



DPC: 15 / 30327747 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: + 44 (0)20 8996 9000

Fax: + 44 (0)20 8996 7400

www.bsigroup.com

Date: 01 July 2015

Origin: International

Latest date for receipt of comments: 30 September 2015

Project No. 2015/01805

Responsible committee: PEL/213 Cable management

Interested committees:

Title: Draft BS EN 61537 Cable management - Cable tray systems and cable ladder systems

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 30 September 2015**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: + 44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Committee Secretary: **Committee Service Centre (BSI)**
Direct tel: **020 8996 7009**
E-mail: **csc@bsigroup.com**

Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent standard. There is a high probability that this text could be adopted by CENELEC as a reference document for harmonization or as a European Standard. Recipients of this draft are requested to comment on the text bearing in mind this possibility.

UK Vote

Please indicate whether you consider the UK should submit a negative (with reasons) or positive vote on this draft.

Submission of Comments

- The guidance given below is intended to ensure that all comments receive efficient and appropriate attention by the responsible BSI committee. **Annotated drafts are not acceptable and will be rejected.**
- All comments must be submitted, preferably electronically, to the Responsible Committee Secretary at the address given on the front cover. Comments should be compatible with version 6.0 or version 97 of Microsoft Word for Windows, if possible; otherwise comments in ASCII text format are acceptable. **Any comments not submitted electronically should still adhere to these format requirements.**
- All comments submitted should be presented as given in the example below. Further information on submitting comments and how to obtain a blank electronic version of a comment form are available from the BSI website at: <http://drafts.bsigroup.com/>

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	-------------------------------

1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



23A/776/CD

COMMITTEE DRAFT (CD)

IEC/TC or SC: SC 23A		Project number IEC 61537 Ed. 3	
Title of TC/SC: Cable Management Systems		Date of circulation 2015-06-26	Closing date for comments 2015-10-30
Also of interest to the following committees		Supersedes document 23A/775/RR	
Proposed horizontal standard ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the TC/SC secretary			
Functions concerned: ☒ Safety ☐ EMC ☐ Environment ☐ Quality assurance			
Secretary: Raj Vagdia		THIS DOCUMENT IS STILL UNDER STUDY AND SUBJECT TO CHANGE. IT SHOULD NOT BE USED FOR REFERENCE PURPOSES. RECIPIENTS OF THIS DOCUMENT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.	

Title:

IEC 61537 Ed. 3: Cable management - Cable tray systems and cable ladder systems

(Titre) :

IEC 61537 Ed. 3: Systèmes de câblage – Systèmes de chemin de câbles et systèmes d'échelle à câbles

Introductory note

Due to the number of significant changes, this CD is circulated in track changed format for a 4 month commenting period.

Copyright © 2015 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

CONTENTS

1	Scope	7
2	Normative references	7
3	Terms and definitions	9
4	General requirements	12
5	General conditions for tests	12
6	Classification	14
7	Marking and documentation	18
8	Dimensions	22
9	Construction	23
10	Mechanical properties	24
11	Electrical properties	87
12	Thermal properties	97
13	Fire hazards	97
14	External influences	102
15	Electromagnetic compatibility (EMC)	107
	Annex A (informative) Sketches of typical cable tray lengths and cable ladder lengths	108
	Annex B (informative) Sketches of typical support devices	109
	Annex C (informative) Protective Earth (PE) function	111
	Annex D (normative) Methods of applying and distributing a UDL for SWL tests using load distribution plates	117
	Annex E (informative) Typical methods of applying a UDL for SWL tests	127
	Annex F Not Used	129
	Annex G (informative) Example for clarification of allowed creep	132
	Annex H (informative) Information for a safe installation of pendants with cantilever brackets	133
	Annex I (informative) Summary of compliance checks	135
	Annex J (normative) Compliance checks to be carried out for cable tray systems and cable ladder systems already complying with IEC 61537:2006	139
	Annex K (informative) Summary of the number of samples required for tests	143
	Annex L (informative) Illustrative flow chart for the SWL tests	145
	Annex M (Normative) Application of a point load to a support	152
	Figure 1 – Flame propagating symbol	18
	Figure 2 – Piston for durability of marking test	20
	Figure 3 – Safe working load test – General arrangement	26
	Figure 4 – Load and temperature diagrams with respect to time for test 10.2.1.3	30
	Figure 5 – Test type I	35
	Figure 6 – Test type II	35
	Figure 7 – Test type III	36
	Figure 8 – Test type IV	37
	Figure 9 – Safe working load for single span test	39

Figure 10 – Load positioning mounted vertical plane running horizontal	41
Figure 11 – Example of a hinge connector for the load.....	41
Figure 12 – Test conditions mounted in the vertical plane running horizontally	44
Figure 13 – Test arrangements for lengths mounted vertically running vertically	47
Figure 14 – Safe working load test for fittings	51
Figure 15 – Test set-up for cantilever brackets (Horizontal plane)	60
Figure 16 – Test on cantilever bracket mounted vertically running vertically	63
Figure 17 – Test set-up Pendants for cantilever brackets.....	65
Figure 18 – Test set up for centrally supported bracket for specified systems with uneven loading.....	71
Figure 19 – Test set up for centrally supported brackets for general use with uneven loading (option 1)	74
Figure 20 – Test set up for centrally supported brackets for general use with uneven loading (option 2)	76
Figure 21 – Optional Test set up for centrally supported brackets intended for general use with even loading	78
Figure 22 – Test set-up for a “C shape” ceiling support.....	80
Figure 23 – Test set-up for trapeze system designed for supporting cable ladder only.....	81
Figure 24 – Test set-up for trapeze system designed for supporting cable tray or both cable tray and cable ladder.....	82
Figure 25 – Test set-up for trapeze systems for unevenly distributed load (a single point load)	83
Figure 26 – Impact test stroke arrangement.....	87
Figure 27 – Test set-up impedance along the length	89
Figure 28 – Test set-up impedance across the width.....	90
Figure 29 – Test set-up impedance of a joint	93
Figure 30 – Test set-up impedance of an earthing terminal or termination	93
Figure 31 – Test set-up impedance of the connection between an access cover and a cable tray or cable ladder	94
Figure 32 – Typical arrangement of surface resistivity test	96
Figure 33 – Arrangement for the flame test.....	100
Figure 34 – Enclosure for the flame test	101
Figure A.1 – Solid bottom cable tray lengths	108
Figure A.2 – Perforated cable tray lengths	108
Figure A.3 – Mesh cable tray lengths	108
Figure A.4 – Cable ladder lengths.....	108
Figure B.1 – Cantilever brackets.....	109
Figure B.2 – Pendants.....	110
Figure B.3 – Fixing brackets	110
Figure C.1 – Test arrangement for the test of 5s current carrying capability	116
Figure D.1 – Examples of distribution load points across the width.....	118
Figure D.2 – Typical arrangement of load distribution plates	120
Figure D.3 – Example of equispaced point loads along the length	121
Figure D.4 – Examples of test load distribution on cable ladder lengths.....	122
Figure D.5 – n rungs.....	123

Figure D.6 – Example of loading on three rungs	124
Figure D.7 – Two rungs	125
Figure D.8 – One rung	125
Figure D.9 – Cantilever with extension	126
Figure E.1 – Point loads applied through a mechanical linkage	127
Figure E.2 – Point loads applied individually	128
Figure E.3 – Block loads	128
Figure G.1 – Example for clarification of allowed creep	132
Figure H.1 – Forces on pendant and cantilever bracket	133
Figure H.2 – Illustration of the safe area	134
Figure M.1 – Maximum area of the applied point load to a support	152
Table 1 – classification for resistance against corrosion	15
Table 2 – Minimum temperature classification	17
Table 3 – Maximum temperature classification	17
Table 4 – Perforation base area classification	17
Table 5 – Free base area classification	18
Table 6 – Use of Test type IV	37
Table 7 – Load distribution plates for the SWL test of the cable tray lengths and cable ladder lengths mounted in the vertical plane running horizontally	40
Table 8 – Impact test values	84
Table 9 – System component compliance and classification for resistance against corrosion	103
Table 10 – Zinc coating thickness of reference materials	104
Table C.1 - Calculated and declared cross sectional area of the system used for the PE function equivalent to copper conductors	114
Table D.1 – Number of point loads across the width	117
Table D.2 – Number of point loads along the length	119
Table I.1 – Summary of compliance checks	135
Table J.1 – Required compliance checks	139
Table K.1 – Summary of the number of samples required for tests	143

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CABLE MANAGEMENT – CABLE TRAY SYSTEMS AND CABLE LADDER SYSTEMS

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 61537 has been prepared by subcommittee 23A: Cable management systems, of IEC technical committee 23: Electrical accessories.

This third edition cancels and replaces the second edition published in 2006. This edition constitutes a technical revision. It incorporates additional tables, annexes and figures as well as revisions to such that appeared in the second edition. In places, the text has been substantially altered including:

- new, repositioned and renumbered figures,
- revised classification for corrosion,
- revised SWL test types and procedures,
- new tests for lengths mounted vertical running horizontal and mounted vertical running vertical.
- tests for support devices: cantilevers, pendants, C-shaped ceiling supports and trapeze systems,
- new and revised annexes including use of tray as a protective earth conductor.

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

FDIS	Report on voting

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.

The following differences exist in some countries:

In the USA it is permitted to use cable tray systems and cable ladder systems as a PE conductor, in which case national wiring regulations have to be adhered to.

In France it is not permitted to use cable tray systems and cable ladder systems as a PE conductor.

In France the use of flame propagating cable tray and cable ladder systems is not permitted.

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.

CABLE MANAGEMENT – CABLE TRAY SYSTEMS AND CABLE LADDER SYSTEMS

1 Scope

This International Standard specifies requirements and tests for cable tray systems and cable ladder systems intended for the support and accommodation of cables and possibly other electrical equipment in electrical and/or communication systems installations. Where necessary, cable tray systems and cable ladder systems may be used for the division or arrangement of cables into groups.

This standard does not apply to conduit systems, cable trunking systems and cable ducting systems or any current-carrying parts.

NOTE Cable tray systems and cable ladder systems are designed for use as supports for cables and not as enclosures.

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 60068-2-75:1997, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

~~IEC 60364-5-52:2001, *Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems*~~

IEC 60364-5-52:2009 *Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems*

~~IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*~~

IEC 60695-2-11:2014, *Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

~~IEC 60695-11-2:2003, *Fire hazard testing – Part 11-2: Test flames – 1 kW nominal pre-mixed flame – Apparatus, confirmatory test arrangement and guidance*~~

IEC 60695-11-2:2013, *Fire hazard testing - Part 11-2: Test flames - 1 kW nominal pre-mixed flame - Apparatus, confirmatory test arrangement and guidance*

ISO 1461:1999/2009, *Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods*

ISO 2081:2008, *Metallic and other inorganic coatings – Electroplated coatings of zinc with supplementary treatments on iron or steel*

ISO 2178:1982, *Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method*

ISO 2808:1997/2007, *Paints and varnishes - Determination of film thickness*

ISO 3575: 2011, *Continuous hot dipped galvanised carbon steel sheet of commercial and drawing qualities*

ISO 4046 (all parts), *Paper, board, pulp and related terms – Vocabulary*

ISO 9227:~~1990~~[2012](#), *Corrosion tests in artificial atmospheres – Salt spray tests*

ISO 10289:1999, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates - Rating of test specimens and manufactured articles subjected to corrosion tests*

3 Terms and definitions

For the purpose of this document, the following definitions apply.

3.1

cable tray system or cable ladder system

assembly of cable supports consisting of cable tray lengths or cable ladder lengths and other system components

3.2

system component

part used within the system. System components are as follows:

- a) cable tray length or cable ladder length
- b) cable tray fitting or cable ladder fitting
- c) support device
- d) mounting device
- e) system accessory

NOTE System components may not necessarily be included together in a system. Different combinations of system components may be used.

3.3

cable tray length

system component used for cable support consisting of a base with integrated side members or a base connected to side members

NOTE Typical examples of cable tray types are shown in Figures A.1 to A.3.

3.4

cable ladder length

system component used for cable support consisting of supporting side members, fixed to each other by means of rungs

NOTE Typical examples of cable ladder types are shown in Figure A.4.

3.5

fitting

system component used to join, change direction, change dimension or terminate cable tray lengths or cable ladder lengths

NOTE Typical examples are couplers, bends, tees, crosses.

3.6

cable runway

assembly comprised of cable tray lengths or cable ladder lengths and fittings only

3.7

support device

system component designed to provide mechanical support and which may limit movement of a cable runway

NOTE Typical examples of support devices are shown in Annex B.

3.8

mounting device

system component used to attach or fix other devices to the cable runway

3.9**apparatus mounting device**

part used to accommodate electrical apparatus like switches, socket outlets, circuit- breakers, telephone outlets, etc. which can be an integral part of the electrical apparatus and which is not part of the cable tray system and cable ladder system

3.10**system accessory**

system component used for a supplementary function such as cable retention, and covers, etc.

3.11**BLANK****3.12****metallic system component**

system component which consists of metal only. Screws for connections and other fasteners are not considered

3.13**non-metallic system component**

system component which consists of non-metallic material only. Screws for connections and other fasteners are not considered

3.14**composite system component**

system component which consists of both metallic and non-metallic materials. Screws for connections and other fasteners are not considered

3.15**non-flame propagating system component**

system component which may catch fire as a result of an applied flame and the resulting flame does not propagate and extinguishes itself within a limited time after the applied flame is removed

3.16**external influence**

presence of water, oil, building materials, corrosive and polluting substances, and external mechanical forces such as snow, wind, and other environmental hazards

3.17**safe working load****SWL**

maximum load that can be applied safely in normal use

3.18**uniformly distributed load****UDL**

load applied evenly over a given area

NOTE Methods of applying uniformly distributed loads are shown in Annexes D and E.

3.19**span**

distance between the centers of two adjacent support devices

3.20**internal fixing device**

device for joining and/or fixing system components to other system components. This device is part of the system but not a system component

NOTE Typical examples are nuts and bolts.

3.21**external fixing device**

device used for fixing a support device to walls, ceilings or other structural parts. This device is not part of the system

NOTE Typical examples are anchor bolts.

3.22**base area of cable tray length or cable ladder length**

plan area available for cables

3.23**free base area**

part of the base area which is open to the flow of the air. Holes in cable ladder rungs are included in the free base area

3.24**load distribution plate**

means through which a point load is applied to the sample for testing purposes

3.25**product type**

~~group of system components which vary in the case of~~

- ~~— cable runways in the width only~~
- ~~— cantilever brackets in the length only~~
- ~~— pendants in the length only~~

~~NOTE Different jointing methods or different jointing positions constitute different product types.~~

A group of system components for which only one dimension is allowed to be changed as specified below:

- the width of a cable tray or cable ladder length
- the length of a cantilever bracket
- the length of a centrally supported bracket
- the length of a pendant
- the length of a trapeze support
- the width of a C-shaped ceiling support

When a product type comprises a combination of the above system components then only one dimension at a time can be changed.

Note Different jointing methods or different jointing positions constitute different product types

3.26**topological shape**

~~group of product types which varies in thickness and height only~~

3.27**transverse deflection**

vertical deflection across the width of the base area, omitting the longitudinal deflection, when mounted horizontally

3.28**Localized weakness**

Area of the cable tray or cable ladder length which, due to the design has

- a lower shearing resistance than the medium shearing resistance of the length
- a lower resistance to the bending moment than the medium resistance to the bending moment

NOTE Typical Example of localized weakness is the perforation of side members to accommodate the rungs of cable ladder

3.29**Organic coating**

coating (such as paint, lacquer or powder coating) in which the principal ingredients are derived from some compound of carbon

3.30**Pendant**

vertical suspension device

3.31**Trapeze support**

Horizontal supporting device supported by two or more pendants

3.32**Trapeze system**

Assembly comprising pendants and a trapeze support

3.33**Centrally supported bracket**

Horizontal supporting device supported in the centre by a single pendant

4 General requirements

Cable tray systems and cable ladder systems shall be so designed and so constructed that in normal use, when installed according to the manufacturer's or responsible vendor's instructions, they ensure reliable support to the cables contained therein. They shall not impose any unreasonable hazard to the user or cables.

Compliance is checked by carrying out all the relevant tests specified in this standard.

The system components shall be designed to withstand the stresses likely to occur during recommended transport and storage.

Cable tray systems and cable ladder systems according to this standard are not intended to be used for human support.

5 General conditions for tests

5.1 Tests according to this standard are type tests.

5.2 Unless otherwise specified, tests shall be carried out with cable tray system components or cable ladder system components assembled and installed as in normal use according to the manufacturer's or responsible vendor's instructions.

5.3 Tests on non-metallic system components or composite system components shall not commence earlier than 168 h after manufacture.

5.4 Unless otherwise specified, tests shall be carried out at an ambient temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

Unless otherwise specified, all tests are carried out on new samples.

5.5 When toxic or hazardous processes are used, precautions should be taken to safeguard the person performing the test.

5.6 Unless otherwise specified, three samples are subjected to the tests and the requirements are satisfied if all the tests are met.

If ~~only~~ one of the samples does not satisfy a test due to an assembly or a manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated and also the tests which follow shall be made in the required sequence on another full set of samples, all of which shall comply with the requirements.

NOTE The applicant, when submitting a set of samples, may also submit an additional set of samples which may be necessary, should one sample fail. The testing station will then, without further request, test the additional set of samples and will reject only if a further failure occurs. If the additional set of samples is not submitted at the same time, the failure of one sample will entail rejection.

5.7 If the relative humidity of the atmosphere has a significant effect on the classified properties of the samples under test, the manufacturer or responsible vendor shall declare this information.

5.8 If a system component or system is coated in paint or any other substance which is likely to affect its classified properties, then the relevant tests in this standard shall be performed on the coated sample.

5.9 For the SWL test specified in subclauses from 10.2 to 10.8, deflections shall be measured by instruments with a resolution of 0,5 mm or better and a precision of 0,1 mm or better in all the range of measurement.

The total applied load for each of the SWL tests shall have a tolerance of 0 to + 3 %.

5.10 to avoid the possibility of false deflection results arising because of slippage between the fixing device and the test sample, the sample shall be positioned either at the limit of its adjustment, which prevents slippage or marked so that any slippage can be easily identified during the test.

6 Classification

6.1 According to material

- 6.1.1 Metallic system component
- 6.1.2 Non-metallic system component
- 6.1.3 Composite system component

6.2 According to resistance to flame propagation

- 6.2.1 Flame propagating system component
- 6.2.2 Non-flame propagating system component

6.3 According to electrical continuity characteristics

- 6.3.1 Cable tray system or cable ladder system without electrical continuity characteristics
- 6.3.2 Cable tray system or cable ladder system with electrical continuity characteristics

~~NOTE—For cable tray systems and cable ladder systems with PE function, see Annex C.~~

6.3.3 Cable tray system or cable ladder system with electrical continuity characteristics and with PE function

NOTE: For metallic cable tray system and metallic cable ladder system with PE function, see annex C for requirements and tests.

6.4 According to electrical conductivity

- 6.4.1 Electrically conductive system component
- 6.4.2 Electrically non-conductive system component

6.5 According to resistance against corrosion

If system components within the cable tray system or cable ladder system have different classifications, then the manufacturer or responsible vendor shall declare all relevant classifications.

Within this clause, only normal atmospheric conditions are considered; special local environmental conditions are not considered in this standard.

6.5.1 Non-metallic system components

6.5.2 System component made of steel with metallic ~~finishes~~ coating or stainless steel

~~Resistance against corrosion is classified according to Table 1. This table lists the most commonly used finishes and materials. These are to be used as a reference against which other finishes or materials are measured for classification purposes.~~

Resistance against corrosion is classified according to Table 1. This table lists some of the commonly used finishes and materials for classification purposes. The classification is an indication only and is used for comparison purposes and should not be used to determine life expectancy of the coating.

NOTE—To indicate the life to first maintenance refer to informative Annex K.

NOTE To indicate the life to first maintenance for zinc coated products refer to ISO 14713 Part 1 and Part 2.

Table 1 – classification for resistance against corrosion

Class	Reference- Material and Finish
0 ^a	None
1	Electroplated to a minimum thickness of 5 µm
2	Electroplated to a minimum thickness of 12 µm
3	Pre-galvanised to grade 275 to EN 10327 and EN 10326
4	Pre-galvanised to grade 350 to EN 10327 and EN 10326
5	Post-galvanised to a zinc mean coating thickness (minimum) of 45 µm according to ISO 1461 for zinc thickness only
6	Post-galvanised to a zinc mean coating thickness (minimum) of 55 µm according to ISO 1461 for zinc thickness only
7	Post-galvanised to a zinc mean coating thickness (minimum) of 70 µm according to ISO 1461 for zinc thickness only
8	Post-galvanised to a zinc mean coating thickness (minimum) of 85 µm according to ISO 1461 for zinc thickness only (usually high silicon steel)
9A	Stainless steel manufactured to ASTM: A 240/A 240M — 95a designation S30400 or EN 10088 grade 1-4301 without a post-treatment ^b
9B	Stainless steel manufactured to ASTM: A 240/A 240M — 95a designation S31603 or EN 10088 grade 1-4404 without a post-treatment ^b
9C	Stainless steel manufactured to ASTM: A 240/A 240M — 95a designation S30400 or EN 10088 grade 1-4301 with a post-treatment ^b
9D	Stainless steel manufactured to ASTM: A 240/A 240M — 95a designation S31603 or EN 10088 grade 1-4404 with a post-treatment ^b
^a For materials which have no declared corrosion resistance classification.	
^b The post-treatment process is used to improve the protection against crevice crack corrosion and the contamination by other steels.	

Class	Salt spray test duration h		Reference- Material and Finish
0	-		None ^a
1	24	or	Electroplated to a minimum thickness of 5 µm according to ISO 2081
2	96	or	Electroplated to a minimum thickness of 12 µm according to ISO 2081
3	155	or	Pre-galvanised to grade 275 to either ISO 3575 or EN 10346
4	195	or	Pre-galvanised to grade 350 to either ISO 3575 or EN 10346
5	450	or	Post-galvanised to a zinc mean coating thickness (minimum) of 45 µm according to ISO 1461 for zinc thickness only
6	550	or	Post-galvanised to a zinc mean coating thickness (minimum) of 55 µm according to ISO 1461 for zinc thickness only
7	700	or	Post-galvanised to a zinc mean coating thickness (minimum) of 70 µm according to ISO 1461 for zinc thickness only
8	850	or	Post-galvanised to a zinc mean coating thickness (minimum) of 85 µm according to ISO 1461 for zinc thickness only (usually high silicon steel)
9	1000		No reference
10	1250		No reference
11	1500		No reference

<u>12</u>	<u>2000</u>		<u>No reference</u>
<u>13</u>	<u>> 2500</u>		<u>No reference</u>
<u>A</u>	<u>-</u>		<u>Stainless steel manufactured to ASTM: A 240/A 240M – 95a designation S30400 or EN 10088 grade 1-4301 without a post-treatment^b</u>
<u>B</u>	<u>-</u>		<u>Stainless steel manufactured to ASTM: A 240/A 240M – 95a designation S30400 or EN 10088 grade 1-4301 with a post-treatment^b</u>
<u>C</u>	<u>-</u>		<u>Stainless steel manufactured to ASTM: A 240/A 240M – 95a designation S31603 or EN 10088 grade 1-4404 without a post-treatment^b</u>
<u>D</u>	<u>-</u>		<u>Stainless steel manufactured to ASTM: A 240/A 240M – 95a designation S31603 or EN 10088 grade 1-4404 with a post-treatment^b</u>
<u>E</u>	<u>-</u>		<u>Stainless steel with grade reference other than A, B, C, D</u>
^a <u>For materials which have no declared corrosion resistance classification.</u>			
^b <u>The post-treatment process is used to improve the protection against crevice crack corrosion and the contamination by other steels according to ASTM: A380-99 (reapproved 2005) or equivalent EN, ISO, etc. standard.</u>			

Table 1 shall be read as a table in which a classification is given to the most common materials and finishes used for the manufacturing of metallic cable trays and ladders and components.

- If a material or finish is referenced in Table 1, a classification without testing is obtained;
- For materials or finishes made of steel with coating and not referenced in Table 1, a salt spray test is required. The classification obtained shall be the one corresponding to the duration of the salt spray test;
- The classification of a material or finish referenced in Table 1 can be higher if this material or finish passes a salt spray test for a longer duration. The classification obtained shall be the one corresponding to the longer duration of the salt spray test.

Example:-

A sample electroplated to a minimum thickness of 12 µm according to ISO 2081 is classified as class 2 according to Table 1, equivalent to 96 hours. If the sample is tested in accordance with 14.2.3 for a duration of 195 hours and passes the test then the finish may be classified as class 4.

6.5.3 System components made from ~~other metals~~ aluminium alloys

Under consideration

6.5.4 System component with organic coating intended to provide resistance against corrosion

Under consideration

Resistance to corrosion is classified according to Table 1.

6.5.4.1 In accordance with Table 1 and when the degree of corrosion around a scribe is measured according to ISO 4628-8

6.5.4.2 In accordance with Table 1 and when the degree of corrosion of the surface is measured according to ISO 4628-3

6.6 According to temperature

6.6.1 Minimum temperature for the system component as given in Table 2

Table 2 – Minimum temperature classification

Minimum transport, storage, installation and application temperature °C
+5
–5
–15
–20
–40
–50

6.6.2 Maximum temperature for the system component as given in Table 3

Table 3 – Maximum temperature classification

Maximum transport, storage, installation and application temperature °C
+40
+60
+90
+105
+120
+150

6.7 According to the perforation in the base area of the cable tray length as given in Table 4

Table 4 – Perforation base area classification

Classification	Perforation in the base area
A	Up to 2 %
B	Over 2 % and up to 15 %
C	Over 15 % and up to 30 %
D	More than 30 %
NOTE Classification D relates to IEC 60364-5-52, Subclause A.52.6.2, second paragraph B.52.6.2 b).	

6.8 ~~According to the free base area of cable ladder length as given in Table 5~~
According to the free base area of mesh cable tray length or cable ladder length as given in Table 5

Table 5 – Free base area classification

Classification	Free base area
X	Up to 80 %
Y	Over 80 % and up to 90 %
Z	More than 90 %
NOTE Classification Z relates to IEC 60364-5-52, Subclause A.52.6.2, third paragraph, B.52.6.2 c).	

6.9 ~~6.9~~ **According to impact resistance**

~~6.8.1~~ **6.9.1** System component offering impact resistance up to 2 J

~~6.8.2~~ **6.9.2** System component offering impact resistance up to 5 J

~~6.8.3~~ **6.9.3** System component offering impact resistance up to 10 J

~~6.8.4~~ **6.9.4** System component offering impact resistance up to 20 J

~~6.8.5~~ **6.9.5** System component offering impact resistance up to 50 J

7 Marking and documentation

7.1 Each system component shall be durably and legibly marked with

- the manufacturer's or responsible vendor's name or trade mark or identification mark;
- a product identification mark which may be, for example, a catalogue number, a symbol, or the like.

When system components other than cable tray lengths and cable ladder lengths are supplied in a package, the product identification mark may be, as an alternative, marked on the smallest package unit.

- [the flame propagating symbol in accordance with IEC 60417-6180, as shown in Figure 1 below, for flame propagating system components.](#)



Figure 1 – Flame propagating symbol

[Flame propagating system components shall be clearly identified as being flame propagating on the system component and on the smallest supplied package or label.](#)

When it is not feasible to have this identification mark on small system components, due to the small size of the item, it is sufficient to place this identification mark on the smallest supplied package.

NOTE 1—The necessity to mark flame-propagating system components is under consideration.

~~Compliance is checked by inspection and, for marking on the product, by rubbing by hand for 15 s with a piece of cotton cloth soaked with water and again for 15 s with a piece of cotton cloth soaked with petroleum spirit.~~

Compliance is checked by inspection, using normal or corrected vision, without additional magnification and by rubbing the marking for 15 s with a piece of cotton cloth soaked with water and again for 15 s with a piece of cotton cloth soaked with n-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3).

NOTE 1 n-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3) is available from a variety of chemical suppliers as a high pressure liquid chromatography (HPLC) solvent.

When using the liquid specified for the test, precautions as stated in the relative material safety datasheet provided by the chemical supplier shall be taken to safeguard the laboratory technicians.

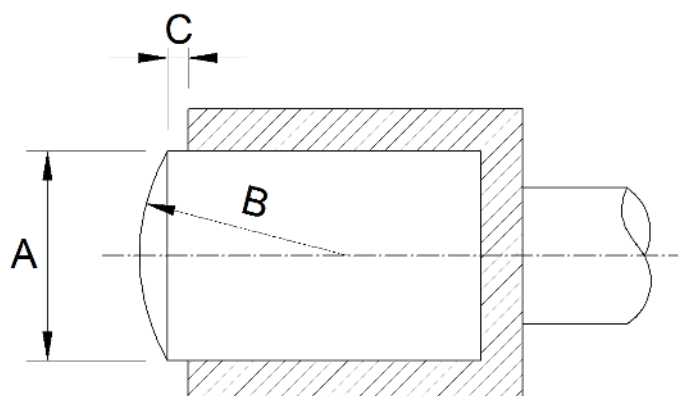
Laser marking directly on the product and marking made by moulding, pressing or engraving are not subjected to this test.

Products complying with a previous edition of the standard need not be tested again as this requirement does not have impact on the safety of the product.

The marking surface to be tested shall be dried before rubbing the marking with n-hexane 95 % solvent.

Rubbing shall commence immediately after soaking the piece of cotton, applying a compression force of (5 ± 1) N at a rate of about one cycle per second (a cycle comprising a forward and backward movement along the length of the marking). For markings longer than 20 mm, rubbing can be limited to a part of the marking, over a path of at least 20 mm length.

The compression force is applied by means of a test piston according to Figure 2 which is wrapped with cotton comprising of cotton wool covered by a piece of cotton medical gauze.



Key

<u>A</u>	<u>Diameter of the piston</u>	<u>(20 ± 1) mm</u>
<u>B</u>	<u>Radius of the piston head</u>	<u>(20 ± 1) mm</u>
<u>C</u>	<u>Gap between piston head and cylinder</u>	<u>(2 + 1-0) mm</u>

Figure 2 – Piston for durability of marking test

The test piston shall be made of an elastic material which is inert against the test liquids and has a Shore-A hardness of 47 ± 5 (for example synthetic rubber).

When it is not possible to carry out the test on the specimens due to the shape/size of the product, a suitable piece having the same characteristics as the product can be submitted to the test.

The test shall be carried out on one sample. If the sample does not satisfy the test, the test shall be repeated on two new samples, both of which shall comply with the requirements.

After the test, the marking shall be legible.

~~NOTE 2—Petroleum spirit is defined as the aliphatic solvent hexane with a content of aromatics of maximum 0,1 % volume, a kauributanol value of 29, an initial boiling point of 65 °C, a dry point of 69 °C and a specific gravity of approximately 0,68 kg/l.~~

~~NOTE 32~~ Marking may be applied, for example, by moulding, pressing, engraving, printing, adhesive labels, or water slide transfers.

~~NOTE 4—Marking made by moulding, pressing, or engraving is not subjected to the rubbing test.~~

7.2 If a system component can, by taking precautions, be stored and transported at a temperature outside the declared temperatures according to Tables 2 and 3, the manufacturer or responsible vendor shall declare the precautions and the alternative temperature limits.

Compliance is checked by inspection.

7.3 The manufacturer or responsible vendor shall provide in his literature all information necessary for the proper and safe installation and use of the cable tray system and cable ladder system. The SWL and impact resistance is valid for the whole temperature classification declared. The information shall include:

- a) instructions for the assembly and installation of system components and for the precautions required to avoid excessive transverse deflection, which could cause damage to the cables (see 5.2, 9.2, 10.3, 10.7, 10.8, and 14.1),
- b) thermal expansion properties and precautions to be taken, if necessary,
- c) relative humidity if it affects the classifications (see 5.7), classification according to Clause 6,
- d) relative humidity if it affects the classifications (see 5.7), classification according to Clause 6,
- e) information on holes or devices when provided for equipotential bonding (see 6.3.2) in particular when a specific electrical connection device is necessary,

- f) precautions for transport and storage outside the declared temperature classification, where applicable (see 7.2),
- g) product dimensions (see Clause 8),
- h) torque settings in Nm for screwed connections and internal fixing devices as well as threads, where applicable (see 9.3d) and 9.3.1),
- i) SWL in N/m for the cable tray lengths or cable ladder lengths for the declared span including joints, where applicable for one or more of the following installation methods (see 10.1),
 - i) mounted in the horizontal plane running horizontally on multiple spans (see 10.3)
 - ii) mounted in the horizontal plane running horizontally on a single span (see 10.4)
 - iii) mounted in the vertical plane running horizontally (see 10.5)
- j) SWL test type (see 10.3),
- k) end span limitations (see 10.3),
- l) position and type of coupling along the span, where applicable,
- m) SWL in N/m for cable tray lengths and cable ladder lengths mounted in the vertical plane running vertically, together with the supports used in the test, for the declared span V. The declaration shall include the distance C which is the maximum cable fixing distance for vertical installation and used in the test defined in clause 10.6, as shown in Figures xxxx
- kn) SWL in N/m for the fittings when not directly supported and the distance Y from the supports adjacent to the fittings (see 10.7),
- lo) fixing method for installing cable tray or cable ladder to the supports when declared for the test (see 10.3, 10.4 and 10.8.1),
- ~~m) SWL in N/m for the cable tray lengths or cable ladder lengths including joints, where applicable for one or more of the following installation methods (see 10.1):~~
 - ~~i) mounted in the horizontal plane running horizontally on multiple spans (see 10.3)~~
 - ~~ii) mounted in the horizontal plane running horizontally on a single span (see 10.4)~~
 - ~~iii) mounted in the vertical plane running horizontally (see 10.5)~~
 - ~~iv) mounted in the vertical plane running vertically (see 10.6),~~
- ~~np) SWL in N for cantilever brackets and if used for cable tray only (see 10.8.1),~~
- ~~o) SWL for pendants as a bending moment in Nm and/or as a force in N (see 10.8.2),~~
- g) SWL for pendants in Nm as a bending moment and/or in N as a force where applicable for one or more of the following installation methods(see 10.8.2):
 - i) for use with cable tray only
 - ii) for use with cable ladder only
 - iii) for use with both cable tray and cable ladder
- r) SWL in N for C shape ceiling supports and if used for cable tray only (see 10.8.2.3)
- s) the degree of uneven loading of a centrally supported bracket (see 10.8.2.4)
- ~~p) the appropriate material specification and environmental conditions, chemical environments or aggressive agents for which the product is suitable (see 14.2).~~

NOTE SWL information can be given in the form of a diagram, table, or similar.

Compliance is checked by inspection.

7.4 [For PE marking and documentation see annex C.](#)

8 Dimensions

The manufacturer or responsible vendor shall give the following information:

- the overall envelope of the cross-section of the cable tray length or cable ladder length;
- the width of the base area of cable tray length or cable ladder length;
- the height of the cable tray length or cable ladder length available for the accommodation of cables when a cover is fitted;
- the minimum internal radius of fittings available for the accommodation of cables;
- the dimensions of the perforations, and their arrangements on the cable tray lengths;
- the dimensions of the rungs including perforations, if any, and the centre line spacing of the rungs.

NOTE System components, such as fittings, when used as part of the system, may change the effective area available for the accommodation of cables.

Compliance is checked by inspection.

9 Construction

The same sample may be used for all the tests in this clause.

9.1 Surfaces of system components which are likely to come into contact with cables during installation or use shall not cause damage to the cables when installed according to the manufacturer's or responsible vendor's instructions.

Compliance is checked by inspection and, if necessary, by manual test.

9.2 Where the manufacturer or responsible vendor does not declare the use of gloves for installation purposes, then the surfaces of system components shall be safe for handling.

Compliance is checked by inspection and, if necessary, by manual test.

9.3 Screwed connections and other internal fixing devices shall be so designed to withstand the mechanical stresses occurring during installations according to the manufacturer's or responsible vendor's instructions and normal use. They shall not cause damage to the cable when correctly inserted.

Screwed connections can be either

- a) ISO metric threads, or
- b) a thread forming type, or
- c) a thread cutting type if suitable design provisions are made, or
- d) threads other than a) to c) as specified by the manufacturer or responsible vendor.

Compliance is checked by 9.3.1 or 9.3.2 or 9.3.3.

9.3.1 Sudden or jerky motions shall not be used to tighten reusable screwed connections. To test the screwed connection, it shall be tightened and removed

- *10 times for metal screwed connections in engagement with a thread of non-metallic material and for screwed connections of non-metallic material,*

or

- *5 times in all other cases.*

The test is carried out using a suitable screwdriver or spanner to apply the torque as specified by the manufacturer or responsible vendor.

After the test, there shall be no breakage or damage, that will impair the further use of the screwed connection.

9.3.2 Reusable connections other than screwed connections, for example push-on and clamping connections, shall be tightened and removed 10 times.

After the test, there shall be no damage to impair the further use of the reusable connections.

9.3.3 Non-reusable connections are checked by inspection and, if necessary, by manual test.

9.4 Any apparatus mounting device shall meet the requirement of the appropriate standard.

9.5 Cable tray lengths, when perforated, shall exhibit a regular perforation pattern over the base area.

Compliance is checked by inspection and measurement.

9.6 Cable ladder lengths shall exhibit a regular rung pattern over the base area.

Compliance is checked by inspection and measurement.

10 Mechanical properties

10.1 Mechanical strength

Cable tray systems and cable ladder systems shall provide adequate mechanical strength.

The main criterion for the SWL is safety in use of the product.

For the declared application, the manufacturer or responsible vendor shall declare the SWL to be tested

- in N/m for each type of cable tray length or cable ladder length at specified distances, preferably in spans of 0,5 m increments, between the support devices,
- in N/m for each type of fitting which is not directly supported by a support device,
- in N or N/m for each type of support device.

NOTE 1 This information can be given in the form of a diagram or table or similar.

NOTE 2 In the tests described below, deflection limits at the SWL for tray & ladder lengths are L/100 along the length and W/20 across the width, and deflection limits at the SWL for trapeze hangers, pendants & cantilever arms are L/20 up to a maximum of 30mm. These deflections limits are used for load tests in this standard as a method of assessing the SWLs. For some installations, severer deflection limits may apply, e.g. from installer specifications, or from specific contract requirements.

Compliance for cable runways is checked by carrying out the relevant tests according to the manufacturer's or responsible vendor's declaration as specified in 10.3, 10.4, 10.5, 10.6 and 10.7 on samples of the widest and narrowest width for each product type. For the intermediate widths the SWLs shall then be determined by interpolation of the test results. The alternative is to test only the widest product. For the tests specified in 10.3, 10.4 and 10.7, the SWL of an untested narrower width may be derived by multiplying the SWL of the tested widest width by the factor of the narrower width divided by the widest (tested) width.

Horizontal lengths running in the horizontal plane which are declared for use with both multiple span and single span applications must be tested in accordance with both 10.3 and 10.4.

Compliance for support devices is checked by carrying out the tests specified in 10.8.

NOTE 23 An overview of the SWL test procedure is shown in Annex L.

Cable tray system components and cable ladder system components shall withstand impacts occurring during transport, storage and installation.

Compliance is checked by the test specified in 10.9.

10.2 SWL test procedure

In 10.2.1 and 10.2.2, the general procedure and alternative procedures for particular cases are respectively described.

10.2.1 General procedure

Two tests shall be carried out:

- ~~minimum temperature test according to 10.2.1.1 at a minimum temperature declared by the manufacturer in accordance with Table 2 and tested in accordance with 10.2.1.1 or 10.2.1.3;~~
- ~~maximum temperature test according to 10.2.1.2 or 10.2.1.3 at a maximum temperature declared by the manufacturer in accordance with Table 3 and tested in accordance with 10.2.1.2 or 10.2.1.3.~~

NOTE For alternative test conditions, see 10.2.2.

10.2.1.1 Minimum temperature test

The test shall be carried out at minimum temperature declared according to the classification of Table 2. During this test, the uniformity of the temperature shall be maintained within the tolerance of $\pm 5^\circ \text{C}$, 0,25 m around the samples.

The mounted sample shall be conditioned for a minimum of 2 h at the minimum temperature before loading.

All loads shall be uniformly distributed over the length and width of the sample as shown in Annex D.

The load shall be applied in such a way that a UDL is ensured even in the case of extreme deformation of the sample.

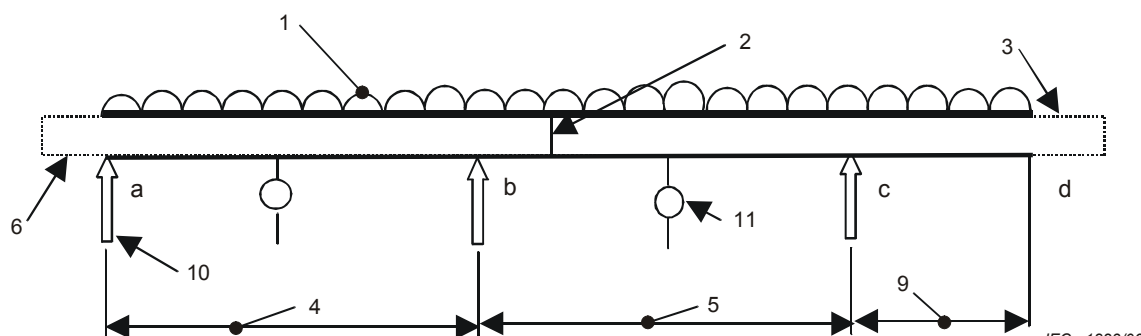
Typical methods of applying a UDL are shown in Annex E.

To allow for settlement of the sample, a pre-load of 10 % of the SWL, unless otherwise specified, shall be applied for 5 min $\pm$ 30 s and then removed. At this time, the measurement apparatus shall be calibrated to zero.

The load shall then be increased by increments or continuously on each sample through the load distribution plates, evenly longitudinally and transversely up to the SWL. Increments shall not be heavier than a quarter of the SWL.

After loading, the deflection shall be measured at the points specified for each test arrangement.

For the tests in 10.3, 10.4, 10.5, 10.6, and 10.7, the mid span deflection of each sample is the arithmetic mean of the deflections at the two measuring points near the side members as shown in Figure 43, key 8.



IEC 1823/06

Figure 43a

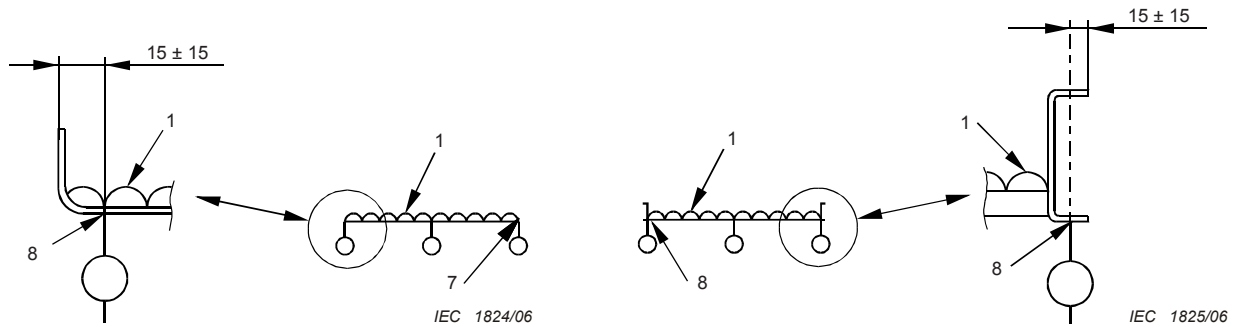


Figure 43b

Figure 43c

Key

1	Symbol to indicate a uniformly distributed load (UDL)
2	Joint
3	Extension of cantilever only permitted when required to support loading media (see Annex D)
4	End span = L
5	Intermediate span = L
6	Maximum unloaded overhang length = 500 mm
7	Deflection measuring point at mid-width
8	Deflection measuring point within 30 mm of product edge
9	Cantilever = $0,4L$
10	Symbol to indicate a support position
11	Symbol to indicate a deflection measurement point
a	Support
b	Support
c	Support
d	End of load
L	Distance between supports on lengths as declared by the manufacturer

All dimensions are in millimetres

Figure 43 – Safe working load test – General arrangement

Where visible transversal deformation occurs, a third measurement of deflection shall be taken in the centre of the cable tray base or cable ladder base at mid-span as shown in Figure 43, key 7 or Figure 5, point s for fittings. The transverse deflection shall be calculated by subtracting the mid-span deflection from the third readings.

The sample shall be left loaded and the deflections measured every 5 min $\pm$ 30 s until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings. The first set of readings measured at this point are the deflections measured at the SWL. For an example see Annex G.

When subjected to the SWL, the sample, its joints and internal fixing devices shall show no damage or crack visible to normal view or corrected vision without magnification and the deflections of each sample shall not exceed the values specified in 10.3, 10.4, 10.5, 10.6, 10.7, and 10.8.

The load on the sample shall then be increased to 1,7 times the SWL.

The sample shall be left and the deflections measured every 5 min $\pm$ 30 s until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings.

The sample shall sustain the increased loading without collapsing. Buckling and deformation of the sample are permissible at this loading.

10.2.1.2 Maximum temperature test ~~for temperatures $\leq 60^{\circ}\text{C}$~~

The test shall be carried out at maximum temperature declared according to the classification of Table 3. During this test, the uniformity of the temperature shall be maintained within the tolerance of $\pm 5^{\circ}\text{C}$, 0,25 m around the samples.

The mounted sample shall be conditioned for a minimum of 2 h at the maximum temperature before loading.

All loads shall be uniformly distributed over the length and width of the sample as shown in Annex D.

The load shall be applied in such a way that a UDL is ensured even in the case of extreme deformation of the sample.

Typical methods of applying a UDL are shown in Annex E.

To allow for settlement of the sample, a pre-load of 10 % of the SWL, unless otherwise specified, shall be applied for 5 min $\pm$ 30 s and then removed. At this time, the measurement apparatus shall be calibrated to zero.

The load shall then be increased by increments or continuously on each sample through the load distribution plates, evenly longitudinally and transversely up to the SWL. Increments shall not be heavier than a quarter of the SWL.

After loading, the deflection shall be measured at the points specified for each test arrangement.

For the tests in 10.3, 10.4, 10.5, 10.6, and 10.7, the mid span deflection of each sample is the arithmetic mean of the deflections at the two measuring points near the side members as shown in Figure ~~43~~, key 8.

Where visible transversal deformation occurs, a third measurement of deflection shall be taken in the centre of the cable tray base or cable ladder base at mid-span as shown in Figure ~~43~~, key 7 or Figure 5, point s for fittings. The transverse deflections shall be calculated by subtracting the mid-span deflection from the third readings.

The sample shall be left loaded and the deflections measured every 5 min $\pm$ 30 s until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings. The first set of readings measured at this point are the deflections measured at the SWL. For an example, see Annex G.

When subjected to the SWL, the sample, its joints and internal fixing devices shall show no damage or crack visible to normal view or corrected vision without magnification and the deflections of each sample shall not exceed the values specified in 10.3, 10.4, 10.5, 10.6, 10.7, and 10.8.

The load on the sample shall then be increased to 1,7 times the SWL.

The sample shall be left and the deflections measured every 5 min $\pm$ 30 s until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings.

The sample shall sustain the increased loading without collapsing. Buckling and deformation of the sample are permissible at this loading.

10.2.1.3 ~~Maximum temperature test for temperatures > 60°C~~ Alternative test for minimum or maximum temperature

The test is carried out as sub-tests A and B. The number of samples for each sub-test is determined from the sample requirement detailed in tests 10.3 to 10.8. The number of samples shall be equal for each sub-test.

Sub-tests A and B shall be carried out from phase 1 through to phase 3 as shown in Figure [124](#).

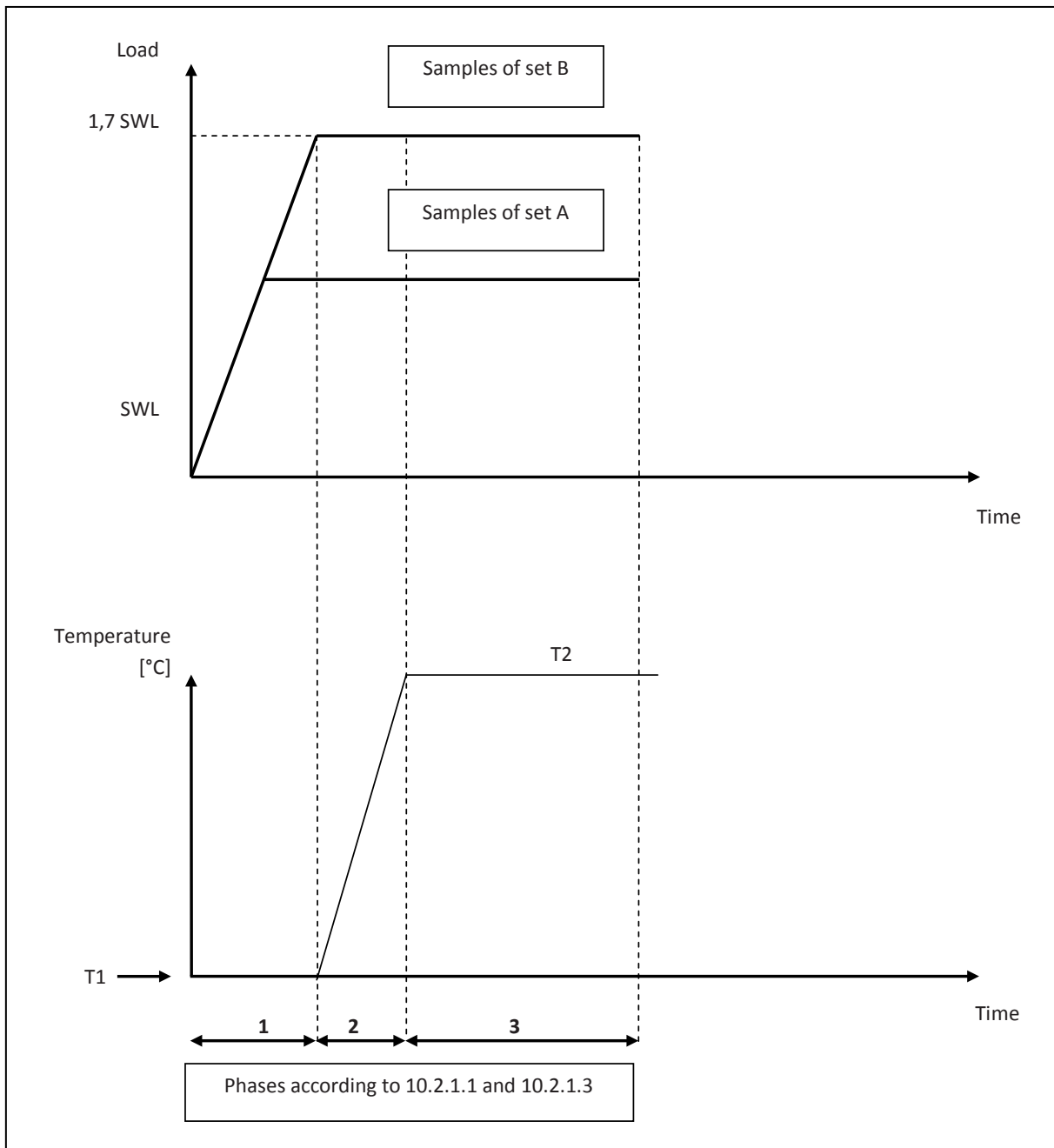


Figure 4a – Load and temperature diagrams for maximum temperature

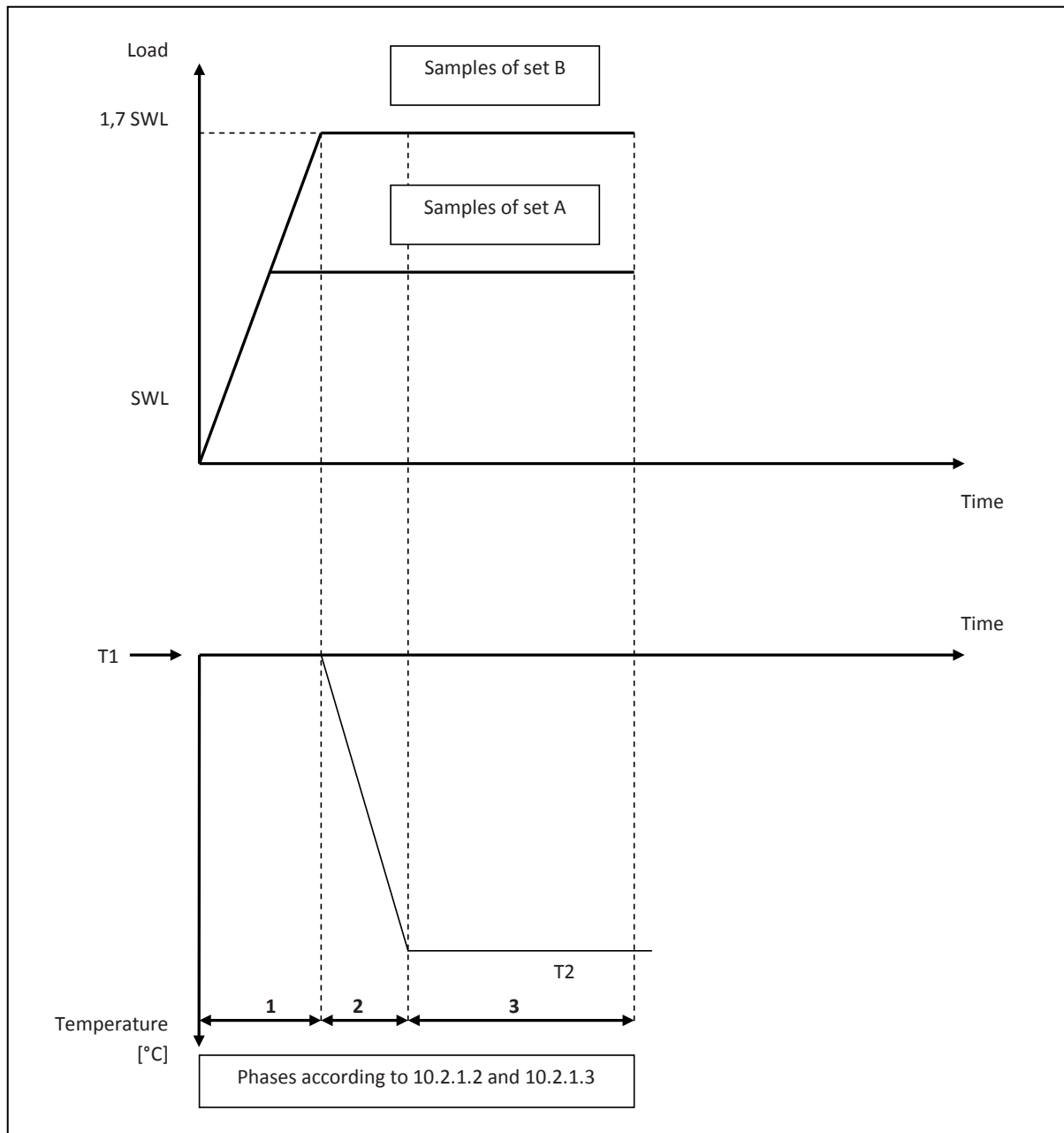


Figure 4b – Load and temperature diagrams for minimum temperature

Key	
T1	Ambient temperature
T2	Temperature declared in Table 3

Figure 424 – Load and temperature diagrams with respect to time for test 10.2.1.3

Phase 1: loading from zero to SWL for sub-test A and from zero to 1,7 SWL for sub-test B

This phase shall be carried out at ambient temperature.

All loads shall be uniformly distributed over the length and width of each sample as shown in Annex D.

The load shall be applied in such a way that a UDL is ensured even in the case of extreme deformation of the samples.

Typical methods of applying a UDL are shown in Annex E.

To allow for settlement of each sample, a pre-load of 10 % of the SWL, unless otherwise specified, shall be applied for 5 min $\pm$ 30 s and then removed. At this time, the measurement apparatus shall be calibrated to zero.

The load shall then be increased by increments or continuously on each sample through the load distribution plates, evenly longitudinally and transversely up to the SWL for sub-test A and up to 1,7 SWL for sub-test B. Increments shall not be heavier than a quarter of the SWL.

Phase 2: ~~temperature rise~~ temperature change

~~Immediately after phase 1 sub-tests A and B shall be continued by elevating the temperature on the samples from ambient temperature to the maximum temperature declared according to Table 3. The declared temperature shall be reached no sooner than 24 h and no later than 48 h after starting the temperature rise. Immediately after phase 1, sub-tests A and B shall be continued by changing the temperature on the samples from ambient temperature to the temperature declared by the manufacturer in accordance with Table 2 or Table 3. The declared temperature shall be reached no later than 48 h after starting the temperature change.~~

The declared temperature is considered to be reached when no change of measured temperature within the tolerance of $\pm 5^\circ\text{C}$ in the test chamber occurs during 4 h.

Phase 3: evaluation of test results

This phase shall be carried out immediately after phase 2 at the declared temperature according to Table 3. During this phase, the uniformity of the temperature shall be maintained within the tolerance of $\pm 5^\circ\text{C}$, 0,25 m around the samples.

This phase requires different procedures for sub-tests A and B.

Sub-test A (measurement of deflection)

During this phase the deflection of the sample, subjected to SWL, shall be measured at the points specified for each test arrangement.

For the tests in 10.3, 10.4, 10.5, 10.6 and 10.7, the mid-span deflection of each sample is the arithmetic mean of the deflections at the two measuring points near the side members as shown in Figure 43, key 8.

Where visible transversal deformation occurs, a third measurement of deflection shall be taken in the centre of each cable tray base or cable ladder base at mid span as shown in Figure 43, key 7, or Figure 5, point s for fittings.

The transverse deflections shall be calculated by subtracting the mid span deflections from the third readings.

The sample shall be left and the deflections measured every 5 min $\pm$ 30 s until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive set of readings. The first set of readings, measured at this point, is all the deflections measured at the SWL. For an example, see Annex G.

When subjected to the SWL, the sample, its joints and internal fixing devices shall show no damage or crack visible to normal view or corrected vision without magnification and the deflections shall not exceed the values specified in 10.3, 10.4, 10.5, 10.6, 10.7 and 10.8.

Sub-test B (evaluation of no collapsing)

The sample shall be left and the deflections measured every 5 min $\pm$ 30 s until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings.

The sample shall sustain the increased loading without collapsing. Buckling and deformation of the sample is permissible at this loading.

10.2.2 Alternative test conditions for 10.2.1

The procedure according to 10.2.1 can be modified by the conditions detailed in either a) or b) or c) below. Different conditions, as detailed in a) or b) or c) can be used for different system components:

- a) at any temperature within the declared range if documentation is available which states that the relevant mechanical properties of the materials as used within the samples do not differ by more than $\pm$ 5 % of the average between the maximum and minimum property values due to temperature change within the declared temperature range;

NOTE An example of a material that fulfils this condition is steel in a range of temperature from -20 °C to + 120 °C.

- b) only at maximum temperature within the range according to 10.2.1.2 or 10.2.1.3, if documentation is available which states that the relevant mechanical properties of the materials improve when the temperature is decreasing.

- ~~c) at maximum and minimum temperature within the range according to 10.2.1 only for the smallest and largest sizes of cable tray lengths or cable ladder lengths having the same material, joint and topological shape. The other sizes can be tested at ambient temperature only.~~

~~The procedure c) can only be used if the percentage of the difference between the TDF of the smallest size and the largest size is less than 10 % using the following formula for the calculation:~~

$$\left| \frac{\text{TDF smallest size} - \text{TDF largest size}}{\text{maximum value of the TDF either of the smallest size or the largest size}} \right| < \frac{10}{100}$$

~~where TDF is the SWL temperature dependence factor.~~

~~The TDF for these sizes is obtained by testing at minimum, ambient, and maximum temperature to determine the loads, which provide the maximum allowed deflection. The loads for each temperature are averaged. The TDF is then calculated by dividing the minimum of these averaged loads by the averaged load at ambient temperature.~~

~~If documentation is available which states that the relevant mechanical properties of the materials improve when the temperature is decreasing, then testing at minimum temperature is not needed and the TDF can be calculated by dividing the averaged loads at maximum temperature by the averaged loads at ambient temperature.~~

~~Other sizes with the same topological shape can be tested at ambient temperature, but increasing the declared load for the maximum or minimum temperature within the range by dividing it by the TDF for the range tested (TDF_R), where TDF_R is the arithmetic mean of the TDF for the smallest size and TDF for the largest size, in order to simulate the worst case within the temperature range.~~

~~For an example of how to determine the TDF_R , see Annex F.~~

10.3 Test for SWL of cable tray lengths and cable ladder lengths mounted in the horizontal plane running horizontally on multiple spans

~~The test shall be carried out on one sample. If the sample does not satisfy the test, the test shall be repeated on two new samples, both of which shall comply with the requirements.~~

~~The test is carried out on cable tray lengths and joints or cable ladder lengths and joints to verify the declared SWL when mounted over multiple spans with the cable tray or cable ladder in the flat and horizontal plane.~~

~~The test is carried out with the samples consisting of two or more cable tray lengths or cable ladder lengths. These shall be coupled, as shown in Figure 1 to form two full spans plus a cantilever. Joints are to be positioned as required for each test type following the manufacturer's or responsible vendor's instructions.~~

~~The samples shall be placed on fixed, rigid supports a, b and c, which shall be horizontal and level with a width of $45\text{ mm} \pm 5\text{ mm}$. The samples shall not be fixed to the supports unless a fixing method is declared by the manufacturer or responsible vendor in which case this fixing method shall be used.~~

~~For all test types, full standard cable tray lengths or cable ladder lengths shall be used for all intermediate lengths. Cut lengths shall only be used at the end positions required.~~

~~The cantilever of $0,4L$ can be increased slightly in length as described in Annex D, if necessary, to ensure a UDL on the cantilever.~~

~~Depending on the installation method(s) declared by the manufacturer or responsible vendor, one or more of the test types in accordance with 10.3.1 to 10.3.5 shall be used.~~

~~The tests for 10.3.1 to 10.3.5 shall be carried out in accordance with 10.2~~

~~The practical mid-span deflection of each span at the SWL shall not exceed 1/100th of the span.~~

~~The transverse deflection of each span at the SWL shall not exceed 1/20th of the width of the sample and the samples shall still ensure reliable support to any cables that would normally be contained therein without imposing any unreasonable hazard or danger to the user or cables.~~

~~Each test shall be carried out on one sample. If the sample does not satisfy the test, the test shall be repeated on two new samples, both of which shall comply with the requirements.~~

~~Each test is carried out on cable tray lengths and joints or cable ladder lengths and joints to verify the declared SWL when mounted over multiple spans with the cable tray or cable ladder in the flat and horizontal plane.~~

Each test is carried out with the samples consisting of two or more cable tray lengths or cable ladder lengths. These shall be coupled, as shown in Figure 1 to form two full spans plus a cantilever. Joints are to be positioned as required for each test type following the manufacturer's or responsible vendor's instructions.

For spans greater than 4 m the cantilever may as an alternative be omitted.

The samples shall be placed on fixed, rigid supports 'a', 'b' and 'c', which shall be horizontal and level with a width of $45 \text{ mm} \pm 5 \text{ mm}$. The samples shall not be fixed to the supports unless a fixing method is declared by the manufacturer or responsible vendor in which case this fixing method shall be used.

For all test types, full standard cable tray lengths or cable ladder lengths shall be used except for the end positions where cut lengths shall be used when required.

The cantilever of $0.4L$ can be increased slightly in length as described in Annex D, if necessary, to ensure a UDL on the cantilever.

Depending on the installation method(s) declared by the manufacturer or responsible vendor, one or more of the test types in accordance with 10.3.1 to 10.3.4 shall be used.

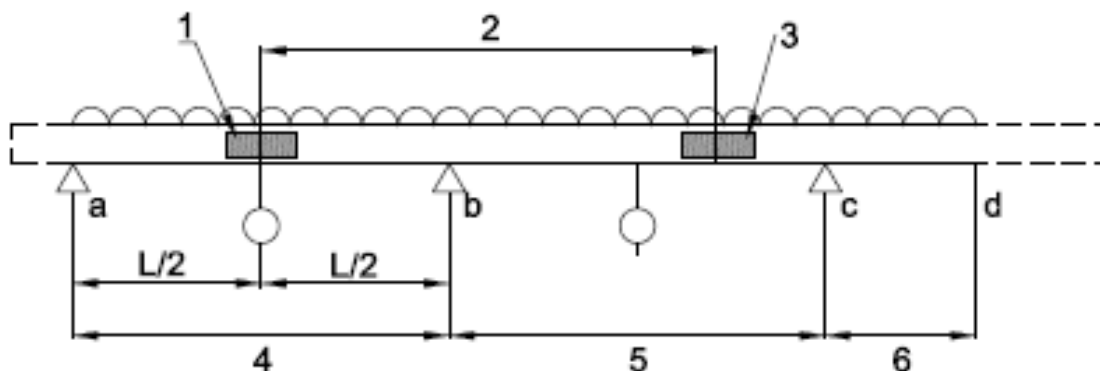
The tests for 10.3.1 to 10.3.4 shall be carried out in accordance with 10.2

The practical mid-span deflection of each span at the SWL shall not exceed 1/100th of the span.

The transverse deflection of each span at the SWL shall not exceed 1/20th of the width of the sample and the samples shall still ensure reliable support to any cables that would normally be contained therein without imposing any unreasonable hazard or danger to the user or cables.

10.3.1 Test type I

Test type I shall be used when the manufacturer or responsible vendor does not declare any end span limitations and where the joints shall be placed on all installations. In this case, joints can occur anywhere on an installation. The test arrangement shall be as shown in Figure 2a. Test type I shall be used when the manufacturer or responsible vendor does not declare any end span length limitations or joint position limitations. In this case, joints can occur anywhere on an installation. The test arrangement shall be as shown in Figure 5



Key

1 Joint at the mid-point of span a-b

- 2 Product standard length; this shall be reduced for test purposes only if the joint is in the cantilever c-d or within 25 % of the span length from support c
- 3 One or more joints may be required dependent upon the product length and span
- 4 End span = L
- 5 Intermediate span = L
- 6 Cantilever = $0,4L$
- a, b and Support positions
- d End of load
- L Distance between supports on lengths as declared by the manufacturer

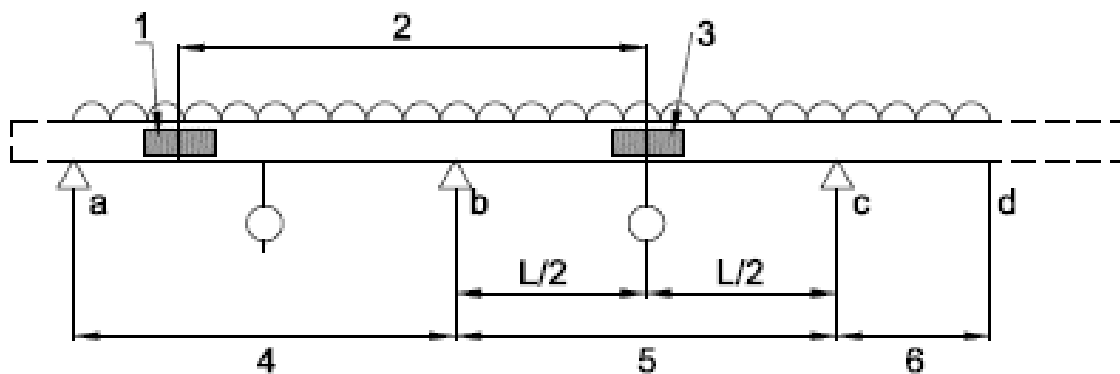
Figure 2a5 – Safe working load Test type I

10.3.2 Test type II

~~Test type II shall be used when the manufacturer or responsible vendor declares that on all installations there shall be no joints in the end span. The test arrangement shall be as shown in Figure 2b.~~

~~If the manufacturer or responsible vendor declares that on all installations the end span shall be reduced in length, the end span X shall then be declared.~~

Test type II shall be used when the manufacturer or responsible vendor declares that on all installations there shall be no joints in the end span. The test arrangement shall be as shown in Figure 6.



Key	
1	For test purposes, a joint may be required in span a-b because the joint in span b-c shall always be at the mid-span position
2	Product standard length; this shall be reduced for test purposes only if the joint is in the cantilever c-d or within 25 % of the span length from support c
3	Joint at the mid-point of span b-c
4	End span = L or X
5	Intermediate span = L
6	Cantilever = $0,4L$
a, b and	Support positions
d	End of load
L	Distance between supports on lengths as declared by the manufacturer

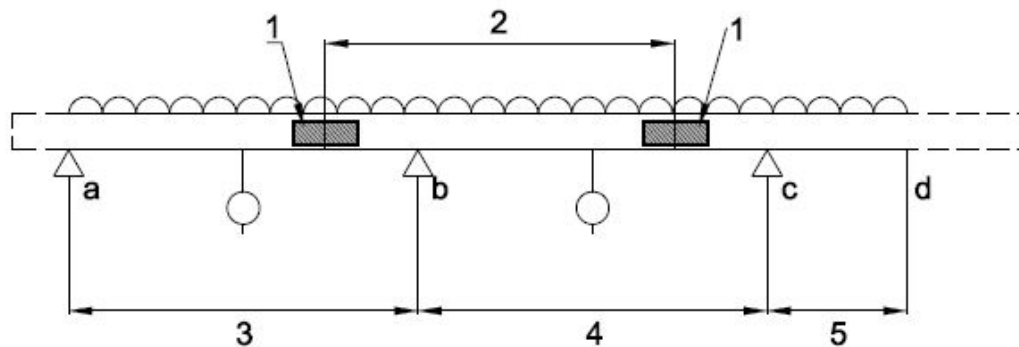
Figure 6 – Safe working load Test types II

If the manufacturer or responsible vendor declares that on all installations the end span shall be reduced in length, the end span X shall then be declared.

10.3.3 Test type III

~~Test type III shall be used when the standard cable tray length or cable ladder length is equal to the span or multiples of the span and the manufacturer or responsible vendor declares the joint position, relative to the end support, to be used on all installations. Test type III can also be used when the standard cable tray length or cable ladder length is 1,5 times the span and the position of the joint is at 25 % of the span from the support a. The test arrangement shall be as shown in Figure 2c.~~

If the manufacturer or responsible vendor declares that on all installations the end span shall be reduced in length, the end span X shall then be declared. Test type III shall be used when the standard cable tray length or cable ladder length is equal to the span or multiples of the span and the manufacturer or responsible vendor declares the joint position, relative to the supports, to be used on all installations. Test type III can also be used when the standard cable tray length or cable ladder length is 1,5 times the span and the position of the joint is at 25 % of the span from the support position 'a'. The test arrangement is shown in Figure 7.



Key	
1	Joint position within each span
2	Product standard length
3	End span = L or X
4	Intermediate span = L (Distance between supports on lengths as declared by the manufacturer)
5	Cantilever = $0,4L$
a, b and c	Support positions
d	End of load
L	Distance between supports on lengths as declared by the manufacturer

NOTE—If the product standard length is equal to two or more times the span, and the manufacturer or responsible vendor states the joint position to be used on all spans for all installations with no end span joints, this test may be used with no joints in the end span, i.e. one joint only in the intermediate span. Test type III can also be used when the standard cable tray length or cable ladder length is 1,5 times the span and the position of the joint is at 25 % of the span from the support a.

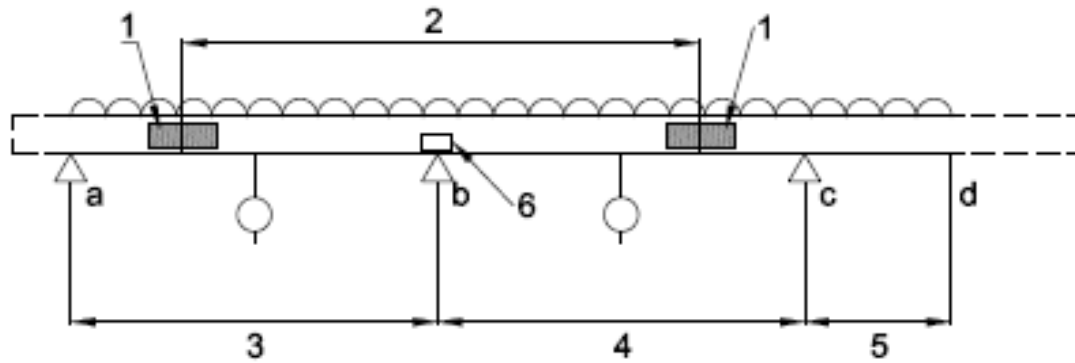
Figure 2c7 — Safe working load Test type III

If the manufacturer or responsible vendor declares that on all installations the end span shall be reduced in length, the end span X shall then be declared.

10.3.4 Test type IV

~~Test type IV shall be used for products with localized weakness. In this case, the localized weakness is positioned over support b as shown in Figure 3. If this can be achieved by modifying test type I or II by moving the joint by up to $\pm 10\%$ of L from its specified position.~~

~~then this shall be done.~~ Test type IV shall be used for products with localized weakness, see Table 6 for an explanation of when Test type IV is required. In this case, the localized weakness is positioned over support 'b' as shown in Figure 8.



Key

- 1 Joint positioned as required in test type I or II, but offset by the minimum distance necessary so that support b is directly underneath any point of local weakness
- 2 Product standard length
- 3 End span = L or X
- 4 Intermediate span = L
- 5 Cantilever = 0,4L
- 6 Localized weakness
- a, b and c Support positions
- d End of load
- L Distance between supports on lengths as declared by the manufacturer

Figure 38 – ~~Safe working load~~ Test type IV

Table- 6 – Use of Test type IV

<u>Installation conditions</u>	<u>No localised weakness</u>	<u>With localised weakness</u>
<u>No end span length limitations or joint position limitations.</u>	<u>Test type I carried out according to 10.3.1</u>	<u>If the distance between the localised weakness and the central support b is less than 10% of the span L then Test type IV shall be carried out according to 10.3.4.</u> <u>If the distance between the localised weakness and the central support b is greater than 10% of the span L then both test Type I and Test type IV shall be carried out.</u>
<u>No joints in the end span and optional end span reduction</u>	<u>Test type II carried out according to 10.3.2</u>	<u>If the distance between the localised weakness and the central support b is less than 10% of the span L then Test type IV shall be carried out according to 10.3.4.</u> <u>If the distance between the localised weakness and the central support b is greater than 10% of the span L then both test Type II and Test type IV shall be carried out.</u>
<u>Joint position fixed in the span and optional end span reduction</u>	<u>Test type III carried out according to 10.3.3</u>	<u>Test type III carried out according to 10.3.3</u>

When tests are required for a range of widths of one product type, and localised weakness requires two tests as shown in Table 6, then the two tests only need to be carried out on one width. The Test type which gives the lowest SWL may then be used for the other widths for that product type. Interpolation may still be used in accordance with 10.1.

10.3.5 — Test type V

~~Multi-span test where the span is greater than 4 m.~~

~~Under consideration.~~

10.4 Test for SWL of cable tray lengths and cable ladder lengths mounted in the horizontal plane running horizontally on a single span installation

The test shall be carried out on one sample. If the sample does not satisfy the test, the test shall be repeated on two new samples, both of which shall comply with the requirements.

The test is carried out on cable tray length(s) or cable ladder length(s) to verify the declared SWL when used as a single beam over a single span with the cable tray or cable ladder in the flat and horizontal plane.

The samples shall be placed on fixed, rigid supports a and b which shall be horizontal and level with a width of $45\text{ mm} \pm 5\text{ mm}$ as shown in Figure 49. The samples shall not be fixed to the supports unless a fixing method is declared by the manufacturer or responsible vendor, in which case this fixing method shall be used.

If the span is greater than the cable tray length or cable ladder length and the manufacturer or responsible vendor does not declare where the joint(s) shall be placed, they shall be at mid-span position as shown in Figure 49.

The test shall be carried out in accordance with 10.2.

The practical mid-span deflection at the SWL shall not exceed 1/100th of the span.

The transverse deflection at the SWL shall not exceed 1/20th of the width of the samples and the samples shall still ensure reliable support to any cables that would normally be contained therein without imposing any unreasonable hazard or danger to the user or cables.

~~For products with localized weakness, a test is required with the localized weakness positioned over support a and b, as shown in Figure 4.~~

If the cable tray length or cable ladder length includes one or more localized weaknesses and if the manufacturer or responsible vendor does not declare any limitation in the position of the localized weaknesses, special test conditions are required.

One test is carried out for each following conditions:

- when the localized weakness is positioned over support a or b, as shown in Figure 9;
- when the localized weakness is positioned at the mid point of the span. If a joint is used, the localized weakness can be moved around mid point of the span within +/- 10% of L.

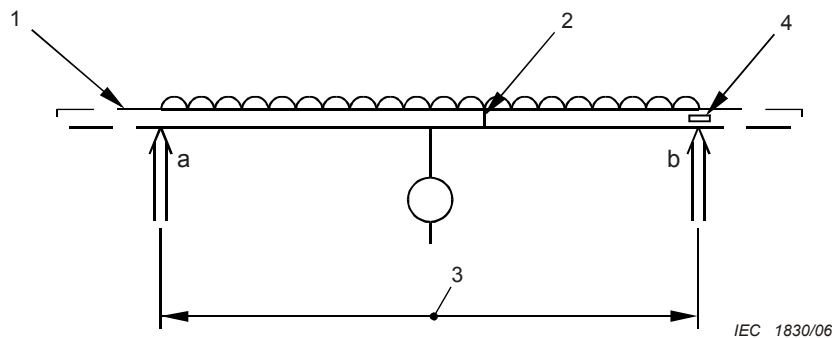
When both conditions can be fulfilled in the same test arrangement, one test is sufficient.

If the manufacturer or responsible vendor declares a support as part of the cable tray systems or cable ladder systems and that the width of this support is smaller than 45mm, support a or b is replaced by the support declared in the system.

~~If this can be achieved by moving the joint by up to $\pm 10\%$ of span L from its specific position, this shall be done.~~

If the manufacturer or responsible vendor does not declare where the joints shall be placed, then this additional test shall be done, independent of the joint location.

This test is carried out identically to the standard test as described in 10.3 using the same SWL as the standard test.



Key	
1	Maximum unloaded overhang length = 500 mm
2	Joint may be required at the position declared by the manufacturer
3	Span = L
4	Localized weakness
a, b	Support positions
L	Distance between supports on lengths as declared by the manufacturer

Figure 49 – Safe working load for single span test

10.5 Test for SWL of cable tray lengths and cable ladder lengths mounted in the vertical plane running horizontally

~~Under consideration.~~

10.5.1 Multiple span test with the product not fixed or fixed according to the manufacturer's instructions

The test is carried out on cable tray lengths and joints or cable ladder lengths and joints to verify the declared SWL when mounted over multiple spans with the cable tray or cable ladder in vertical plane running horizontally.

Each test shall be carried out on one sample. If the sample does not satisfy the test, the test shall be repeated on two new samples, both of which shall comply with the requirements.

The test is carried out with the samples consisting of two or more cable tray lengths (see Figure 12a or cable ladder lengths (see Figure 12b). These shall be coupled, as shown in Figure 12, to form two full spans plus a cantilever. Joints are to be positioned as shown in Figure 12 unless stated differently by the manufacturer.

Full standard cable tray lengths or cable ladder lengths shall be used for all intermediate lengths. Cut lengths shall only be used at the end positions required.

The cantilever of $0,4 L$ can be increased slightly in length as described in Annex D, if necessary, to ensure a UDL on the cantilever.

The test shall be carried out in accordance with 10.2.

The practical mid-span deflection at the SWL shall not exceed 1/100th of the span.

The transverse deflection at the SWL shall also not exceed 1/100th of the span of the samples and the samples shall still ensure reliable support to any cables that would normally be contained therein without imposing any unreasonable hazard or danger to the user or cables. For measuring the deflections see Figure 12c.

For products with localised weakness, a test is required with the localised weakness positioned over support a and b, in the same way as indicated in Figure 9, for cable tray lengths and cable ladder lengths mounted in the horizontal plane, running horizontally.

For the test the samples shall be fixed on vertical rigid supports, with a width of 45 mm $\pm$ 5mm or as declared by the manufacturer. Separate tests shall be carried out on each product type using all fixing methods and support devices according to the manufacturer or responsible vendor instructions.

For cable tray length the load shall be applied in the middle of the base area by a load distribution plate. All loads shall be uniformly distributed over the length of the sample as shown in Annex D.

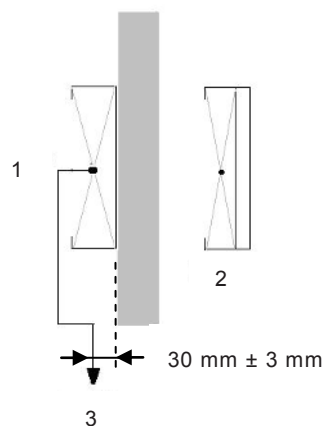
For cable ladder length the load shall be applied on all the cable ladder rungs.

Load distribution plates shall be used as indicated in Table 7. The distance "a" between the loads and the base area shall be 30 $\pm$ 3 mm as shown in Figure 10.

All loads shall be applied using a hinged connector where the centre point of the weight shall be placed at the middle of the free space for filling cables on the base area of the cable tray or cable ladder, as shown in Figure 11.

Table 7 – Load distribution plates for the SWL test of the cable tray lengths and cable ladder lengths mounted in the vertical plane running horizontally

<u>Tray or Ladder width [mm]</u>	<u>Load plate, length x height [mm x mm]</u>
<u>Up to 200</u>	<u>120 x 40</u>
<u>Above 200 up to 300</u>	<u>40 x 120</u>
<u>above 300</u>	<u>60 x 180</u>



Key	
1	Centre of tray
2	Ladder
3	Load (F)

Figure 10 – Load positioning mounted vertical plane running horizontal

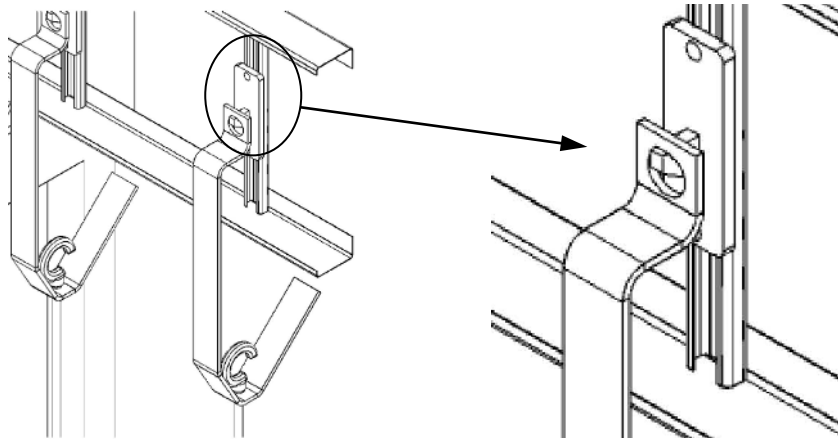
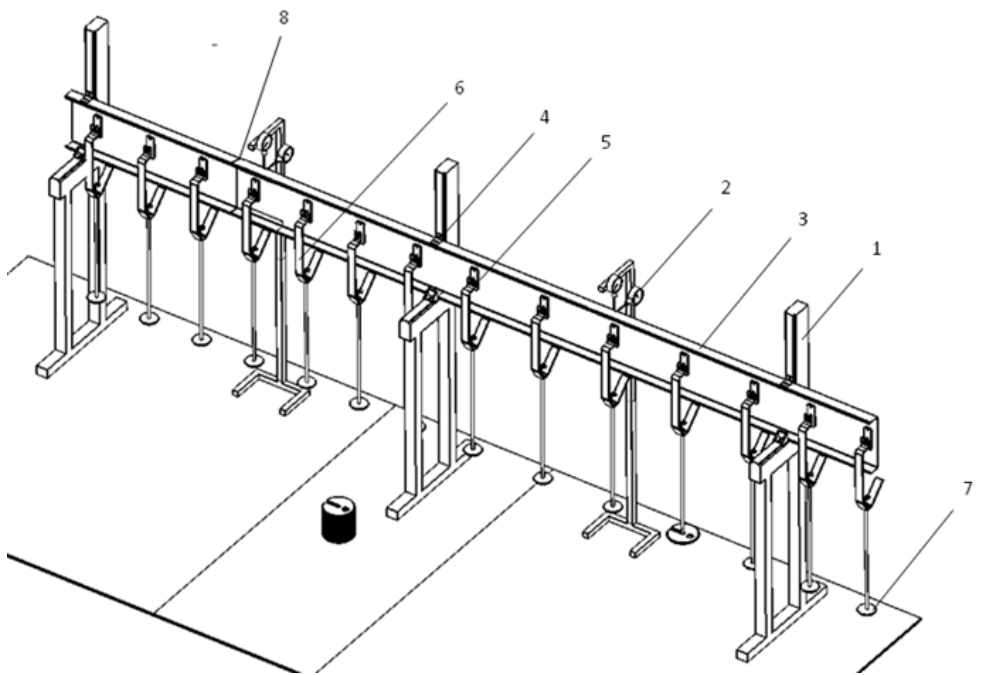
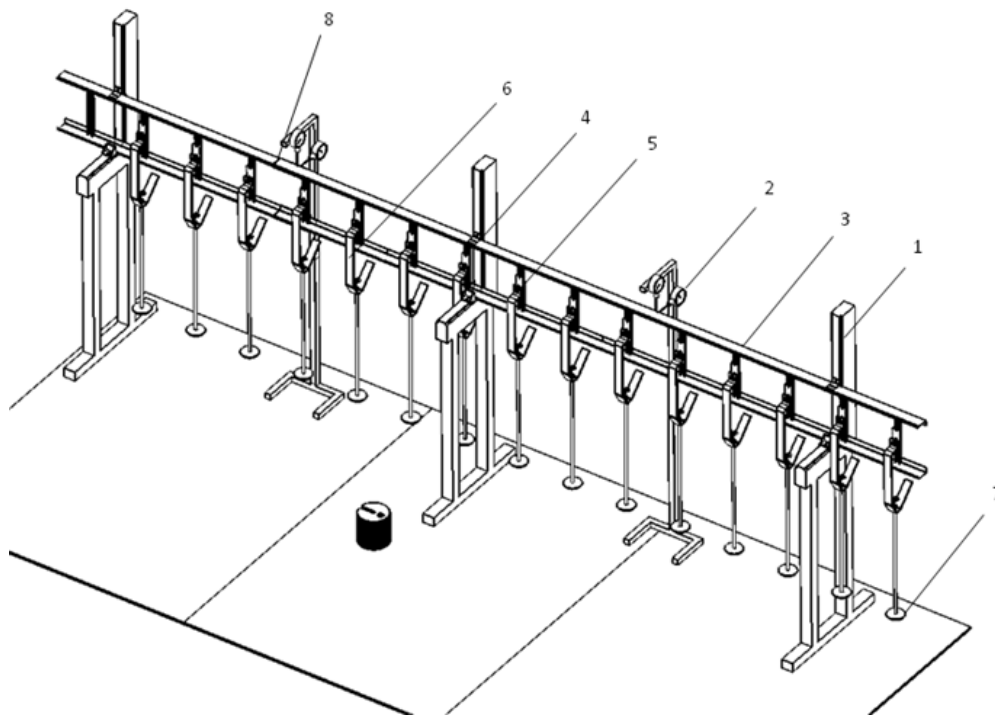


Figure 11 – Example of a hinge connector for the load



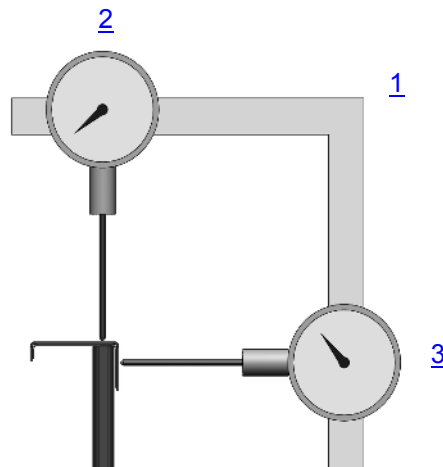
Key	
1	Rigid test support for cable tray
2	Deflection measurements (see Fig yc)
3	Cable tray
4	Cable tray fixing /support device
5	Hinged connector
6	Fixing hook for load
7	Load elements
8	Cable tray joint

Figure 12a – Test conditions Cable Tray mounted in the vertical plane running horizontally



<u>Key</u>	
1	Rigid test support for cable ladder
2	Deflection measurements (see Fig 3c)
3	Cable ladder
4	Cable ladder fixing /support device
5	Hinged connector
6	Fixing hook for load
7	Load elements
8	Cable ladder joint

Figure 12b – Test conditions Cable ladder mounted in the vertical plane running horizontally



Key	
1	Deflection measurement support
2	Example of measurement equipment for measuring vertical deflection b
3	Example of measurement equipment for measuring horizontal deflection a

Figure 12c – Details for Figure 12a and 12b regarding measuring the deflections

Figure 12 – Test conditions mounted in the vertical plane running horizontally

10.6 Test for SWL of cable tray lengths and cable ladder lengths mounted in the vertical plane running vertically

~~Under consideration.~~

The test is carried out on cable tray lengths or cable ladder lengths, and support devices to verify the declared SWL per span when mounted in the vertical plane running vertically.

The test shall be carried out on one sample. If the sample does not satisfy the test, the test shall be repeated on two new samples, both of which shall comply with the requirements.

The sample shall consist of a cable tray length or a cable ladder length as appropriate. The length of the sample can be calculated as follows:

The length of the sample shall be at least $(V + 200)$ mm

The sample is fixed as shown in Figures 13a and 13b to a rigid construction.

When B is greater than zero a spacer providing low friction shall be positioned at distance V as shown in Figures 13a and 13b; this allows the tray or ladder to move vertically whilst under test. Where the contact surface of a tray is not plain then the spacer may be in two parts.

The sample shall be loaded according to the following:

- The load shall be uniformly distributed over the width of the sample as shown in annex D
- The number of point loads applied in line along the length of the tray or ladder shall be calculated from the formula:

$$\text{Number of loads} = \text{int}((V-100)/C + 1).$$

NOTE 'int' requires the equation to be a whole number for example if $((V-100)/C + 1) = 3.7$ then the number of loads would be 3

V = The vertical span as declared by the manufacturer in mm

C = Maximum cable fixing distance in mm as declared by the manufacturer

- On cable tray lengths the load shall be applied (30 ± 3) mm from the base area through a load adapter with equal sides of (40 ± 1) mm.
- On cable ladder lengths, the load shall be applied (30 ± 3) mm from the rung base through a load adapter with a width of (40 ± 1) mm and a profile to fit on the rung.

The test arrangement is shown:

- In Figure 13a for cable tray lengths.
- In Figure 13b for cable ladder lengths

The test shall be carried out in accordance with 10.2 but with a pre-load of 50 % of the SWL. For cable tray the deflections are measured on the side members and in the middle of the top edge of the base area. For cable ladder the deflections are measured on the side members and in the middle of the top rung.

The vertical deflection of the side members shall have limiting values:

- If B is zero to 20 mm then the maximum vertical deflection shall not exceed 2 mm.
- If B is greater than 20 mm then the maximum vertical deflection shall not exceed 1/10th of the distance B with a maximum deflection of 30 mm.

The vertical deflection of the middle of the base area shall have limiting values:

- The total displacement at the middle of the top rung minus the mean deflection of the side members shall not exceed $1/20^{\text{th}}$ of the width of the base area of the cable ladder.
- The total displacement in the middle of the top edge of the base area minus the mean deflection of the side members shall not exceed $1/20^{\text{th}}$ of the width of the base area of the cable tray.