IEC 60794-3-10

Edition 2.0 2009-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Withdrawn

Optical fibre cables –
Part 3-10: Outdoor cables – Family specification for duct, directly buried and 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 60794-3-10:2009

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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 la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI 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

Withdrawn

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.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you 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 on-line 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 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

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 la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

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

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI 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.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. 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 au monde 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 les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

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.

AVA Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

IEC 60794-3-10

Edition 2.0 2009-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

withdrawn

Optical fibre cables –
Part 3-10: Outdoor cables – Family specification for duct, directly buried and 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

PRICE CODE
CODE PRIX

U

ICS 33.180.10

ISBN 978-2-83220-605-8

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 2009

CONTENTS

FOREWORD ... 3
1 Scope ... 5
2 Normative references ... 5
3 Symbols ... 6
4 Optical fibre, cable construction and tests applicable for optical telecommunication cables to be used in ducts, direct buried or lashed aerial applications ... 7
4.1 Optical fibres ... 7
4.1.1 Common single-mode fibre requirements ... 8
4.1.2 Single-mode dispersion unshifted (B1.1) optical fibre ... 8
4.1.3 Single-mode dispersion unshifted (B1.2) optical fibre ... 8
4.1.4 Single-mode dispersion unshifted (B1.3) optical fibre ... 9
4.1.5 Single-mode dispersion shifted (B2) optical fibre ... 9
4.1.6 Single-mode non-zero dispersion (B4) optical fibre ... 9
4.1.7 Single-mode non-zero dispersion shifted (B5) optical fibre ... 9
4.1.8 Single-mode (B6.a) optical fibre ... 10
4.2 Cable element ... 10
4.3 Installation and operating conditions ... 10
4.4 Mechanical and environmental tests ... 11
4.4.1 Tests applicable ... 11
4.4.2 Details of family requirements and test conditions for optical fibre cable tests ... 12
Annex A (normative) Family specification for optical telecommunication cables to be used in ducts, directly buried or lashed aerial application ... 17
Annex B (informative) Lashed aerial applications ... 23

Table 1 – Common single-mode fibre requirements ... 8
Table 2 – Single-mode dispersion unshifted (B1.1) optical fibre ... 8
Table 3 – Single-mode dispersion unshifted (B1.2) optical fibre ... 8
Table 4 – Single-mode dispersion unshifted (B1.3) optical fibre ... 9
Table 5 – Single-mode dispersion shifted (B2) optical fibre ... 9
Table 6 – Single-mode non-zero dispersion (B4) optical fibre ... 9
Table 7 – Single-mode non-zero dispersion shifted (B5) optical fibre ... 9
Table 8 – Single-mode (B6.a) optical fibre ... 10
Table 9 – Cable element ... 10
Table 10 – Tests applicable ... 10
Table 11 – Mechanical and environmental applicable tests ... 11

Withdrawn

Documents
Document Sharing Hub
Full document details: IEC 60794-3-10 2009

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

Part 3-10: Outdoor cables – Family specification for duct, directly buried and 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
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 second edition cancels and replaces the first edition published in 2002. It constitutes a technical revision.

The main changes are listed below:

- the title of the specification has been updated to include lashed applications;
- the fibres specification clause (Clause 4) has been enlarged to include fibre Types B5 and B6.a;
- an annex has been added for additional requirements according to the MICE table.

Withdrawn

AVA Documents Document Sharing Hub

Full document details: IEC 60794-3-10 2009

This bilingual version (2013-01) corresponds to the monolingual English version, published in 2009-01.

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

FDIS	Report on voting
86A/1245/FDIS	86A/1252/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.

The French version of this standard has not been voted upon.

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

A list of all parts of 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 maintenance result 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.

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.

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

OPTICAL FIBRE CABLES –

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

Withdrawn

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.

Clause A.2 contains requirements that supersede the normal requirements in case the cables are intended to be used in installation governed by the MICE table of ISO/IEC 24702.

Annex B gives information on the lashed aerial application.

The parameters specified in this standard may be affected by measurement uncertainty arising either from measurement errors or calibration errors due to lack of suitable standards. Acceptance criteria shall be interpreted with respect to this consideration (see IEC 60794-3 Clause 8).

The number of fibres tested shall be representative of the cable design and shall be agreed between the customer and the supplier.

2 Normative references

The following referenced documents are indispensable for the application 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 60304, *Standard colours for insulation for low-frequency cables and wires*

IEC 60654-4, *Operating conditions for industrial-process measurement and control equipment – Part 4: Corrosive and erosive influences*

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60721-3-3, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations*

IEC 60793-1-20, *Optical fibres – Part 1-20: Measurement methods and test procedures – Fibre geometry*

IEC 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*

IEC 60793-1-44, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength*

AVA Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

IEC 60793-1-48, *Optical fibres – Part 1-48: Measurement methods and test procedures – Polarization mode dispersion*

IEC 60793-2-50, *Product specifications – Sectional specification for class B single-mode fibres*

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

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

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

IEC 60811-1-1, *Common test methods for insulating and sheathing materials of electric cables and optical cables – Part 1-1: Methods for general application – Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*

IEC 60811-5-1, *Insulating and sheathing materials of electric and optic cables – Common test methods – Part 5-1: Methods specific to filling compounds – Drop-point – Separation of oil – Lower temperature brittleness – Total acid number – Absence of corrosive components – Permittivity at 23 °C – DC resistivity at 23 °C and 100 °C*

IEC 61000-2-5, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 5: Classification of electromagnetic environments. Basic EMC publication*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 62363, *Radiation protection instrumentation – Portable photon contamination meters and monitors*

ISO/IEC 24702, *Information technology – Generic cabling – Industrial premises*

3 Symbols

For the purposes of this standard the following symbols apply.

λ_{cc} Cabled fibre cut-off wavelength.

d Nominal outer diameter of the cable.

DS Detail specification.

T_L The acceptable amount of long term tensile load which is expected that the cable may experience during operation (i.e. after installation is completed). This load may be due to residual loading from the installation process and/or environmental effect.

T_M The acceptable amount of short term tensile load which is expected that the cable experience during installation and/or handling .

T_{A1} Temperature cycling test temperature limit according to IEC 60794-1-2, Method F1.

T_{A2} Temperature cycling test temperature limit according to IEC 60794-1-2, Method F1.

T_{B1} Temperature cycling test temperature limit according to IEC 60794-1-2, Method F1.

Withdrawn
AVA Documents Document Sharing Hub
Full document details: IEC 60794-3-10 2009

T_{B2} Temperature cycling test temperature limit according to IEC 60794-1-2, Method F1.

t_1 Temperature cycling test dwell time.

$n \times d$ A value, n, times cable outer diameter, d, used for bends, mandrels, etc.

4 Optical fibre, cable construction and tests applicable for optical telecommunication cables to be used in ducts, direct buried or lashed aerial applications

4.1 Optical fibres

Attenuation at the wavelength 1 625 nm is optionally specified by the customer.

withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

4.1.1 Common single-mode fibre requirements

Table 1 – Common single-mode fibre requirements

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Uncabled optical fibre	5.1	IEC 60793-2-50		
Attenuation discontinuities at 1 310 nm and 1 550 nm	5.2.2	≤ 0,10 dB	IEC 60793-1-40	
Cabled fibre cut-off wavelength	5.3	$\lambda_{cc} < \lambda$ operational	IEC 60793-1-44	
Fibre colouring	5.4	IEC 60304	Visual inspection	
Polarisation mode dispersion PMD_Q	5.5	IEC 60794-3	IEC 60793-1-48	
Outer diameter including colouring	8.2.1.1	IEC 60793-2-50	IEC 60793-1-20	

4.1.2 Single-mode dispersion unshifted (B1.1) optical fibre

Table 2 – Single-mode dispersion unshifted (B1.1) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 310 nm at 1 550 nm at 1 625* nm	5.2.1	≤ 0,40 dB/km ≤ 0,30 dB/km ≤ 0,40 dB/km		

4.1.3 Single-mode dispersion unshifted (B1.2) optical fibre

Table 3 – Single-mode dispersion unshifted (B1.2) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 550 nm at 1 625* nm	5.2.1	≤ 0,30 dB/km ≤ 0,40 dB/km		

* 1 625 nm performance is optional depending on agreement between customer and supplier.

Withdrawn

Documents
Document Sharing Hub

4.1.4 Single-mode dispersion unshifted (B1.3) optical fibre

Table 4 – Single-mode dispersion unshifted (B1.3) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 310 at 1 383 ± 3 nm at 1 550 at 1 625* nm	5.2.1	≤ 0,40 dB/km ≤ 0,40 dB/km ≤ 0,30 dB/km ≤ 0,40 dB/km		

4.1.5 Single-mode dispersion shifted (B2) optical fibre

Table 5 – Single-mode dispersion shifted (B2) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 550 nm	5.2.1	≤ 0,30 dB/km		

4.1.6 Single-mode non-zero dispersion (B4) optical fibre

Table 6 – Single-mode non-zero dispersion (B4) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 550 nm at 1 625* nm	5.2.1	≤ 0,30 dB/km ≤ 0,40 dB/km		

4.1.7 Single-mode non-zero dispersion shifted (B5) optical fibre

Table 7 – Single-mode non-zero dispersion shifted (B5) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 460 nm at 1 550 nm and at 1 625* nm	5.2.1	≤ 0,40 dB/km ≤ 0,30 dB/km ≤ 0,40 dB/km		

* 1 625 nm performance is optional depending on agreement between customer and supplier.

Withdrawn

Documents
Document Sharing Hub
Full document details: IEC 60794-3-10 2009

4.1.8 Single-mode (B6.a) optical fibre

Table 8 – Single-mode (B6.a) optical fibre

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Attenuation coefficient (cabled fibres)	5.2.1	According to DS	IEC 60793-1-40	
at 1 310 nm at 1 310 nm -1625 nm at 1 383 nm at 1 550 nm at 1 625* nm	5.2.1	NS ≤ 0,40 dB/km ≤ 0,40 dB/km ≤ 0,30 dB/km NS		

4.2 Cable element

Table 9 – Cable element

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Cable element				
Compatibility	6	According to DS	Under consideration	
Slotted core	6.3	According to DS	Visual inspection	
Tube	6.4	According to DS	Visual inspection	
Compound flow and evaporation		According to DS	IEC 60794-1-2, Methods E14 and E15	
Outer diameter	8.2.1.1	According to DS	IEC 60811-1-1	
Ribbon	6.5	According to DS	Visual inspection	
Filler		According to DS		
Insulated copper conductor		According to DS		
Central strength member		According to DS		

4.3 Installation and operating conditions

Table 10 – Tests applicable

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
General requirements	8.1	Agreement between customer and supplier		
Bend of cable element	8.2.1.2	According to DS	IEC 60794-1-2, Method G1	
Tube kinking	8.2.2.1	According to DS	IEC 60794-1-2, Method G7	
Ribbons :				
- dimensions	8.2.3.1	IEC 60794-3,	IEC 60794-3,	

Withdrawn

Documents
Document Sharing Hub

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
		Table 1	8.2.3.1	
- separability of individual fibres from ribbon	8.2.3.2.1	IEC 60794-3, 8.2.3.2.1 or according to DS	IEC 60794-1-2, Method G5 or according to DS	
- ribbon stripping	8.2.3.2.2	According to DS		
- torsion	8.2.3.2.3	According to DS	IEC 60794-1-2, Method G6	

4.4 Mechanical and environmental tests

4.4.1 Tests applicable

Table 11 – Mechanical and environmental applicable tests

Characteristics (9)	IEC 60794-3 clause/subclause (10)	Family requirements (11)	Test methods (12)	Remarks (13)
Tensile performance	9.1	See 4.4.2.1 and according to DS	IEC 60794-1-2, Methods E1A and E1B	See 4.4.2.1
Installation capability (selection from the following)	9.2			
- bending under tension	9.2.1	According to DS	IEC 60794-1-2, Method E18	
- repeated bending	9.2.2	See 4.4.2.2	IEC 60794-1-2, Method E6	
- impact	9.2.3	See 4.4.2.3	IEC 60794-1-2, Method E4	
- kink	9.2.4	According to DS	IEC 60794-1-2, Method E10	
- torsion	9.2.5	See 4.4.2.4	IEC 60794-1-2, Method E7	
Cable bend	9.3	See 4.4.2.5	IEC 60794-1-2, Method E11	
Crush	9.4	According to DS	IEC 60794-1-2, Method E3	See 4.4.2.6
Temperature cycling	9.5	According to DS	IEC 60794-1-2, Method F1	See 4.4.2.7
Ageing	9.6			
- coating adhesion stability	9.6.1	According to DS	IEC 60794-1-2, Method E5	
- finished cable	9.6.2	Under consideration		
Water penetration	9.7	According to DS	IEC 60794-1-2, Method F5B	
Pneumatic resistance (for unfilled pressurised cables)	9.8	According to DS	IEC 60794-1-2, Method F8	
Special installation conditions (selection from the following as suitable)				

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

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

NOTE For some of the parameters specified in this standard, the objective is no change in attenuation.

These parameters may be affected by measurement uncertainty arising either from measurement errors or calibration errors due to a lack of suitable standards. Acceptance criteria should be interpreted with respect to this consideration. The total uncertainty of measurement for this standard is ≤ 0,05 dB for attenuation or 0,05 dB/km for attenuation coefficient.

Any measured value within this range, either positive or negative, should be considered as "no change in attenuation". The requirement for these parameters is indicated as "No change (≤ 0,05 dB or ≤ 0,05 dB/km)".

By agreement between customer and supplier, minor deviation from this limit may be accepted at some low frequency, for example less than 10 %. However, for mechanical tests no deviation in excess of 0,15 dB is acceptable. For environmental tests, no deviation in excess of 0,10 dB/km is acceptable.

4.4.2.1 Tensile performance

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) Family requirements

Under long term tensile load (T_L) the fibre strain shall not exceed 20 % of the fibre proof 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. For aerial cables, the long term tensile load may be ≥ to the short term tensile load. Other criteria may be agreed between the customer and the supplier.

Depending on application and cable construction and agreement between customer and supplier, a maximum tensile force less than the calculation, for example 2 700 N, may be allowed.

Where $T_M \geq 9{,}8 \times a \times m$

with m: weight of 1 km of cable,

typical value of a: 1 for direct burial or blowing in duct
1,5 for pulling in duct

Maximum long term tensile load shall be 30 % of short term tensile load.

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

b) Test conditions

Cable length under tension: not less than 50 m. Taking into account the measurement accuracy and end effects, shorter lengths may be used by agreement between the customer and the supplier.

Fibre length: finished cable length.

Tensile load on cable: long term tensile load (T_L) and short term tensile load (T_M) Other loads may be applied in accordance with particular user conditions.

Diameter of test pulleys: 1 m but not less than the minimum loaded bending diameter specified for the cable.

Withdrawn

AVA Documents Document Sharing Hub

Full document details: IEC 60794-3-10 2009

4.4.2.2 Repeated bending

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) Family requirements

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

b) Test conditions

Bending radius: 20 d.

Load: Adequate to assure uniform contact with the mandrel.

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

Duration of cycle: Approximately 2 s.

4.4.2.3 Impact

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) 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.

The variation in attenuation for each fibre shall be ≤ 0,10 dB at 1 550nm after the test. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier.

b) Test conditions

Striking surface radius: 10 mm or 300 mm.

Impact energy: 3 J with striking surface radius of 10 mm or 10 J with striking surface radius of 300 mm.

Armoured cable: 10 J with striking surface radius of 10 mm or 20 J to 30 J with striking surface radius of 300 mm depending on particular user conditions.

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

4.4.2.4 Torsion

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) Family requirements

Withdrawn

AVA Documents Document Sharing Hub

Full document details: IEC 60794-3-10 2009

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

The variation in attenuation for each fibre shall be ≤ 0,10 dB at 1 550 nm after the test. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier.

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

b) Test conditions

Length under test: 2 m.

Number of turns: one half turn (through 180°) over the length of 2 m in each direction.

Number of cycles: 5.

4.4.2.5 Bend

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) Family requirements

The variation in attenuation for each fibre shall be ≤ 0,10 dB at 1 550 nm. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier.

This requirement applies at room temperature and, if required, at –30 °C.

b) Test conditions

Diameter of mandrel: ≤ 20 d.
For cable incorporating a non-metallic rod and/or metallic armouring, bending shall be limited to a value from 20 d to 80 d.

Number of turns/helix: 4.

Number of cycles: 3.

4.4.2.6 Crush

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) Family requirements

Under long term load there shall be no increase in attenuation at 1 550 nm during the test and under installation load there shall be no change in attenuation at 1 550 nm after the test. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier. The installation load shall be ≥ 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.

b) Test conditions

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009

It is optional to test either mandrel/plate and plate/plate test. Short and long term tests may be conducted separately.

Plate/plate crush test

- Short term test:
  - unarmoured = 1,5 kN.
  - armoured = 2,2 kN.

Crush for 1 min, after release of load, no change in attenuation (≤ 0,05 dB).

- Long term test:
  - unarmoured = 0,75 kN.
  - armoured = 1,1N.

Crush for 10 min, during load, no change in attenuation during load (≤ 0,05 dB).

Mandrel/plate: 25 mm mandrel if used

- Short term test
  - unarmoured = 1,5 kN.
  - armoured = 2,0 kN.

Crush for 1 min, after release of load, no change in attenuation (≤ 0,05 dB).

- Long term test:
  - unarmoured = 0,75 kN.
  - armoured = 1,0 kN.

Crush for 10 min, during load, no change in attenuation during load (≤ 0,05 dB).

4.4.2.7 Temperature cycling

This subclause identifies family requirements and test conditions that are referred to in Table 11.

a) Family requirements

During the last cycle, there shall be no change in attenuation −10 °C to −20 °C or +30 °C to +60 °C at 1 550 nm. For 1 625 nm applications, performance criteria shall be mutually agreed upon between the customer and supplier. On completion of the test, there shall be no change in attenuation.

b) Definitions

Definition of a cycle: T_{B2} to T_{A2}

Definition of the last cycle: T_{A2}, T_{A1}, T_{B1}, T_{B2} with a final measurement at room temperature.

c) Test conditions

Sample length: finished cable length of at least 1 000 m.

High temperature, T_{B2}: +60 °C to +70 °C, depending on customer requirements.

High temperature, T_{B1}: +30 °C to +60 °C, depending on customer requirements.

Low temperature, T_{A1}: −10 °C to −20 °C, depending on customer requirements.

Withdrawn

Documents
Document Sharing Hub

Full document details: IEC 60794-3-10 2009