

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Optical fibre cables –
Part 1-21: Generic specification – Basic optical cable test procedures –
Mechanical test methods**

**Câbles à fibres optiques –
Partie 1-21: Spécification générique – Procédures fondamentales d'essais
des câbles optiques – Méthodes d'essai mécanique**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 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 Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and definitions clause of IEC publications issued between 2002 and 2015. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

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 une fois par mois par email.

Service Clients - webstore.iec.ch/csc

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

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et définitions des publications IEC parues entre 2002 et 2015. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Optical fibre cables –
Part 1-21: Generic specification – Basic optical cable test procedures –
Mechanical test methods**

**Câbles à fibres optiques –
Partie 1-21: Spécification générique – Procédures fondamentales d'essais
des câbles optiques – Méthodes d'essai mécanique**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.180.10

ISBN 978-2-8322-7947-2

**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.**

REDLINE VERSION

VERSION REDLINE



Optical fibre cables –

**Part 1-21: Generic specification – Basic optical cable test procedures –
Mechanical test methods**

Câbles à fibres optiques –

**Partie 1-21: Spécification générique – Procédures fondamentales d'essais
des câbles optiques – Méthodes d'essai mécanique**

CONTENTS

FOREWORD	10
INTRODUCTION to Amendment	12
1 Scope and object	13
2 Normative references	13
3 Method E1: Tensile performance	14
3.1 Object	14
3.2 Sample length	14
3.3 Apparatus	14
3.4 Procedure	15
3.4.1 General requirements	15
3.4.2 Procedure	15
3.5 Requirements	15
3.6 Details to be specified	16
3.7 Details to be reported	16
4 Method E2: Abrasion	17
4.1 Object	17
4.2 Sample	17
4.3 Method E2A: Abrasion resistance of optical fibre cable sheaths	17
4.3.1 Apparatus	17
4.3.2 Procedure	18
4.3.3 Requirements	18
4.3.4 Details to be specified	18
4.4 Method E2B: Abrasion resistance of optical fibre cable markings	18
4.4.1 Apparatus	18
4.4.2 Procedure	19
4.4.3 Requirements	19
4.4.4 Details to be specified	19
5 Method E3: Crush	20
5.1 Object	20
5.2 Sample	20
5.3 Method E3A: Plate/plate	20
5.3.1 Apparatus	20
5.3.2 Procedure	20
5.4 Method E3B: Mandrel/plate	21
5.4.1 Apparatus	21
5.4.2 Procedure	21
5.5 Requirements	21
5.6 Details to be specified	21
6 Method E4: Impact	23
6.1 Object	23
6.2 Sample	23
6.2.1 Sample length	23
6.2.2 Termination	23
6.3 Apparatus	23
6.4 Procedure	24
6.5 Requirements	24

6.6	Details to be specified.....	24
7	Method E5A: Stripping force stability of cabled optical fibres	24
8	Method E5B: Strippability of optical fibre ribbons	24
9	Method E5C: Strippability of buffered optical fibres.....	29
9.1	Object.....	29
9.2	Sample	29
9.3	Apparatus	29
9.4	Procedure	30
9.5	Requirements	30
9.6	Details to be specified.....	30
10	Method E6: Repeated bending.....	30
10.1	Object.....	30
10.2	Sample	30
10.2.1	Sample length	30
10.2.2	Termination	31
10.3	Apparatus	31
10.4	Procedure	31
10.5	Requirements	31
10.6	Details to be specified.....	31
11	Method E7: Torsion	32
11.1	Object.....	32
11.2	Sample	32
11.3	Apparatus	33
11.4	Procedure	33
11.5	Requirements	34
11.6	Details to be specified.....	34
11.7	Details to be reported	34
12	Method E8: Flexing.....	36
12.1	Object.....	36
12.2	Sample	36
12.3	Apparatus	36
12.4	Procedure	36
12.5	Requirements	36
12.6	Details to be specified.....	36
13	Method E9: Snatch (deleted)	37
14	Method E10: Kink	37
14.1	Object.....	37
14.2	Sample	37
14.3	Apparatus	37
14.4	Procedure	38
14.5	Requirements	38
14.6	Details to be specified.....	38
15	Method E11: Bend	39
15.1	Object.....	39
15.2	Sample	39
15.3	Apparatus	39
15.4	Procedure	39
15.4.1	Procedure 1 – Test method E11A (standard test procedure)	39

15.4.2	Procedure 2 – Test method E11B (alternative test procedure)	39
15.5	Requirements	40
15.6	Details to be specified	40
16	Method E12: Cut-through resistance (deleted)	41
17	Method E13: Shotgun damage	41
17.1	Object	41
17.2	General	41
17.3	Method E13A: Shotgun test	41
17.3.1	Sample	41
17.3.2	Apparatus	41
17.3.3	Procedure	41
17.3.4	Requirements	42
17.3.5	Details to be specified	42
17.4	Method E13B: Shotgun simulation	42
17.4.1	Sample	42
17.4.2	Apparatus	42
17.4.3	Procedure	43
17.4.4	Requirements	43
17.4.5	Details to be specified	43
17.4.6	Calculation of drop weight and height	43
18	Method E14: Compound flow (drip)	44
19	Method E15: Bleeding and evaporation	45
20	Method E16: [Title unknown] (deleted)	50
21	Method E17: Bending stiffness	50
21.1	Object	50
21.2	General	50
21.3	Method E17A: Three-point bend	51
21.3.1	Sample	51
21.3.2	Apparatus	51
21.3.3	Procedure	51
21.3.4	Requirements	52
21.3.5	Details to be specified	52
21.4	Method E17B: cantilever bend	52
21.4.1	Sample	52
21.4.2	Apparatus	52
21.4.3	Procedure	52
21.4.4	Requirements	52
21.4.5	Details to be specified	53
21.5	Method E17C: Buckling bend	53
21.5.1	Sample	53
21.5.2	Apparatus	53
21.5.3	Procedure	53
21.5.4	Requirements	53
21.5.5	Details to be specified	53
22	Method E18A: Bending under tension	55
22.1	Object	55
22.2	Sample	55
22.3	Apparatus	55

22.4	Procedure	56
22.5	Requirements	56
22.6	Details to be specified	56
23	Method E18B: Sheave test (primarily for OPGW and OPAC)	58
23.1	Object	58
23.2	Sample	58
23.3	Apparatus	59
23.4	Procedure	59
23.5	Requirements	60
23.6	Details to be specified	60
24	Method E19: Aeolian vibration	61
24.1	Object	61
24.2	Sample	61
24.3	Apparatus	61
24.4	Procedure	62
24.5	Requirements	63
24.6	Details to be specified	63
25	Method E20: Cable coiling performance	64
25.1	Object	64
25.2	Sample	64
25.3	Apparatus	64
25.4	Procedure	64
25.5	Requirements	65
25.6	Details to be specified	65
26	Method E21: Sheath pull-off force for optical fibre cable for use in patch cords	65
26.1	Object	65
26.2	General	65
26.3	Sample	65
26.4	Apparatus	65
26.4.1	General	65
26.4.2	Tensile test rig	65
26.4.3	Recording equipment	66
26.4.4	Stripping tools	66
26.4.5	Pulling	66
26.4.6	Cable anchor	66
26.5	Procedure	66
26.6	Requirements	66
26.7	Details to be specified	66
27	Method E22: Buffered fibre movement under compression in optical fibre cables for use in patch cords	68
27.1	Object	68
27.2	Sample	68
27.3	Apparatus	68
27.4	Procedure	69
27.5	Requirements	69
27.6	Details to be specified	69
28	Method E23: Microduct route verification test	70
28.1	Object	70

28.2	General.....	70
28.3	Sample	70
28.4	Apparatus	70
28.5	Procedure	71
28.6	Requirements	71
28.7	Details to be reported	71
29	Method E24: Installation test for microduct cabling	71
29.1	Object.....	71
29.2	General.....	71
29.3	Sample	71
29.4	Apparatus	71
29.5	Procedure	72
29.6	Requirements	72
29.7	Details to be specified.....	72
29.8	Details to be reported	73
30	Method E25: Rip cord functional test	73
30.1	Object.....	73
30.2	Sample	74
30.3	Apparatus	74
30.4	Procedure	74
30.5	Requirements	74
30.6	Details to be specified.....	74
30.7	Details to be reported	75
31	Method E26: Galloping	75
31.1	Object.....	75
31.2	Sample	75
31.3	Apparatus	75
31.4	Procedure	76
31.5	Requirements	76
31.6	Details to be specified.....	76
32	Method E27: Indoor simulated installation test.....	77
32.1	General.....	77
32.1	Object.....	77
32.2	Sample	78
32.3	Apparatus	78
32.4	Procedure	80
32.5	Requirements	80
32.6	Details to be specified.....	81
33	Method E28: Cable and fibre mechanical reliability test	81
33.1	Object.....	81
33.2	Sample	81
33.3	Apparatus	81
33.4	Procedure	82
33.5	Requirements	82
33.6	Detail to be specified	82
34	Method E29: Straight midspan access to optical elements	83
34.1	Object.....	83
34.2	Apparatus	83

34.3	Sample	84
34.4	Procedure	84
34.4.1	General	84
34.4.2	Procedure 1	84
34.4.3	Procedure 2	85
34.4.4	Overview	86
34.5	Requirements	86
34.6	Details to be specified	86
35	Method E30: Coefficient of friction between cables	86
35.1	Object	86
35.2	Sample	87
35.3	Apparatus	87
35.4	Procedure	88
35.5	Requirement	89
35.6	Details to be specified	89
36	Method E31: Microduct inner clearance test: under consideration	89
37	Method E32: Creep behaviour tension test (for ADSS)	89
37.1	Object	89
37.2	Sample	89
37.3	Apparatus	90
37.4	Procedure	90
37.4.1	General procedure requirements	90
37.4.2	Procedure steps	91
37.5	Calculations	92
37.6	Details to be specified	93
37.7	Details to be reported	93
37.8	Additional information	93
38	Method E33: Multiple cable coiling and uncoiling performance	94
38.1	Object	94
38.2	Sample	94
38.3	Apparatus	94
38.4	Procedure	94
38.5	Requirements	95
38.6	Details to be specified	95
39	Method E34: Coefficient of dynamic friction between cables	95
39.1	Object	95
39.2	Sample	95
39.3	Apparatus	96
39.4	Procedure	96
39.5	Details to be specified	96
	Bibliography	97
	Figure 1 – Tensile performance measuring apparatus	16
	Figure 2 – Example of tensile performance measuring apparatus using transfer devices and chuck drums	17
	Figure 3 – Typical test set-up for tests E2A and E2B method 1	19
	Figure 4 – Typical test set-up for test E2B, apparatus 2	20
	Figure 5 – Apparatus for crush test, Method E3A, details of plate/plate option	22

Figure 6 – Apparatus for crush test, Method E3B, details of plate/mandrel option	23
Figure 7 – Impact test	26
Figure 8 – Repeated bending test for cable/connector assembly	32
Figure 9 – Cable torsion apparatus	35
Figure 10 – Cable torsion apparatus with tension applied	35
Figure 11 – Alternative cable torsion apparatus with tension applied.....	35
Figure 12 – Flexing apparatus.....	37
Figure 13 – Kink test.....	38
Figure 14 – Bend test apparatus	40
Figure 15 – Method E13B test set-up	45
Figure 16 – Drop weight incorporating shot support pin.....	46
Figure 17 – Alternative drop weight and shot support pin	46
Figure 18 – Bleeding and evaporation test set-up	46
Figure 19 – Method E17A – Test set-up	54
Figure 20 – Example of results of applied force and displacement	54
Figure 21 – Method E17B – Test set-up	54
Figure 22 – Method E17C – Test set-up	55
Figure 23 – Single-bend.....	57
Figure 24 – S-bend	58
Figure 25 – Partial-bend	61
Figure 26 – Partial-bend, multiple pulley	61
Figure 27 – Aeolian vibration test.....	64
Figure 28 – Schematic of test arrangement.....	67
Figure 29 – Example of pulling jig	67
Figure 30 – Cable sample preparation	68
Figure 31 – Test set-up for fibre movement under compression	70
Figure 32 – Schematic representation of test route, with leg-length L	73
Figure 33 – Cable galloping test	77
Figure 34 – Indoor simulated installation test installation simulation apparatus	79
Figure 35 – Mechanical reliability test apparatus.....	83
Figure 36 – Stapling and bending test fixture	80
Figure 37 – Concept of straight midspan access	83
Figure 38 – Straight midspan access – Procedure 1	85
Figure 39 – Straight midspan access – Procedure 2	86
Figure 40 – Coefficient of friction test apparatus (drum test)	88
Figure 41 – Tensile cycling test apparatus	90
Figure 42 – Control cable length arrangement.....	91
Figure 43 – Delimiting zero strain baseline for high load level and low load level	92
Figure 44 – Load applied on cable sample	92
Figure 45 – Strain of ADSS cable at high load as function of load cycles	93
Figure 46 – Coefficient of friction test apparatus (flat plate test).....	95

Table 1 – Condition of stripped samples	95
--	---------------

Table 2 – Typical test gauge length	33
Table 3 – Test values for cable galloping test schematic.....	77

This document is a preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OPTICAL FIBRE CABLES –

Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical 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 60794-1-21 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

DISCLAIMER

This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 60794-1-21 bears the edition number 1.1. It consists of the first edition (2015-03) [documents 86A/1638/FDIS and 86A/1655/RVD] and its amendment 1 (2020-03) [documents 86A/1975/FDIS and 86A/1990/RVD]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60794-1-21 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This first edition 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, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*
- IEC 60794-1-20, *Optical fibre cables – Part 1-20: Generic specification – Basic optical cable test procedures – General and definitions*
- IEC 60794-1-21, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*
- IEC 60794-1-22, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental tests methods*
- IEC 60794-1-23, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable elements tests methods*
- IEC 60794-1-24, *Optical fibre cables – Part 1-24: Generic specification – Basic optical cable test procedures – Electrical tests methods*

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

This standard is intended to be used in conjunction with IEC 60794-1-1.

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 the base publication and its amendment 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.

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.

INTRODUCTION to Amendment

This Amendment adds new test methods and revises existing ones in a timely fashion until the next full revision of IEC 60794-1-21:2015.

Both the E-series numbering of the test methods, clause numbers, figures and equations of the technical section are aligned with IEC 60794-1-21:2015.

As part of the ongoing rationalization of the test methods specification set, several tests of IEC 60794-1-21 were determined to be more properly aligned with others of the set and have been moved. To that end, the proposed text to affect these moves has been inserted in this document.

Clause 7 has been redesignated as a cable element test method. It has been moved to IEC 60794-1-23 Ed2 and given the test method number G10A.

Clause 8 has been redesignated as a cable element test method. It has been moved to IEC 60794-1-23 Ed2 and given the test method number G10B.

Clause 18 has been redesignated as an environmental test method. It has been moved to IEC 60794-1-22 Ed2 and given the test method number F16.

Clause 19 has been redesignated as a cable element test method. It has been moved to IEC 60794-1-23 Ed2 and given the test method number G9.

OPTICAL FIBRE CABLES –

Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical test methods

1 Scope and object

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 mechanical requirement performance.

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

~~General requirements and definitions are given in IEC 60794-1-20 and a complete reference guide to test method of all types in the IEC 60794-1-2.~~

See IEC 60794-1-2 for general requirements and definitions and for a complete reference guide to test methods of all types.

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 60227-2, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60793-1-22:2001, *Optical fibres – Part 1-22: Measurement methods and test procedures – Length measurement*

IEC 60793-1-32:2010, *Optical fibres – Part 1-32: Measurement methods and test procedures – Coating strippability*

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

IEC 60793-1-46:2001, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

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

IEC 60794-1-2:2013, *Optical fibre cables – Part 1-2: Generic specification – Cross reference table for optical cable test procedures*

IEC 60794-1-20:2014, *Optical fibre cables – Part 1-20: Generic specification – Basic optical cable test procedures – General and definitions*

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

IEC TR 62691, *Guide to the installation of optical fibre cables*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

3 Method E1: Tensile performance

3.1 Object

This test method applies to optical fibre cables which are tested at a particular tensile strength in order to examine the behaviour of the attenuation and/or the fibre elongation strain as a function of the load on a cable which may occur during installation and operation. This method is intended to be non-destructive.

3.2 Sample length

Length under tension ≥ 50 m unless otherwise defined in the relevant specification. For cables requiring specialized anchoring devices (e.g. OPGW, all-dielectric self-supporting (ADSS), heavy wire armored cables, etc.), the minimum length shall be 25 m.

Short lengths in the tensile test will adversely affect the accuracy of the measurement. The lengths shown above are the recommended minimum lengths for this test.

Total sample length is longer than the length under tension to allow for clamping and connection to test equipment.

3.3 Apparatus

The apparatus consists of

- a) an attenuation measuring apparatus for the determination of attenuation changes (see IEC 60793-1-40), and/or a fibre elongation strain measuring apparatus (see IEC 60793_1_22:2001, Method C: Fibre elongation);
- b) a tensile strength measuring apparatus which is able to accommodate the minimum length to be tested. Transfer devices may be used for testing longer samples under tension (see Figure 2). The diameters of sheaves in the transfer device shall be no smaller than the minimum bending diameter of the cable under test; typically 1 m diameter;
- c) a load cell with a maximum error of ± 3 % of its maximum range;
- d) a clamping device to secure all cable components at the ends of the length under test: care should be taken that the specific method of capturing the cable components does not affect the results. A mandrel is frequently an appropriate device, with a diameter typically 1 m, but not less than the minimum bending diameter specified for the cable;
- e) if required, mechanical or electrical means for measuring the cable load or elongation, per the detail specification shall be provided.

Examples of suitable apparatus are shown in Figure 1 and Figure 2.