Class 3.

5 Method H3 – Electrical continuity test of cable metallic elements

5.1 Object

The electrical continuity test is to verify that cable metallic elements are electrically continuous throughout the cable. Electrical continuity is important for bonding and grounding, toning for location, and other related system issues, and may represent a "goodness of manufacture" criteria. Typically, the test is one of continuity and carries no resistance or conductivity requirement. The metallic elements may be tested individually, or may be tested as a total group. Since this latter criterion is frequently the case, all elements are to be measured as a group unless specified otherwise.

NOTE Detail specifications may allow such elements as strength members to be non-continuous throughout the cable. This is a special case, and attention is directed to the detail specification.

5.2 Sample

The sample is an entire cable to be measured. As this test is non-destructive, the cable may be shipped afterward.

5.3 Apparatus

The apparatus may be any device capable of assuring electrical continuity. Common examples include

- ohm meter,