# IEC 60794-3-10

Edition 3.0 2015-01

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

## Optical fibre cables –
## Part 3-10: Outdoor cables – Family specification for duct, directly buried or lashed aerial optical telecommunication cables

## Câbles à fibres optiques –
## Partie 3-10: Câbles extérieurs – Spécification de famille pour les câbles optiques de télécommunication destinés à être installés dans des conduites, directement enterrés ou attachés en aérien

IEC 60794-3-10:2015-01(en-fr)

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015

**THIS PUBLICATION IS COPYRIGHT PROTECTED**

**Copyright © 2015 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembé
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 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - std.iec.ch/glossary**
More than 60 000 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.

---

**A propos de l'IEC**
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

**A propos des publications IEC**
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

**Catalogue IEC - webstore.iec.ch/catalogue**
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

**Recherche de publications IEC - www.iec.ch/searchpub**

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

**IEC Just Published - webstore.iec.ch/justpublished**

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

**Electropedia - www.electropedia.org**

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

**Glossaire IEC - std.iec.ch/glossary**
Plus de 60 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

**Service Clients - webstore.iec.ch/csc**

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015

# IEC 60794-3-10

Edition 3.0 2015-01

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

## Optical fibre cables –
## Part 3-10: Outdoor cables – Family specification for duct, directly buried or lashed aerial optical telecommunication cables

## Câbles à fibres optiques –
## Partie 3-10: Câbles extérieurs – Spécification de famille pour les câbles optiques de télécommunication destinés à être installés dans des conduites, directement enterrés ou attachés en aérien

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.180.10

ISBN 978-2-8322-2188-4

**Warning! Make sure that you obtained this publication from an authorized distributor.**
**Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

AVA Documents
Document Sharing Hub

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

Full document details: IEC 60794-3-10 2015

CONTENTS

FOREWORD ... 3
1 Scope ... 5
2 Normative references ... 5
3 Terms, definitions, symbols and abbreviations ... 5
4 General requirements ... 6
4.1 Optical fibres ... 6
4.2 Cable element ... 6
4.3 Optical fibre cable construction ... 6
5 Details of family requirements and test conditions for optical fibre cable tests ... 6
5.1 General ... 6
5.2 Tensile performance ... 6
5.2.1 Family requirements ... 6
5.2.2 Test conditions ... 6
5.3 Crush ... 7
5.3.1 Family requirements ... 7
5.3.2 Test conditions ... 7
5.4 Impact ... 7
5.4.1 Family requirements ... 7
5.4.2 Test conditions ... 7
5.5 Repeated bending ... 7
5.5.1 Family requirements ... 7
5.5.2 Test conditions ... 7
5.6 Torsion ... 8
5.6.1 Family requirements ... 8
5.6.2 Test conditions ... 8
5.7 Bend ... 8
5.7.1 Family requirements ... 8
5.7.2 Test conditions ... 8
5.8 Temperature cycling ... 8
5.8.1 Family requirements ... 8
5.8.2 Test conditions ... 8
5.9 Water penetration ... 9
5.9.1 Family requirements ... 9
5.9.2 Test conditions ... 9
5.10 Ageing ... 9
5.10.1 Family requirements ... 9
5.10.2 Test conditions ... 9
Annex A (normative) Blank detail specification and minimum requirements ... 10
A.1 Blank detail specification ... 10
A.2 Cable construction ... 12
Bibliography ... 13

Table A.1 – Cable description ... 10
Table A.2 – Cable construction ... 12

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# OPTICAL FIBRE CABLES –

## Part 3-10: Outdoor cables – Family specification for duct, directly buried or lashed aerial optical telecommunication cables

## 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 60794-3-10 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2009 and constitutes a technical revision.

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

a) the specification has been streamlined by cross-referencing IEC 60794-1-1, the IEC 60794-3 series and IEC 60794-1-2;
b) reference to the MICE table in the previous Annex A has been deleted;
c) lashed aerial installation techniques as referenced in the previous Annex B has been removed for inclusion in the next edition of IEC TR 62691.

AVA Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015

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

| FDIS | Report on voting |
|---|---|
| 86A/1630/FDIS | 86A/1639/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 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 website 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.

**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.**

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015

# OPTICAL FIBRE CABLES –

## Part 3-10: Outdoor cables – Family specification for duct, directly buried or lashed aerial optical telecommunication cables

## 1 Scope

This part of IEC 60794, which is a family specification, covers optical telecommunication cables to be used in ducts or direct buried applications. The cable may also be used for lashed aerial applications. Requirements of the sectional specification IEC 60794-3 for duct, buried and aerial cables are applicable to cables covered by this standard.

## 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.

IEC 60793-2, *Optical fibres – Part 2: Product specifications – General*

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

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Cross reference table for optical cable test procedures*

IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods*[1]

IEC 60794-1-22:2012, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

IEC 60794-3:2001, *Optical fibre cables – Part 3: Sectional specification – Outdoor cables*

IEC 60811-202, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 202: General tests – Measurement of thickness of non-metallic sheath*

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

IEC 60811-604, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 604: Physical tests – Measurement of absence of corrosive components in filling compounds*

## 3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms, definitions, symbols and abbreviations given in IEC 60794-1-1 apply.

[1] To be published.

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015

# 4 General requirements

## 4.1 Optical fibres

The optical fibre shall conform to the requirements of IEC 60793-2. The fibre type shall be agreed between the customer and supplier. The cabled fibre shall conform to IEC 60794-3.

## 4.2 Cable element

The cable elements shall conform to IEC 60794-3.

## 4.3 Optical fibre cable construction

The cable construction shall conform to IEC 60794-3.

# 5 Details of family requirements and test conditions for optical fibre cable tests

## 5.1 General

Tests on single-mode fibre cables are typically carried out at 1 550 nm. Multimode fibre cables are typically tested at 1 300 nm. Measurement at other wavelengths or range of wavelengths may be agreed upon between the customer and supplier.

## 5.2 Tensile performance

### 5.2.1 Family requirements

For 1 % proof-tested fibres, the fibre strain under long-term tensile load ($T_L$) shall not exceed 20 % of this fibre proof strain (equal to absolute 0,2 % strain) and there shall be no change in attenuation during the test. Under short-term tensile load ($T_M$) the fibre strain shall not exceed 60 % of the fibre proof strain and the attenuation change during test shall be measured and recorded. Other criteria may be agreed between the customer and the supplier. For fibres proof tested at higher levels the safe long-term load will not scale linearly with proof strain, so a lower percentage of the proof strain is applicable. For greater than 1 % up to 2 % proof-tested fibres, $T_L$ shall be limited to 17 % of the proof-test strain (equal to absolute 0,34 % strain for 2 % proof tested fibres).Under visual examination without magnification, there shall be no damage to the sheath or to the cable elements.

### 5.2.2 Test conditions

| | |
|---|---|
| Method: | IEC 60794-1-21, Method E1 |
| Fibre length: | Finished cable length |
| Tensile load on cable: | Long-term tensile load ($T_L$) and short-term tensile load ($T_M$), where:<br>– $T_M \geq 1 \times W$ (direct burial or blowing in duct);<br>– $T_M \geq 1{,}5 \times W$ (pulling in duct);<br>Other loads may be applied in accordance with particular user conditions, e.g. 2 700 N<br>– $T_L = 0{,}3 \times T_M$<br>For aerial cables, the long-term tensile load may be greater than or equal to the short-term tensile load. |
| Diameter of test pulleys: | Typically 1 m but not less than the minimum loaded bending diameter specified for the cable. |

Documents
Document Sharing Hub
Full document details: IEC 60794-3-10 2015

## 5.3 Crush

### 5.3.1 Family requirements

Under long-term load there shall be no change in attenuation at 1 550 nm during the test and under short-term load there shall be no change in attenuation at 1 550 nm after the test. The installation load shall not be less than the long-term load.

Under visual examination there shall be no damage to the sheath or to the cable elements. The imprint of the plate or mandrel on the sheath is not considered mechanical damage.

### 5.3.2 Test conditions

Method: IEC 60794-1-21, Method E3A

The default method is the plate/plate test, Method E3A. Optionally, the mandrel/plate test, Method E3B, may be conducted if requested by the detail specification. Short- and long-term tests may be conducted separately.

Load (short term): 1,5 kN (un-armoured); 2,2 kN (armoured)

Load (long term): 0,75 kN (un-armoured); 1,1 kN (armoured)

## 5.4 Impact

### 5.4.1 Family requirements

Under visual examination without magnification there shall be no damage to the sheath or to the cable elements. The imprint of the striking surface on the sheath is not considered mechanical damage.

There shall be no permanent change in attenuation after the test.

### 5.4.2 Test conditions

Method: IEC 60794-1-21, Method E4

Number of impacts: One in 3 different places spaced not less than 500 mm apart

Impact energy: Un-armoured cable: 10 J

Armoured cable: 20 J to 30 J, depending on particular user conditions

Striking surface curvature radius: 300 mm

## 5.5 Repeated bending

### 5.5.1 Family requirements

Under visual examination without magnification there shall be no damage to the sheath and to the cable elements.

### 5.5.2 Test conditions

Method: IEC 60794-1-21, Method E6

Number of cycles: 25 or different number of cycles may be applied in accordance with the particular user conditions

Load: Adequate to assure uniform contact with the mandrel

Bending radius: 20 d

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2015