UL 62275

STANDARD FOR SAFETY

Cable Management Systems – Cable Ties for Electrical Installations

UL Standard for Safety for Cable Management Systems – Cable Ties for Electrical Installations UL 62275

Third Edition, Dated September 24, 2021

Summary of Topics

This new edition of ANSI/UL 62275 dated September 24, 2021 is being issued to update requirements to those published in IEC 62275, Standard for Cable Management Systems – Cable Ties for Electrical Installations.

UL 62275 is an adoption of IEC 62275, Edition 3, issued August 2018. Please note that the National Difference document incorporates all of the U.S. national differences for UL 62275.

The requirements are substantially in accordance with Proposal(s) on this subject dated December 18, 2020.

No Text on This Page

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NMX-J-623-ANCE-2021
Third Edition

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CSA C22.2 No. 62275:21
Third Edition
(IEC 62275:2018, MOD)

Underwriters Laboratories Inc.
UL 62275
Third Edition

Cable Management Systems – Cable Ties for Electrical Installations

September 24, 2021

This national standard is based on publication IEC 62275, Third Edition (2018).

ANSI/UL 62275-2021

Commitment for Amendments

This standard is issued jointly by the Association of Standardization and Certification (ANCE), the Canadian Standards Association (operating as “CSA Group”), and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to ANCE, CSA Group, or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of ANCE, CSA Group, and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue. ANCE will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA Group and UL pages.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. The technical content of IEC and ISO publications is kept under constant review by IEC and ISO. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the Third Edition.

The most recent designation of ANSI/UL 62275 as an American National Standard (ANSI) occurred on September 24, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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PREFACE

This is the harmonized ANCE, CSA Group, and UL standard for Cable management systems – Cable ties for electrical installations. It is the third edition of NMX-J-623-ANCE, CSA C22.2 No. 62275, and UL 62275. This edition of NMX-J-623-ANCE, CSA C22.2 No. 62275 and UL 62275 supersedes the previous edition published October 14, 2016.

This harmonized standard is based on IEC Publication 62275: third edition, Cable management systems – Cable ties for electrical installations, issued August 2018. IEC 62275 is copyrighted by the IEC.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL). The efforts and support of the CANENA Technical Harmonization Subcommittee 23A-62275 are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

The present Mexican Standard was developed by the CT PIE-A from the Comite de Normalizacion de la Asociacion de Normalizacion y Certificacion, A.C., CONANCE, with the collaboration of the manufacturers and users.

This standard was reviewed by the CSA Integrated Committee on Fittings, Hardware, and Positioning Devices, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard adopts the IEC text with national differences.

This standard is published as an identical standard for ANCE, CSA Group, and UL.

An identical standard is a standard that is exactly the same in technical content except for national differences resulting from conflicts in codes and governmental regulations. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the ANCE, CSA Group and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for Differences From IEC

Differences from the IEC are being added in order to address safety and regulatory situations present in the US, Canada and Mexico.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

IEC Copyright

For ANCE, the text, figures, and tables of International Electrotechnical Commission Publication 62275, Cable management systems – Cable ties for electrical installations, copyright 2018, are used in this standard according to the guidelines provided in the ISO/IEC/POCOSA.

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 62275, Cable management systems – Cable ties for electrical installations, copyright 2018, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword is not a part of the requirements of this standard but is included for information purposes only.

NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 62275, Cable management systems – Cable ties for electrical installations, copyright 2018, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CABLE MANAGEMENT SYSTEMS – CABLE TIES FOR ELECTRICAL INSTALLATIONS

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.

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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 62275 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 2013. This edition constitutes a technical revision.

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

a) consideration of adhesive fixing devices,

b) revised and updated normative references,

c) modified definitions for metallic and composite cable ties,

d) new definitions,

e) improvement of test procedures,

f) new figures for typical arrangement of test assembly for fixing devices and for integral fixing devices.

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

FDIS	Report on voting
23A/851A/FDIS	23A/868/RVD

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

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

The following differing practices of a less permanent nature exist in the countries indicated below.

– 6.2.2: additional type classifications are applicable when pre-qualified moulding materials are used (Canada, USA).

– 6.2.3: additional type classifications are applicable when pre-qualified moulding materials are used (Canada, USA).

– 7.3: some marking information is required to be placed on the packaging (Canada, Russia, USA).

In this publication, the following print types are used:

– Requirements proper: in roman type.

– *Test specifications: in italic type.*

– Notes: in smaller roman type.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

DV.1 DE *Modify the IEC Foreword by adding the following:*

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

CABLE MANAGEMENT SYSTEMS – CABLE TIES FOR ELECTRICAL INSTALLATIONS

1 Scope

This document specifies requirements for metallic, non-metallic and composite cable ties and their associated fixing devices used for the management and support of wiring systems in electrical installations.

1DV.1 D2 ***Modify Clause 1 by replacing the first paragraph with the following:***

This Standard specifies requirements for metallic, non-metallic, and composite cable ties and their associated fixing devices and integral assemblies used for the management and support of wiring systems in electrical installations in accordance with the Canadian Electrical Code (CE Code), Part I, CSA C22.1, in Canada, Standard for Electrical Installations, NOM-001-SEDE, in Mexico, and the National Electrical Code (NEC), NFPA 70, in the United States of America.

Cable ties and associated fixing devices can also be suitable for other applications and where so used, additional requirements can apply.

This document does not contain requirements that evaluate any electrical insulation properties of the cable tie or mechanical protection of the cables provided by the cable tie.

This document contains requirements for the mechanical interface of an adhesive fixing device to a solid surface. It does not consider the mechanical behaviour of the solid surface in itself.

This document does not consider the mechanical interface, for example the mounting screw, of a fixing device other than adhesive to a solid surface.

1DV.2 D2 ***Modify Clause 1 by deleting the last paragraph and adding the following note:***

NOTE 1DV: This Standard considers the mechanical securement means of a fixing device to a surface when the means for securing is provided with the fixing device or is part of the fixing device, i.e., the push mount for an integral fixing device (See 9.7.1, 9.7.2, and 9.7.3).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-6:2007,
Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)

IEC 60695-11-5:2016,
Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance

IEC 60216-4-1:2006,
Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens

ISO 4892-2:2013,
Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps

ISO 9227:2017,
Corrosion tests in artificial atmospheres – Salt spray tests

2DV D1 *Modify Clause 2 by adding the following:*

2DV.1 In Canada, the following additional normative references apply:

CSA C22.1-18
Canadian Electrical Code, Part I

CSA C22.2 No. 0:20
General requirements – Canadian Electrical Code, Part II

CAN/CSA-C22.2 No. 0.17-00 (R2018)
Evaluation of properties of polymeric materials

CAN/ULC-S142:2016
Standard method of fire test for heat and visible smoke release for discrete products

2DV.2 In the United States, the following additional normative references apply:

NFPA 70-2020
National Electrical Code (NEC®)

UL 94
Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 746A
Standard for Polymeric Materials – Short Term Property Evaluations

UL 746B
Standard for Polymeric Materials – Long Term Property Evaluations

UL 746C
Standard for Polymeric Materials – Use in Electrical Equipment Evaluations

UL 2043
Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces

2DV.3 The following additional normative references apply:

ASTM D1002-10 (2019)
Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)

IEC 60695-11-10:2013
Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods

2DV.4 In Mexico, the following normative references apply. Compliance with the requirements in IEC and ISO standards shall be according to the relevant Mexican standards provided in Annex DVF:

NMX-J-417-ANCE-2005
Wires and cables – Convection laboratory ovens for evaluation of electrical insulation – Specifications and test methods

NMX-J-553-ANCE-2002
Wires and cables – Weather resistance of insulation or jacket of electrical conductors – Test method

NMX-J-564/1-3-ANCE-2010
Environmental testing for electrical equipment – Part 1-3: Method of testing corrosion endurance – Salt mist

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

3.1
cable tie
band or length of material, employing a locking device, used for bundling or tying groups of cables together, securing and/or supporting the cables

Note 1 to entry: Type 1 and Type 2 cable ties are classified in 6.2.2 and 6.2.3.

Note 2 to entry: In some countries, such as Canada and the United States, additional Type classifications are applicable when prequalified moulding materials are used. See UL 62275/CSA C22.2 No. 62275.

3.2
fixing device
component (such as a block or bracket) specifically designed to secure the cable tie to a mounting surface

3.3
metallic component
component that consists of metal only

Note 1 to entry: A metallic cable tie having a thin non-metallic or organic coating, where the coating does not contribute to the determination of the loop tensile strength, is considered a metallic component

Note 2 to entry: In case of doubt, "as-received condition" tests with and without coating can be carried out.

3.4
non-metallic component
component that consists of non-metallic material only

3.5
composite component
component comprising both metallic and non-metallic materials where both metallic and non-metallic materials contribute to the determination of the loop tensile strength

3.5DV D1 ***Modify by adding the following to this definition:***

For a cable tie principally of nonmetallic construction, the metallic element is determined to be essential in achieving the loop tensile strength.

3.6
environmental influence
effect of corrosive substances or solar radiation, etc.

3.7
loop tensile strength
reference mechanical characteristic of a cable tie with its locking mechanism engaged

3.8
locking device
feature of a cable tie for fixing it in a closed position

3.9
low hygroscopic polymer
polymer having the characteristic of not enabling attraction or holding water greater than 1,0 % by weight of the material from the surrounding environment at 23 °C and 50 % relative humidity

Note 1 to entry: Examples of low hygroscopic polymers include: polypropylene, acetal, ethylene tetrafluoroethylene, ethylene chlorotrifluoroethylene, nylon 12, polyetheretherketone.

3.10
equilibrium moisture content
state at which a polymer neither absorbs or releases moisture when exposed to a surrounding environment of 23 °C and 50 % relative humidity

3.11
integral assembly
component which incorporates a cable tie and a fixing device

3.12
adhesive fixing device
fixing device provided with an adhesive tape specifically designed to secure the cable tie to a mounting surface

3DV D1 ***Add the following terms to Clause 3:***

3.13DV
air-handling spaces

equipment intended for use in spaces used for environmental air, such as the space above suspended ceilings or below floors. This does not include plenums used for the removal of dust, loose stock, or vapor, or for ventilation of commercial-type cooking equipment.

3.14DV
type test
test conducted on sample representing production.

3.15DV
fastener
mechanical device, such as a rivet, bolt, screw, or pin, that is used to hold two or more components together securely

3.16DV
surface
base that is conductive to stabilizing (securing) and supporting an object

3.17DV
bundle
collection of things or quantity of material (such as wire and cables) tied or wrapped up together

3.18DV
locate
situate in a particular place or specific location

3.19DV
position
put or arrange something in a particular place or way

3.20DV
route
direct along a specific course

3.21DV
securement
fix or attach (something) firmly so that it cannot be moved or lost

3.22DV
support
bear all or part of the weight

4 General requirements

A cable tie and a fixing device shall withstand the stresses likely to occur during recommended installation practice and perform under the conditions of classifications in Clause 6 as declared by the manufacturer.

Compliance is checked by carrying out all the appropriate specified tests.

NOTE Annex A details the compliance checks to be carried out for cable ties and fixing devices currently complying with IEC 62275:2013 in order to comply with this edition 3.

4DV DC *Modify Clause 4 by adding the following:*

4DV.1 In Canada, general requirements applicable to this Standard are given in CSA C22.2 No. 0:20.

4DV.2 In Canada and the United States, Type 11, 21, 2S and 21S cable ties and fixing devices are classified according to 6.2.2 and 6.2.3.

4DV.3 In Mexico, Type 11, 21, 2S, and 21S cable ties and fixing devices are not recognized.

5 General notes on tests

5.1 Tests according to this document are type tests. Unless otherwise specified, tests are carried out with the cable ties and their associated fixing devices, where available, installed as in normal use according to the manufacturer's instructions.

Unless otherwise specified, requirements and tests for fixing devices also apply to adhesive fixing devices.

NOTE For guidance in determining product types and sample sets, a family of cable ties or fixing devices having material, construction characteristics, and classifications according to Clause 6, in common, are considered of the same product type. Examples for consideration are identical generic material description, material colours, or variable lengths of a cable tie of otherwise similar construction. The sample sets selected for testing from each product type is representative of the extremes of the range (example: shortest and longest), and the minimum performance level obtained for either extreme is determined to be representative of the entire range.

Consideration is given to minor construction variations that can be determined by inspection to have no effect on performance, when determining product types.

5.2 Unless otherwise specified, tests on non-metallic and composite components shall commence when the samples have been removed from their packaging and then stabilized at a temperature of (23 ± 5) °C and at a relative humidity of (50 ± 5) %, for a period as indicated in Table 1.

NOTE This stabilization intends to achieve equilibrium of moisture content for all samples before and after further conditioning and testing.

Table 1
Stabilization time for samples

Reference thickness (RT) of device mm	Stabilization time days
RT ≤ 1,2	7 ± 1
1,2 < RT ≤ 1,4	21_{-7}^{0}
1,4 < RT	35_{-7}^{0}
All thicknesses of materials known to have low hygroscopic characteristics	2 ± 1/3

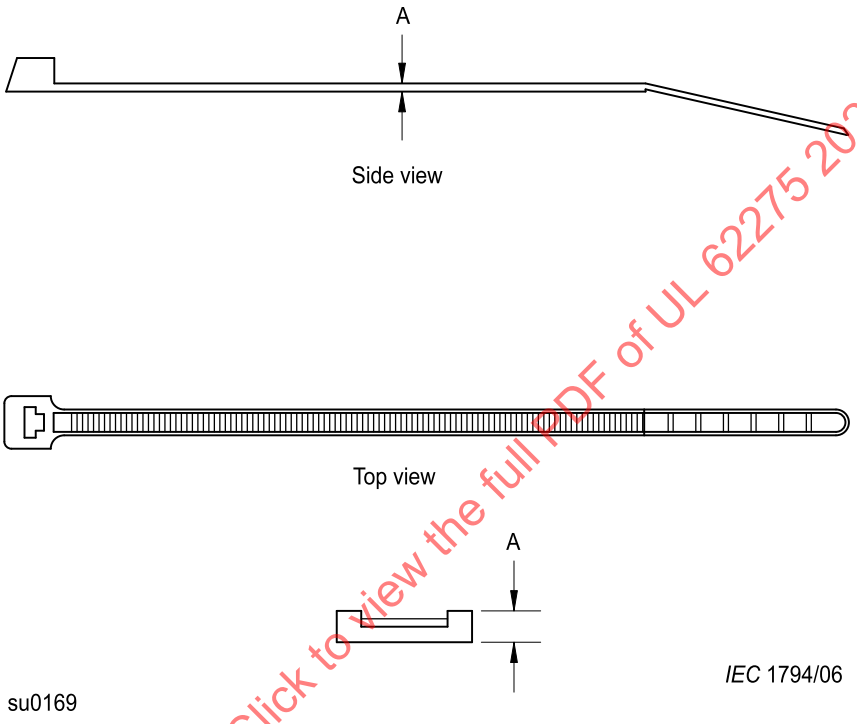
The reference thickness of a cable tie is measured at the midpoint of the strap. The reference thickness of a fixing device shall be the smallest cross-section in the area that interfaces with the cable tie or as declared by the manufacturer. See Figure 1.

When the equilibrium moisture content for a material at (23 ± 5) °C and (50 ± 5) % relative humidity is determined through a method agreed to by the manufacturer and the testing laboratory, the stabilization time in Table 1 may be reduced when all of the following conditions are met:

a) the product's moisture content in the as-received condition and after each appropriate conditioning is measured using a calibrated moisture analyzer device;

b) the samples are subjected to exposure to a constant temperature not exceeding 50 °C and a relative humidity not exceeding 80 %; and

c) the product's equilibrium moisture content at (23 ± 5) °C and (50 ± 5) % relative humidity is verified using a calibrated moisture analyzer device. This verification process is repeated until equilibrium is determined.



Key

A reference thickness of cable tie

Figure 1

Reference thickness for cable ties

5.3 Unless otherwise specified, the tests shall be carried out at an ambient temperature of (23 ± 5) °C and with a relative humidity of between 40 % and 60 %.

5.4 Unless otherwise specified, three new samples are submitted 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 owing to an assembly or manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated. The tests that follow shall be carried out in the required sequence on another full set of samples, all of which shall comply with the requirements.

NOTE The applicant, when submitting the first set of samples, can also submit an additional set of samples which may be necessary if one sample fails. The test 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, a failure of one sample will entail a rejection.

5.5 When toxic or hazardous processes are used, due regard shall be taken of the safety of persons within the test area.

5.6 Unless otherwise specified, the cross-head speed of a tensile machine used during the tests shall be (25 ± 2,5) mm/min.

5.6DV D1 ***Modify Clause 5.6 by replacing it with the following text:***

Unless otherwise specified, the cross-head speed of a tensile machine when used for conducting the tests shall be (25 ±2,5) mm/min. Dead weights may be used for conducting loop tensile strength tests for cable ties classified according to 6.2.3 and 6.2.3DV.1, with no sudden application of force or jerking if the weights are suspended, or at a speed of (25 ±2,5) mm/min if the weights are lifted.

5.7 Where required for heat ageing, a full draft circulating-air oven as specified in IEC 60216-4-1:2006 shall be used. A portion of the air shall be allowed to re-circulate and a substantial amount of air shall be admitted continuously to maintain the normal air content surrounding the samples. The oven shall be adjusted to achieve more than five complete fresh-air changes per hour.

5.7DV D1 ***Modify Clause 5.7 by adding the following text:***

In Mexico, an oven as specified in NMX-J-417-ANCE-2005 is considered equivalent.

5.8 An integral assembly shall be tested as a complete sample. The integral assembly shall be subjected to the conditionings for the cable tie prior to conducting the mechanical strength test for the fixing device in accordance with 9.7.

A fixing device, the performance of which is dependent on the mounting hole size, the thickness of the material sheet to which it is to be mounted, or the mounting orientation declared by the manufacturer in accordance with Table 7, shall comply with all applicable tests when the device is assembled to the minimum and maximum thickness of each mounting surface, in the largest hole size, and in each intended mounting orientation declared by the manufacturer. When it can be determined that a particular mounting orientation represents the most onerous condition, the results of the tests in that orientation may represent all mounting orientations.

An adhesive fixing device, the performance of which is dependent on the mounting surface or the mounting orientation, shall comply with all applicable tests when the device is assembled on the surfaces for which it is intended, and in each intended mounting orientation declared by the manufacturer. When it can be determined that a mounting orientation represents the most onerous condition, the results of the tests in that orientation may represent all mounting orientations.

5.8DV D1 ***Modify Clause 5.8 by adding the following paragraph:***

A surface-mounted fixing device, the performance of which is dependent on the mounting surface or the mounting orientation, shall comply with all applicable tests when the device is assembled on the surfaces for which it is intended, and in each intended mounting orientation declared by the manufacturer. If the manufacturer does not make a declaration of mounting orientation or when it can be determined that a particular mounting orientation represents the most onerous condition, the results of tests in that orientation may represent all mounting orientations.

5.9 Unless otherwise specified, when conducting the tests on cable ties in Clause 9, the samples shall be installed according to the manufacturer's instructions on a steel or aluminium mandrel which has a diameter A according to Table 2.

If the minimum declared diameter of the cable tie is greater than the diameter of the test mandrel specified in Table 2, then a test mandrel that has the minimum diameter as declared by the manufacturer shall be used.

The width B of the mandrel shall be at least 5 mm greater than the maximum width of the cable tie as shown in Figure 2.

Table 2
Test mandrel diameter

Maximum declared diameter mm	Test mandrel diameter (A) mm
≤ 20	9,5 ± 1
> 20 and ≤ 38	20 ± 2
> 38	38 ± 2

For the loop tensile strength tests, the mandrel shall be split in two equal parts and the cable ties positioned as shown in Figure 2a).

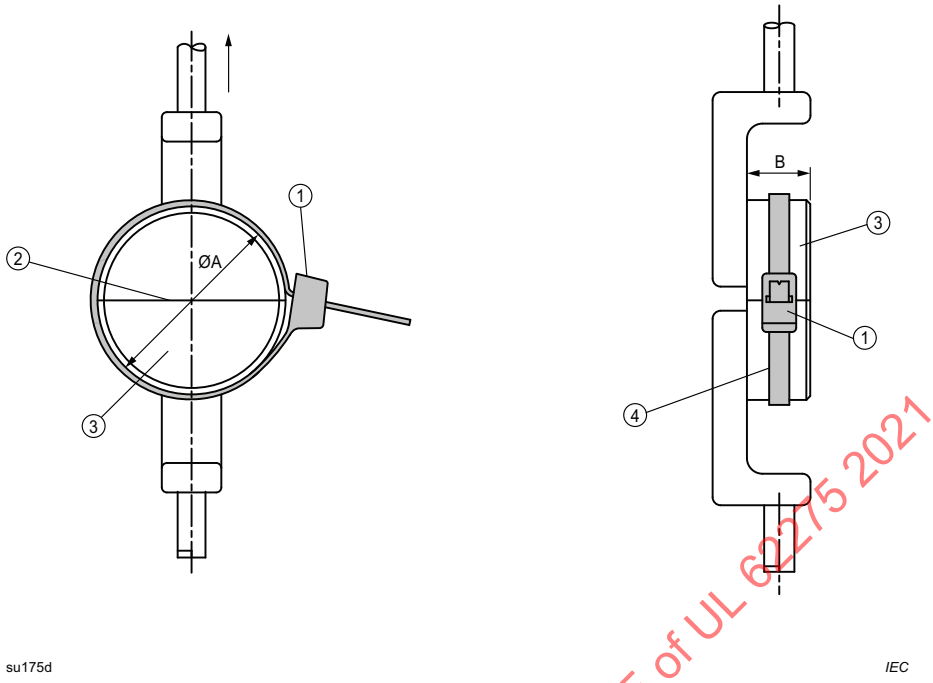
Cable ties having a parallel entry strap shall be mounted to the mandrel as shown in Figure 2b).

The excess end (tail) of the cable tie is permitted to be cut off after assembly, except in the tests where marking is required for the purpose of measurement (see 9.6).

The use of separate steel or aluminium conditioning mandrels is permitted. The conditioning mandrels need not be split but shall have a diameter approximately equivalent to the appropriate test mandrel to allow transfer of the sample to the test mandrel. Conditioned samples shall be carefully transferred to the appropriate test mandrel for carrying out the loop tensile test. Where it has been determined that the transfer of the samples from the conditioning mandrel to a test mandrel has influenced the test results, an additional sample set shall be conditioned and tested.

5.9DV D1 ***Modify Clause 5.9 by replacing the fifth paragraph with the following:***

Non-metallic or composite cable ties having a parallel entry strap shall be mounted to the mandrel as shown in Figure 2b). A metallic cable tie having a parallel entry strap shall be mounted to the mandrel as shown in Figure 2a).



Key

1 Locking device (head)

2 Split line

3 Mandrel

4 Cable tie

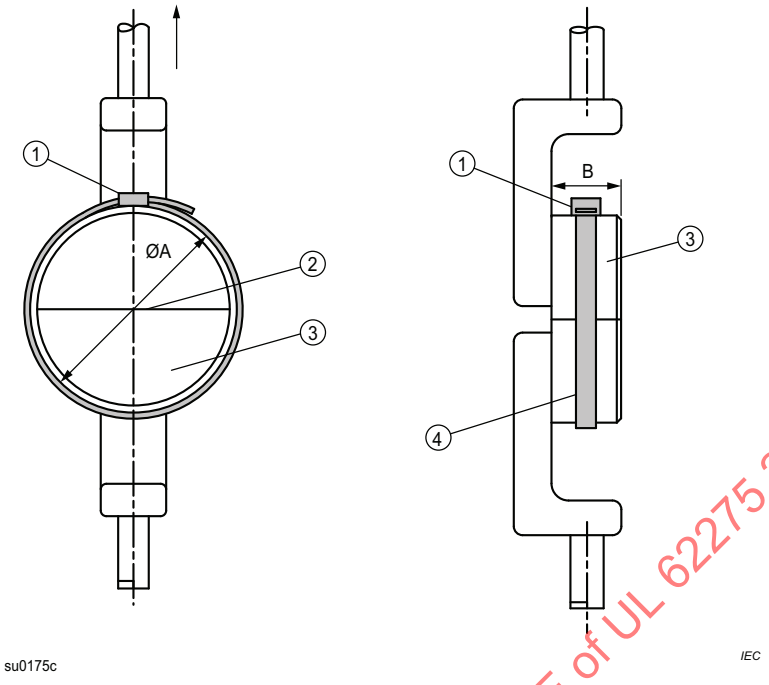
A Diameter of test mandrel

B Width of test mandrel

Mandrels shall be made of steel or aluminium and shall be smooth and free of burrs.

Care should be taken that the separation of the two halves of the mandrel remains parallel to the split line.

Figure 2a) Typical arrangement for cable tie orientation on split mandrel for tensile test – Right angle entry strap



Key

1 Locking device (Head)

2 Split line

3 Mandrel

4 Cable tie

A Diameter of test mandrel

B Width of test mandrel

Mandrels shall be made of steel or aluminium and shall be smooth and free of burrs.

Care should be taken that the separation of the two halves of the mandrel remains parallel to the split line.

Figure 2b) Typical arrangement for cable tie orientation on split mandrel for tensile test – Parallel entry strap

Figure 2

Typical arrangements for cable tie orientation on split mandrel for tensile test

Figure 2DV DE *Modify Figures 2a) and 2b) by replacing the titles with the following:*

Figure 2a) Typical arrangement for a right-angle non-metallic and composite cable tie and a parallel entry metallic cable tie orientation on split mandrel for tensile test

Figure 2b) Typical arrangement for non-metallic and composite cable tie orientation on split mandrel for tensile test – Parallel entry strap

5.10 Tests for adhesive fixing devices on a stainless steel or aluminium bare panel covers the installation on any bare metal surface and on the following painted metal surfaces:

– enamel;

– epoxy;

– polyester.

The installation on other surfaces requires testing on these materials and painted surfaces.

Unless specified otherwise by the manufacturer, the samples are to be held to the panel for a period of 5^{+1}_{0} with a force of (50 ± 5) N prior to the start of the prescribed pre-conditioning period or other exposures. Before applying any force, the time recommended by the manufacturer shall be respected.

5.10DV D1 *Modify Clause 5.10 by replacing it with the following:*

Tests for rubber adhesive fixing devices and integral fixing devices on stainless steel or aluminum bare panel cover installation on any bare metal surface and on the following painted surfaces:

– enamel;

– epoxy; and

– polyester.

The installation on other surfaces shall be tested on those surfaces.

5.11DV D2 *Add Clauses 5.11DV.1 to 5.11DV.4 to Clause 5 as follows:*

5.11DV.1 Tests for acrylic fixing devices and integral fixing devices on stainless steel or aluminum bare panel cover the installation on any bare metal surface.

The installation on other surfaces shall be tested on those materials.

5.11DV.2 Any other generic type of adhesive used on a fixing device or an integral fixing device shall be tested on each surface type.

5.11DV.3 Unless specified otherwise by the manufacturer, the samples shall be secured to the panel for 5 (0/+1) seconds with a force of 50 ±5 N prior to the start of the prescribed pre-conditioning period or other exposures.

5.11DV.4 As an alternative to the requirements specified in Clauses 5.10DV, 5.11DV.1, and 5.11DV.2, an adhesive relied upon for securing a fixing device may be tested in accordance with Clauses 9.7 and 9.8DV.

NOTE In Canada and the United States, an adhesive previously evaluated to the appropriate requirements for polymeric adhesive systems according to UL 746C or CAN/CSA-C22.2 No. 0.17 meets the intent of the requirement in Clause 9.8DV and only requires the evaluation according to Clause 9.7 on one substrate.

6 Classification

6.1 According to material

6.1.1 Metallic component

6.1.2 Non-metallic component

6.1.3 Composite component

6.2 According to loop tensile strength for cable ties and mechanical strength for fixing devices

6.2.1 Loop tensile strength for cable ties

As given in Table 3.

Table 3
Loop tensile strength

Loop tensile strength N	
50	530
80	800
130	890
180	1 150
220	1 300
360	2 200
450	

Other values may be declared at the manufacturer's discretion.

NOTE Loop tensile strength does not provide an indication of long-term static load-bearing capabilities.

6.2.2 Type 1 – Retains at least 50 % of declared loop tensile strength for cable ties and mechanical strength for fixing devices after test conditions

NOTE In some countries, such as Canada and the United States, additional type classifications are applicable when pre-qualified moulding materials are used. See UL 62275/CSA C22.2 No. 62275.

6.2.2DV D1 *Modify Clause 6.2.2 by adding the following:*

6.2.2DV.1 Type 11 – The Type 11 classification refers to Type 1 according to 6.2.2 with additional pre-qualification to long-term performance characteristics of non-metallic moulding materials according to CAN/CSA-C22.2 No. 0.17 or UL 746B

6.2.2DV.2 For a cable tie and fixing device that are manufactured as an integral product, both the cable tie and fixing device shall have the same Type classifications according to either 6.2.2 or 6.2.2DV.1.

6.2.2DV.3 Products may have multiple Type classifications Type 1 and 11. In Mexico, Type 11 does not apply.

6.2.3 Type 2 – Retains 100 % declared loop tensile strength for cable ties and mechanical strength for fixing devices after test conditions

NOTE In some countries, such as Canada and the United States, additional type classifications are applicable when pre-qualified moulding materials are used. See UL 62275/CSA C22.2 No.62275.

6.2.3DV D1 *Modify Clause 6.2.3 by adding the following:*

6.2.3DV.1 Type 21 – The Type 21 classification refers to Type 2 according to 6.2.3 with additional pre-qualification to long-term performance characteristics of non-metallic moulding materials according to CAN/CSA-C22.2 No. 0.17 or UL 746B. Cable ties classified according to 6.1.1 are considered only as Type 2 according to 6.2.3. Type 21 does not apply.

6.2.3DV.1.1 Type 2S – Retains 100 % declared loop tensile strength for cable ties and mechanical strength for fixing devices after test conditions and is also intended for primary support of flexible conduit, flexible tubing, or cable in accordance with the relevant national installation code. The manufacturer's mechanical strength for such products shall be at least 220 N.

NOTE In some countries, such as Canada and the United States, additional Type classifications are applicable when pre-qualified moulding materials are used. See UL 62275/CSA C22.2 No.62275.

6.2.3DV.1.2 Type 21S – The Type 21S classification refers to Type 2S according to 6.2.3DV.1.1 with additional pre-qualification to long-term performance characteristics of non-metallic moulding materials according to CAN/CSA-C22.2 No. 0.17 or UL 746B and is also intended for primary support of flexible conduit, flexible tubing, or cable in accordance with the relevant national installation code. The manufacturer's mechanical strength for such products shall be at least 220 N.

6.2.3DV.2 For a cable tie and fixing device that are manufactured as an integral product, both the cable tie and fixing device shall have the same Type classifications according to 6.2.3, 6.2.3DV.1, 6.2.3DV.1.1, and 6.2.3DV.1.2.

6.2.3DV.3 Products may have multiple Type classifications Type 2 and 21 or Type 2S and 21S.

In Mexico, Type 21 and 21S does not apply.

6.2.4 According to loop tensile strength and mechanical strength of integral assemblies

An integral assembly shall have a single classification type according to 6.2.2 and 6.2.3.

6.3 According to temperature

6.3.1 According to maximum operating temperature for application given in Table 4

Table 4
Maximum operating temperature for application

Temperature °C
50
60
75
85
105
115
125
150

Additional ratings above 150 °C may be declared in 10 °C increments.

6.3.1DV D1 ***Modify Clause 6.3.1 by adding the following:***

6.3.1DV.1 These ratings should be used. Additional ratings in 5-degree increments may also be used.

6.3.1DV.2 The maximum operating temperatures declared by the manufacturer shall be applied for testing according to this Standard. For required markings in Clause 7, lower temperatures may be marked at the manufacturer's discretion.

NOTE: When declaring maximum operating temperatures, be certain laboratory conditioning ovens are capable of maintaining the parameters required in Clause 5.7.

6.3.1DV.3 The maximum operating temperature declared for a fixing device that includes an adhesive for fixing to a surface shall not exceed that of the adhesive as determined by Clause 9.8DV.

6.3.2 According to minimum operating temperature for application given in Table 5

Table 5
Minimum operating temperature for application

Temperature °C
0
−5
−15
−25
−40
−60

6.3.2DV D1 ***Modify Clause 6.3.2 by adding the following:***

6.3.2DV.1 These ratings should be used. Additional ratings in 5-degree increments may also be used.

6.3.2DV.2 The minimum operating temperature declared for a fixing device that includes an adhesive for fixing to a surface shall not be lower than that of the adhesive as determined by Clause 9.8DV.

6.3.3 According to minimum temperature during installation as declared by the manufacturer

6.3.3DV D1 ***Modify Clause 6.3.3 by adding the following:***

This classification shall apply only when the temperature declared is lower than 0 °C.

6.4 According to contribution to fire for non-metallic and composite cable ties and integral assemblies only

6.4.1 Flame propagating

NOTE Due to the small mass of material, cable ties classified as flame propagating are considered to present only a minor potential contribution in the case of fire.

6.4.2 Non-flame propagating

Metallic cable ties and metallic integral assemblies without a non-metallic coating are considered non-flame propagating.

6.5 According to environmental influences

6.5.1 According to resistance to ultraviolet light for non-metallic and composite components

6.5.1.1 Not declared

6.5.1.2 Resistant to ultraviolet light

6.5.2 According to resistance to corrosion for metallic and composite components

6.5.2.1 Not declared

6.5.2.1DV D1 ***Delete Clause 6.5.2.1:***

This Clause does not apply.

6.5.2.2 Resistant to corrosion

6.6DV D1 ***Add Clause 6.6DV to Clause 6 as follows:***

6.6DV According to smoke and heat generation

6.6DV.1 ***Not declared***

6.6DV.2 AH-1: Suitable for use in air-handling spaces – 1 (plenums)

For cable ties and fixing devices according to 6.1.1

In Mexico, the classification AH-1 does not apply.

6.6DV.3 AH-2: Suitable for use in air-handling spaces – 2 (plenums)

For cable ties and fixing devices according to 6.1.2 and 6.1.3

In Mexico, the classification AH-2 does not apply.

7 Marking and documentation

7.1 Each cable tie and fixing device shall be marked with:

– the manufacturer's or responsible vendor's name or trademark, and

– an identifying symbol as defined by the manufacturer.

Compliance is checked by inspection.

Where it is not possible, for example, due to the small size of a cable tie or fixing device to mark on it the identifying symbol, then this symbol may be marked on the packaging.

NOTE 1 The identifying symbol can be a reference number, letter, etc.

NOTE 2 Marking can be applied, for example, by moulding, pressing, engraving, printing, adhesive labels, etc.

7.1DV D1 ***Modify by replacing the first paragraph of 7.1 with the following:***

Each cable tie and fixing device shall be marked with the manufacturer's or responsible vendor's name or trademark or identifying symbol.

7.2 Marking on cable ties, fixing devices and integral assemblies shall be legible, durable and indelible.

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

Compliance is checked by inspection, using normal or corrected vision, without additional magnification.

The test is made 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 n-hexane 95 % 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.

The marking surface to be tested shall be dried after the test with water.

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 which is wrapped with cotton comprising of cotton wool covered by a piece of cotton medical gauze. Test piston is shown in Figure 3.

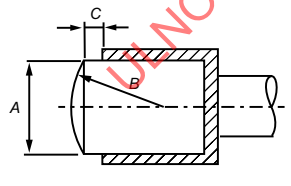
The test piston shall have the dimensions shown in Figure 3 and shall be made of an elastic material that is inert against the test liquids and has a Shore-A hardness of 47 ± 5 (for example synthetic rubber). When it is not possible to carry out the test on the specimens owing to the shape/size of the product, a suitable piece having the same characteristics as the product can be submitted to the test.

7.2DV.1 D2 *Modify Clause 7.2 by replacing the first paragraph with the following:*

Permanence of markings – Marking specified in Clause 7.1 on cable ties, fixing devices, and integral assemblies shall be legible, durable, and indelible.

7.2DV.2 D2 *Modify Clause 7.2 by adding the following:*

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



Dimensions mm		
A	B	C
20	20	2

Figure 3

Test piston for durability test for marking

7.3 The manufacturer or responsible vendor shall provide in their literature the information according to Table 6.

7.3DV D1 *Modify Clause 7.3 by adding the following:*

7.3DV.1 The markings in Table 6 shall be provided on packaging provided with the product, except for the following:

– According to resistance to corrosion for metallic and composite according to 6.5.2;

– The recommended method of installation, including the tool to be used, if any, and the load to be applied;

– Recommendations on transport and storage;

– Specific mounting or assembly conditions such as mounting hole sizes, material thicknesses, mounting orientations, etc., according to 5.8;

– Material of the surfaces to which the adhesive fixing device is intended to be affixed according to 5.10;

– Classification according to material according to 6.1; and

– Contribution to fire for non-metallic and composite according to 6.4.

The aforementioned information shall be provided in literature including instruction sheets, product bulletins, websites and the like.

7.3DV.2 An integral assembly shall indicate the same Type classification according to 6.2.2DV.2 and 6.2.3DV.2.

Compliance is checked by inspection.

7.3DV.3 In Canada and the United States, a fixing device that relies upon adhesive for securement shall be marked to include the following:

a) substrates accepted by testing in accordance with 5.10DV, 5.11DV.1, 5.11DV.2, 5.11DV.3 and 9.7 or testing in accordance with 9.7 and 9.8DV; and

b) manufacturer's recommendations for surface preparations, adhesive application temperature range, application pressure and duration, and curing time prior to loading.

In Mexico, this requirement does not apply.

7.3DV.4 Cable ties and fixing devices classified according to 6.5.1.2 shall be marked "Resistant to Ultraviolet light" or with equivalent wording. The products may additionally be marked "For use outdoors" or "For use outdoors or indoors" or with equivalent wording.

7.3DV.5 In Canada and the United States, the manufacturer's declared loop tensile strength according to Table 3 may be supplemented with equivalent values expressed in pounds-force (lb-f) or kilograms-force (kg-f).

In Mexico, this does not apply.

7.3DV.6 In Canada and the United States, a cable tie or fixing device classified as Type 2 according to 6.2.3, Type 2S according to 6.2.3DV.1.1, Type 21 according to 6.2.3DV.1 or Type 21S according to 6.2.3DV.1.2, and also classified according to 6.6DV.2 or 6.6DV.3 may be marked as follows:

a) For products classified as 6.1.1 and 6.6DV.2, "Suitable for use in air-handling spaces (plenums)" in accordance with Section 300.22 (B), (C), and (D) of the National Electrical Code, and Rules 12-010 (3), (4), and (5), and 12-020 of the Canadian Electrical Code, Part I, or an equivalent wording. Marking of the code "AH-1" meets the intent of this requirement.

b) For products classified as 6.1.2 or 6.1.3 and 6.6DV.3, "Suitable for use in air-handling spaces (plenums)" in accordance with Section 300.22 (C) and (D) of the National Electrical Code, and Rules 12-010 (3), (4), and (5), and 12-020 of the Canadian Electrical Code, Part I, or an equivalent wording. Marking of the code "AH-2" meets the intent of this requirement.

7.3DV.7 A cable tie classified Type 2S, according to 6.2.3DV.1.1, or Type 21S according to 6.2.3DV.1.2, and that complies with the requirements in 9.6.1DV, 11.1.4DV.6, and 11.2DV where applicable, may be marked with the suffix "S" or "Support" in conjunction with the Type marking required in Table 6.

Table 6
Literature information

Information	Cable ties	Fixing devices	Integral assemblies
Classification according to material according to 6.1	X	X	X
Loop tensile strength according to 6.2.1	X		X[a]
The manufacturer's declared mechanical strength		X	X[a]
Type designation according to 6.2.2 or 6.2.3	X	X	X
Maximum operating temperature for application according to 6.3.1	X	X	X
Minimum operating temperature for application according to 6.3.2	X	X	X
Minimum temperature during installation according to 6.3.3	X		X
Contribution to fire for non-metallic and composite according to 6.4	X		X
Resistance to ultraviolet light for non-metallic and composite according to 6.5.1	X	X	X
Resistance to corrosion for metallic and composite according to 6.5.2	X	X	X
The maximum and minimum bundle diameter in mm	X		X
The recommended method of installation, including the tool to be used, if any, and the load to be applied	X	X	X
Recommendations on transport and storage	X	X	X
Specific mounting or assembly conditions such as mounting hole sizes, material thicknesses, mounting orientations, etc. according to 5.8		X	X

Table 6 Continued on Next Page

Table 6 Continued

Information	Cable ties	Fixing devices	Integral assemblies
Material of the surfaces to which the adhesive fixing device is intended to be affixed according to 5.10		X	X
Manufacturer's recommendations for surface preparations, adhesive application temperature range, and curing time prior to loading		X	X
[a] Mechanical strength of the fixing device and loop tensile strength of the cable tie, as declared by the manufacturer. If the two ratings are the same, a single combined rating may be declared. For example, mechanical strength and loop tensile strength 80 N. If the two ratings differ, both shall be declared. For example, mechanical strength 40 N, loop tensile strength 80 N. The declared mechanical strength of the fixing device that is integral to a cable tie shall not exceed the declared value for the loop tensile strength of the cable tie.			

NOTE In the following countries, some marking information in Table 6 is required to be placed on the packaging accompanying the product: CA, US and RU.

Compliance is checked by inspection.

Table 6DV D2 ***Modify Table 6 by replacing the NOTE with the following:***

NOTE 1DV: Some countries, such as CA, US, RU, and MX require the marking information to be placed on the packaging accompanying the product.

Compliance is checked by inspection.

8 Construction

The surface of the cable tie or fixing device shall be free from burrs and similar inconsistencies, and edges shall be smooth so as not to damage the cables or to inflict injury to the installer or user.

Compliance is checked by inspection.

8DV D1 ***Add Clauses 8DV.1 to 8DV.5 to Clause 8 as follows:***

8DV.1 Flammability requirements for Type 11 and Type 21 cable ties and fixing devices

8DV.1.1 Non-metallic materials and the non-metallic components of composite cable ties and fixing devices classified as Type 11 or Type 21 shall have a minimum flammability classification of HB. Flammability classification of a pre-selected material shall be based on a nominal 1.5 mm thickness.

Compliance shall be checked by the test in IEC 60695-11-10.

Flame classifications determined in accordance with CAN/CSA-C22.2 No. 0.17 or UL 94 meet the intent of this requirement.

8DV.2 Relative thermal index ratings for Type 11 and Type 21 cable ties and fixing devices

8DV.2.1 In Canada and the United States, the maximum operating temperature of a non-metallic or composite cable tie, as classified in 6.3.1, or as declared for a fixing device,

shall be based on the relative thermal index (RTI – Strength) properties of the material used in the device. This declared temperature shall not exceed the relative thermal index of a 1.5 mm thick material from which the product is molded.

In Mexico, this requirement does not apply.

8DV.2.2 The relative thermal index shall be determined as given in UL 746B or CAN/CSA-C22.2 No. 0.17.

NOTE: The relative thermal index of a material is an indication of the material's ability to retain a particular property (such as physical or electrical) when exposed to an elevated temperature for an extended period of time. For each material, a number of relative thermal indices are established, each related to a specific property and specific thickness of the material.

8DV.3 Material requirements for Type 11 and Type 21 cable ties and fixing devices

8DV.3.1 Except as indicated in Items a) and b), polymeric materials used to mold or fabricate products covered by this Standard shall be made from materials that are 100 percent virgin and unmodified by the molder:

a) Products made from thermoplastic materials shall be limited to 25 percent regrind by weight of the same material, unless the results of a separate investigation indicate acceptable performance for the material or the specific device.

NOTE: Annex DVB, Polymeric material modifications, includes guidelines to be considered in such a separate investigation.

b) Products covered by this Standard may employ colorants, flame retardants, fillers, mold-release lubricants, color concentrates, dyestuff, chemical blowing agents, or reinforcements in conjunction with the polymeric material, when the additive or concentrate is tested and found not to adversely affect the critical properties of the material. An additive or concentrate of unknown performance shall not be used. Annex DVB, Polymeric material modifications, provides guidance for the use of specific additives that may be used in the molding process without need for separate investigation.

8DV.3.2 Cable ties and fixing devices shall not employ materials that have been blended together unless one of the following conditions has been met:

a) When two materials have already been individually considered acceptable for an application, and are both found to be generically similar, are both produced by the same manufacturer, and are both classed HB according to 8DV.1.1, these materials may be dry blended in any proportion by the manufacturer without further testing.

b) When two materials have already been individually considered acceptable for an application, and are both found to be generically similar, are both produced by the same manufacturer, are each classed V-0, V-1, or V-2 when tested in accordance with 8DV.1, and the results of a separate investigation indicate performance meeting the requirements for the material or the specific device, these materials may be dry blended in any proportion by the manufacturer without further testing.

Annex DVB, Polymeric material modifications, includes guidelines for a separate investigation.

A product made from blended material described in Item a) or b) shall be considered to have flammability, mechanical, and thermal properties that are no better than the performance of the weaker of the individual constituents on a property-to-property basis.

8DV.4 Material substitution for Type 11 and Type 21 cable ties and fixing devices

8DV.4.1 Another polymeric material may be substituted in cable ties and fixing devices having met the requirements of this Standard only when the material meets the conditions in Annex DVA, Substitution of materials, and compliance is determined through appropriate investigation.

8DV.5 Material identification for Type 1 cable ties and Type 2 cable ties and fixing devices.

8DV.5.1 In Canada and the United States, polymeric materials in cable ties and fixing devices classified Type 1 according to 6.2.2, and cable ties and fixing devices classified as Type 2 and 2S according to 6.2.3 and 6.2.3DV.1.1, shall be identified according to the tests in Annex DVC . Another polymeric material shall be allowed to be substituted, and is considered of the same material type according to 5.1, when determined to have a similar profile.

Compliance is checked by the tests for polymer identification in Annex DVC. In the United States, compliance with these tests in UL 746A meets the intent of this requirement. In Canada, compliance with these tests in CAN/CSA-C22.2 No. 0.17 meets the intent of this requirement.

In Mexico, this requirement does not apply.

9 Mechanical properties

9.1 Requirements

Cable ties, fixing devices and integral assemblies shall withstand the stresses likely to occur during installation and application.

An integral assembly shall comply with the requirements for both the fixing device and the cable tie.

The cable tie shall:

– be capable of fixing the maximum and minimum bundle diameter declared by the manufacturer.

Compliance is checked by the test according to 9.2;

– be able to be installed at the minimum temperature declared by the manufacturer.

Compliance is checked by the test according to 9.3, for cable ties classified according to 6.1.2 and 6.1.3 only;

– be resistant to the effect of impact forces at the minimum operating temperature declared by the manufacturer.

Compliance is checked by the test according to 9.4, for cable ties classified according to 6.1.2 and 6.1.3 only;

– maintain its fixing function at the minimum and maximum application temperature declared by the manufacturer. Metallic cable ties shall maintain their fixing function when exposed to vibration.

NOTE Non-metallic and composite cable ties are considered to be resistant to the effects of vibration.

Compliance is checked by the relevant tests. For cable ties classified according to 6.2.2, by the tests according to 9.5. For cable ties classified according to 6.2.3, by the tests according to 9.6.

Cable ties classified according to 6.1.1 are considered only as Type 2 according to 6.2.3.

The fixing device shall maintain its fixing function at the minimum and maximum application temperature as declared by the manufacturer.

Compliance is determined by the tests according to 9.7.

9.1DV D1 *Modify Clause 9.1 by adding the following:*

NOTE: This requirement does not apply to cable ties intended to be installed at temperatures of 0 °C or higher.

9.1DV.1 When a metallic cable tie of the same size or range of sizes is provided both with and without a non-metallic or organic coating, all tests in 9.6 shall be conducted on uncoated samples. The coated cable ties shall be subjected only to the loop tensile strength test in the as-received condition according to 9.6.1.

Moisture stabilization according to 5.2 is not applicable for this test.

In Mexico, the vibration test specified in 9.6.4 does not apply.

9.1DV.2 Compliance of cable ties classified according to 6.2.2DV.1 (Type 11) shall be checked according to the tests specified in 9.5, and cable ties classified according to 6.2.3DV.1 (Type 21) shall be checked according to the tests specified in 9.6.

9.1DV.3 Cable ties classified according to 6.1.1 are considered only as Type 2 according to 6.2.3.

9.1DV.4 Non-metallic and composite cable ties and fixing devices, and metallic cable ties having a non-metallic or organic coating, shall be either flame propagating or non-flame propagating.

Compliance for non-flame propagation shall be checked by the test specified in Clause 10DV for Type 1 and Type 2 cable ties and fixing devices, or, in accordance with 8DV.1 for Type 11 and Type 21 cable ties and fixing devices.

9.1DV.5 Metallic cable ties and fixing devices, and metallic components of composite cable ties and fixing devices, shall be resistant to corrosion.

Compliance shall be checked by the test specified in 11.2DV.

9.2 Installation test

The sample shall be installed on a mandrel representing the maximum specified diameter or size and the minimum specified diameter or size to determine that it is able to be installed in the intended manner, as specified by the manufacturer.

Moisture stabilization according to 5.2 is not applicable for this test.

9.3 Minimum installation temperature test for cable ties

If the manufacturer gives no recommendation that the cable tie should be installed immediately after unpacking, in order to maintain the humidity level, non-metallic and composite cable ties shall be dried out for (72 ± 1) h at the maximum operating temperature declared by the manufacturer before the following test is carried out. The sample and a steel or aluminium mandrel, which reflects the minimum bundle diameter, shall be placed separately in a cold chamber, the temperature in which shall be maintained at the declared minimum temperature for installation with a tolerance of ±2 °C. When the sample has attained this temperature or after 2 h, whichever is the longer period, the sample is installed on the mandrel. After the test, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

Moisture stabilization according to 5.2 after removal from the cold chamber is not applicable.

9.3DV D2 *Modify Clause 9.3 by replacing the first paragraph with the following:*

Non-metallic and composite cable ties intended to be assembled at temperatures lower than 0 °C shall be dried out for 72 ±1 hours at the maximum operating temperature declared by the manufacturer before the following test is carried out.

9.4 Minimum operating temperature test for cable ties

The test mandrel as specified in 5.9 with the sample installed shall be placed in a cold chamber, the temperature within which shall be maintained at the declared temperature according to Table 5 with a tolerance of ±2 °C.

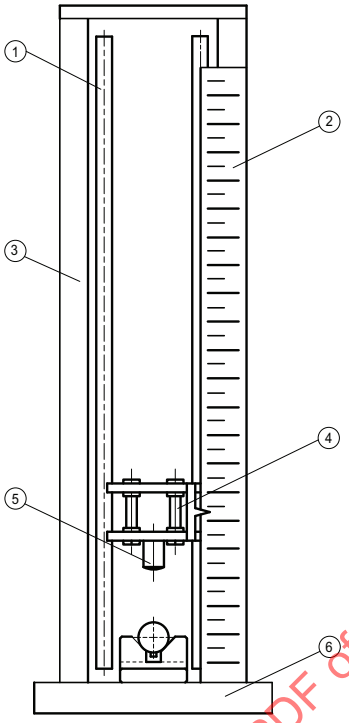
Two hours after the cold chamber has recovered to the declared temperature, the sample is removed from the cold chamber and placed on a V-block as shown in Figure 4, with the locking device of the tie placed opposite to the point of impact.

Moisture stabilization according to 5.2 after removal from the cold chamber is not applicable.

An impact shall be applied on the strap by a free fall hammer (12 ± 2) s after removal of the test assembly from the cold chamber. Compliance with impact applied before 10 s also complies with this test of this document. A typical apparatus is shown in Figure 4.

The energy of the hammer shall be as given in Table 7.

The sample shall be deemed to have passed the test if, after the test, it has not broken open, nor shall there be any crack visible to normal or corrected vision.



su4068 IEC

Figure 4a) Test apparatus assembly

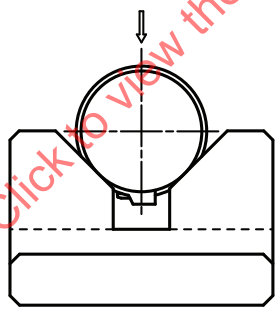


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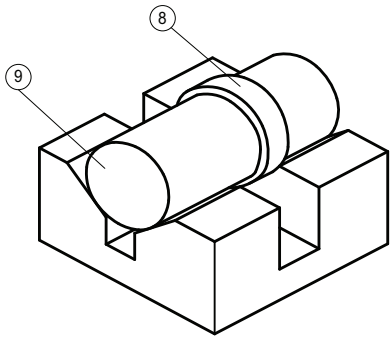
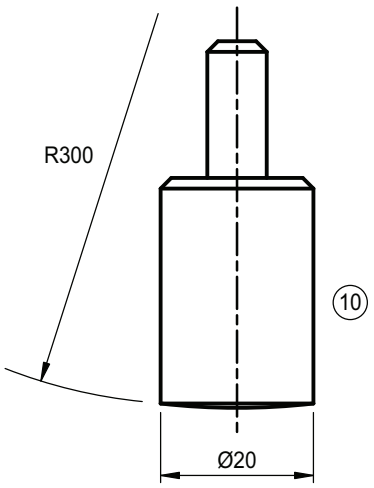
Figure 4b) Test mandrel with supporting V-block



su4069 IEC

Figure 4c) Position of tie strap



su4070 IEC

Figure 4d) Hammer details

Key

1 Guide rails
2 Height scale
3 Frame
4 Hammer guidance weight carriage
5 Hammer
6 Rigid base
7 Impact direction
8 Tie strap
9 Position of the test mandrel on mounting fixture (V-block)
10 Hammer

The gap in the V-block should be so wide and deep that neither the strap nor the tie locking device are in contact with the V block.

Figure 4

Test apparatus for cable tie impact test

Table 7
Energy values of hammer

Minimum declared loop tensile strength N		≤ 80	> 80 to 180	>180 to 230	> 230 to 540	> 540 to 1 300	> 1 300
Energy	J	0,14	0,35	0,7	1	2	5
Equivalent mass	kg	0,25	0,25	0,25	0,25	0,5	1,7
Height of fall	mm ± 1 %	56	140	280	400	400	300

9.5 Loop tensile strength test for cable ties classified according to 6.2.2

9.5DV D1 ***Modify Clause 9.5 by adding the following:***

The requirements in 9.5 also apply to Type 11 cable ties classified according to 6.2.2DV.1.

9.5.1 As-received condition

The test is carried out on a new set of ten non-metallic or composite cable ties. The samples shall be installed on a test mandrel as specified in 5.9.

Each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than the loop tensile strength declared according to 6.2.

9.5.2 After heat ageing

The test is carried out on a new set of ten non-metallic or composite cable ties. The samples shall be installed on a test mandrel as specified in 5.9.

Moisture stabilization according to 5.2 before heat ageing is not applicable for this test.

The samples shall be aged in a full draft circulating-air oven with forced air at the maximum declared temperature according to Table 4 increased by (15 ± 1) °C for ($1\,000^{+48}_{0}$) h. Then the samples and the mandrels shall be conditioned according to 5.2.

Each sample shall be subjected to a tensile pull. The maximum force is measured.

No individual value shall be less than 50 % of the loop tensile strength declared according to 6.2.

9.5.3 After temperature cycling

The test is carried out on a new set of ten cable ties. The sample shall be installed on a test mandrel as specified in 5.9. Moisture stabilization according to 5.2 before temperature cycling is not applicable for this test.

The test assembly is subjected to the following temperature cycling with transfer between each condition described in list items a) to f), of 4 min to 5 min duration:

a) for 120 min to 130 min, the assembly is stored in a full draft circulating-air oven at the maximum operating temperature as declared by the manufacturer according to Table 4 with a tolerance of $^{+2}_{0}$ °C;

b) for 60 min to 70 min, the assembly is then placed in a cold chamber at the minimum temperature for application in normal use as declared by the manufacturer according to Table 5 with a tolerance of $^{0}_{-2}$ °C;

c) condition a) is repeated;

d) condition b) is repeated but for (18^{+2}_{0}) h;

e) the test conditions a) and b) are repeated twice;

f) the test assembly consisting of non-metallic and composite components shall be conditioned according to 5.2.

After the cycling, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

Each sample shall be subjected to a tensile pull. The maximum force is measured.

No individual value shall be less than 50 % of the loop tensile strength declared according to 6.2.

9.6 Loop tensile strength test for cable ties classified according to 6.2.3

9.6DV D1 *Modify Clause 9.6 by adding the following:*

The requirements in 9.6 also apply to Type 21 cable ties classified according to 6.2.3DV.1, Type 2S cable ties classified according to 6.2.3DV.1.1, and Type 21S cable ties classified according to 6.2.3DV.1.2.

9.6.1 As-received condition

The test is carried out on a new set of ten cable ties. Each sample shall be installed on a test mandrel as specified in 5.9.

Each sample shall be subjected to a tensile pull until the load equivalent to the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s.

Excessive slippage measurements shall be determined by marking each tie across its width 1,6 mm beyond where the strap exits the locking device. A second mark shall then be placed 5,6 mm beyond the first mark for cable ties subjected to a load of 450 N or less, or 7,9 mm beyond the first mark for cable ties subjected to a load greater than 450 N. After the tie has withstood its test load for 1 min and the first mark is still visible, the test shall be terminated. When the slippage is more than 1,6 mm, the tie shall be tested for an additional 5 min. If the second mark moves out of sight within 5 min, the slippage is deemed excessive.

The cable tie shall not break and excessive slippage shall not occur as a result of the test.

9.6.1DV D1 *Modify Clause 9.6.1 by adding the following:*

A cable tie classified as Type 2S according to 6.2.3DV.1.1 or Type 21S according to 6.2.3DV.1.2 shall maintain this load for 5 minutes. Excessive slippage shall be measured as described above, except that if the first mark moves out of sight within the first minute, then the total test period shall be increased to 6 minutes. If the second mark moves out of sight, the slippage shall be deemed excessive.

9.6.2 After-heat ageing

The test is carried out on a new set of ten non-metallic or composite cable ties. Metallic cable ties are not required to be subjected to this test. Each sample shall be installed on a test mandrel as specified in 5.9. Moisture stabilization according to 5.2 before heat ageing is not applicable for this test. The samples shall be aged in a full draft circulating-air oven with forced air at the maximum declared temperature according to Table 4 increased by (15 ± 1) °C for ($1\ 000_{0}^{+48}$) h. Then the samples and the mandrels shall be conditioned according to 5.2.

Each sample shall be subjected to a tensile pull until the load equivalent to the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60_{0}^{+5}) s.

The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1.

9.6.2DV D1 *Modify Clause 9.6.2 by adding the following:*

A cable tie classified as Type 2S according to 6.2.3DV.1.1 or Type 21S according to 6.2.3DV.1.2 shall maintain this load for 5 minutes. Excessive slippage shall be measured as described above, except that if the first mark moves out of sight within the first minute, then the total test period shall be increased to 6 minutes. If the second mark moves out of sight, the slippage shall be deemed excessive.

9.6.3 After temperature cycling

The test is carried out on a new set of ten cable ties. The sample shall be installed on a test mandrel as specified in 5.9. Samples shall be stabilized by being exposed to a temperature of (23 ± 2) °C and (50 ± 5) % relative humidity between each phase of the cycle for at least 30 min. Moisture stabilization according to 5.2 before temperature cycling is not applicable for this test.

The test assembly is subjected to the following cycling.

a) The samples shall be placed in a full draft circulating-air oven at the declared maximum operating temperature of the device for 48 h.

b) The samples shall then be placed in a chamber at (90 ± 5) % relative humidity and (40 ± 2) °C for 48 h.

c) The samples shall then be placed in a cold chamber at (−35 ± 2) °C for 8 h.

d) The samples shall then be placed in a full draft circulating-air oven, at the declared maximum operating temperature for 64 h.

e) The test assembly consisting of non-metallic and composite components shall be conditioned according to 5.2.

After the cycling, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

Each sample shall be subjected to a tensile pull until the load equivalent to the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60_{0}^{+5}) s.

The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1.

9.6.3DV D1 *Modify Clause 9.6.3 by adding the following:*

A cable tie classified as Type 2S according to 6.2.3DV.1.1 or Type 21S according to 6.2.3DV.1.2 shall maintain this load for 5 minutes. Excessive slippage shall be measured as described above, except that if the first mark moves out of sight within the first minute, then the total test period shall be increased to 6 minutes. If the second mark moves out of sight, the slippage shall be deemed excessive.

9.6.4 After vibration test for metallic cable ties

A minimum of two cable ties shall be installed around separate mandrels as described in 5.9. Each tie then shall be marked across its width adjacent to the strap's entry into the locking device. The ties then shall be subjected to the temperature cycle conditioning in accordance with 9.6.3 but not the loop tensile strength test. Upon completion of this conditioning, the mandrels shall be securely mounted to the vibration table such that the direction of the vibration is parallel to the plane of the circular configuration of the assembled tie. See Figure 5. The mandrels then shall be subjected to the following vibration test in accordance with IEC 60068-2-6:2007:

– frequency range: 10 Hz to 150 Hz, logarithmic ramp and return;

– duration 75 min: 10 sweep cycles, 1 octave/min;

– maximum peak amplitude: 0,35 mm (0,7 mm from peak to peak);

– maximum acceleration: 50 m/s^2;

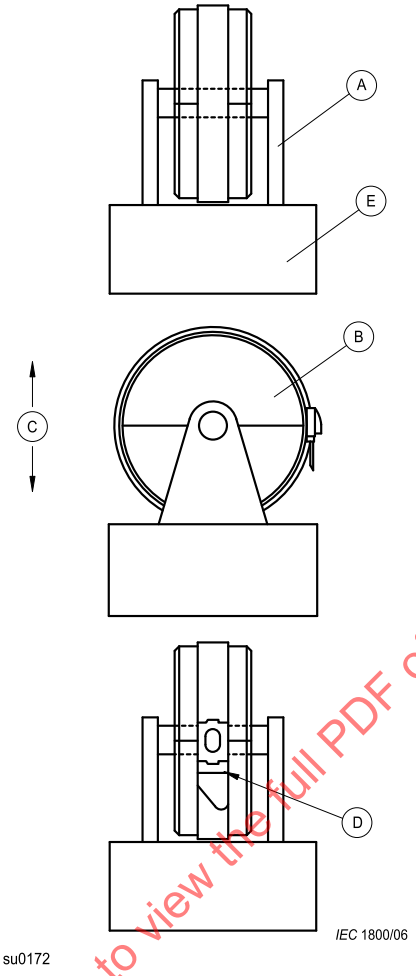
– crossover frequency between 58 Hz and 62 Hz.

Each sample shall be subjected to a tensile pull until the load equivalent to the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s.

The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1 including the measurement of the slippage from the original reference mark.

9.6.4DV D1 *Modify Clause 9.6.4 by adding the following:*

A cable tie classified as Type 2S according to 6.2.3DV.1.1 or Type 21S according to 6.2.3DV.1.2 shall maintain this load for 5 minutes. Excessive slippage shall be measured as described above, except that if the first mark moves out of sight within the first minute, then the total test period shall be increased to 6 minutes. If the second mark moves out of sight, the slippage shall be deemed excessive.



Key

A mounting bracket

B split mandrel

C direction of vibration

D reference line scribed on strap

E vibration table

Figure 5

Typical arrangement for the vibration test

9.7 Mechanical strength test for fixing devices and integral assemblies

9.7.1 As-received condition

The test is carried out on a new set of ten samples for each product function (loop tensile strength, mechanical strength).

The fixing device or the integral assembly shall be fixed to a rigid support according to the manufacturer's instructions. The adhesive fixing device shall be adhered to a rigid panel, according to 5.10.

When testing for mechanical strength, the following applies:

– For a separately supplied fixing device, an appropriate cable tie shall be assembled to the fixing device.

– A separately supplied fixing device and an integral assembly shall be installed on a non-split mandrel according to 5.9. A split mandrel can be used as long as the two parts are linked together to operate as a solid mandrel.

– For integral assemblies, the test fixture shall allow for self-alignment of the test load with the integral assembly during the test. In order to achieve self-alignment of the test load, a sliding mounting table shall be used. The sliding mounting table shall be able to move without a significant friction. If during the test the self-alignment does not occur, the test is considered invalid.

– Typical arrangements of the test assembly are shown in Figure 6.

– For a separately supplied fixing device and for an integral assembly according to 6.2.2, each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than the declared mechanical strength.

– For a separately supplied fixing device and for an integral assembly classified according to 6.2.3, each sample shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s.

When testing for loop tensile strength, the following applies:

– An integral assembly shall be installed on a split mandrel according to 5.9.

– Typical arrangements of the test assembly are shown in Figure 2.

– For an integral assembly classified according to 6.2.2, each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than the declared loop tensile strength.

– For an integral assembly classified according to 6.2.3, each sample shall be subjected to a tensile pull until the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s.

After the test, the fixing device or the integral assembly shall show no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

If during the test

– the fixing device or the integral assembly, excluding the adhesive ones, detaches from the rigid support without signs of disintegration, cracking or the like, it is not considered a failure but the test shall be repeated with a more appropriate fixing method;

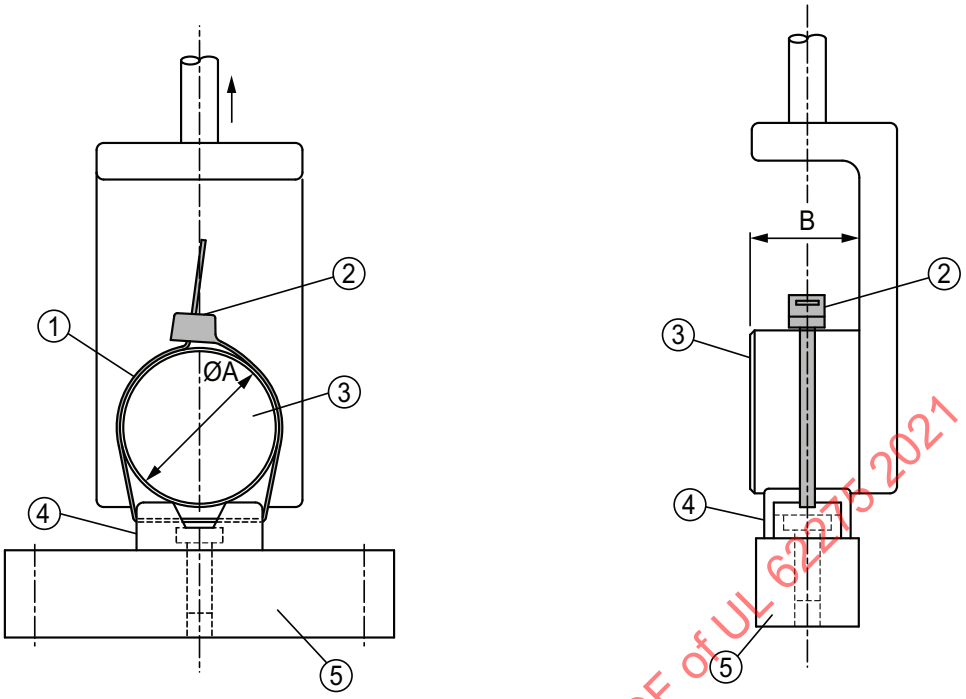
– the adhesive fixing device or the adhesive integral assembly detaches from the rigid support, this is considered a failure.

9.7.1DV.1 D2 ***Modify Clause 9.7.1 by adding the following dashed item to the list in the third paragraph:***

– For a separately supplied fixing device and for an integral assembly classified according to 6.2.3DV.1.1 and 6.2.3DV.1.2, each sample shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached, minimum 220 Newtons. This load is maintained for 5 minutes.

9.7.1DV.2 D2 ***Modify Clause 9.7.1 by adding the following dashed item to the list in the fourth paragraph:***

– For an integral assembly classified according to 6.2.3DV.1.1 and 6.2.3DV.1.2, each sample shall be subjected to a tensile pull until the loop tensile strength declared by the manufacturer is reached, minimum 220 Newtons. This load is maintained for 5 minutes.



su4072

IEC

Key

1 cable tie

2 locking device

3 mandrel

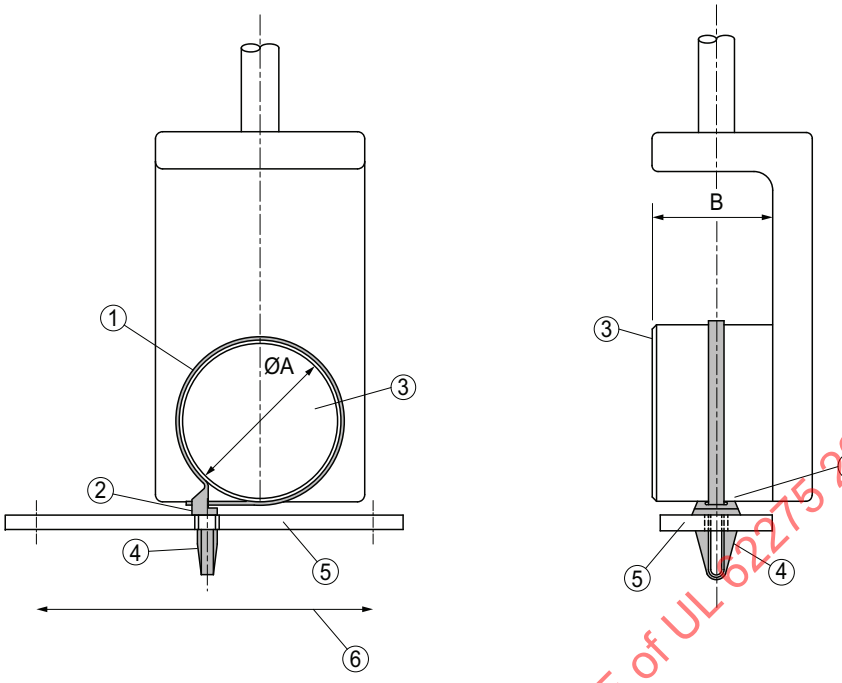
4 fixing device

5 rigid support

A diameter of test mandrel

B width of test mandrel

Figure 6a – Typical arrangement of test assembly for separately supplied fixing device



su0176c IEC

Key

1 cable tie

2 locking device

3 mandrel

4 fixing device

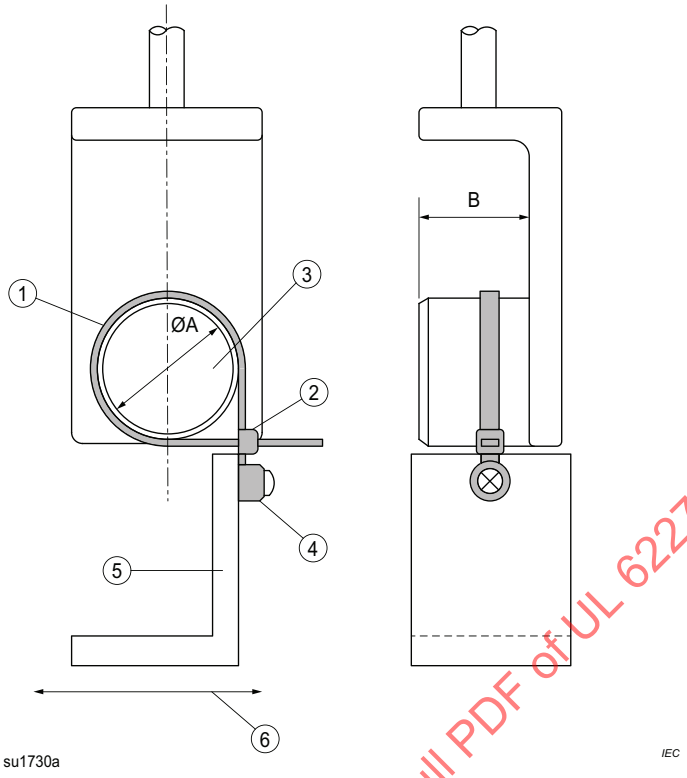
5 rigid support

6 Sliding table allowed to slide in this direction to allow self-alignment under force.

A diameter of test mandrel

B width of test mandrel

Figure 6b – Typical arrangement of test assembly for an integral push-mount fixing device



Key

1 cable tie

2 locking device

3 mandrel

4 fixing device

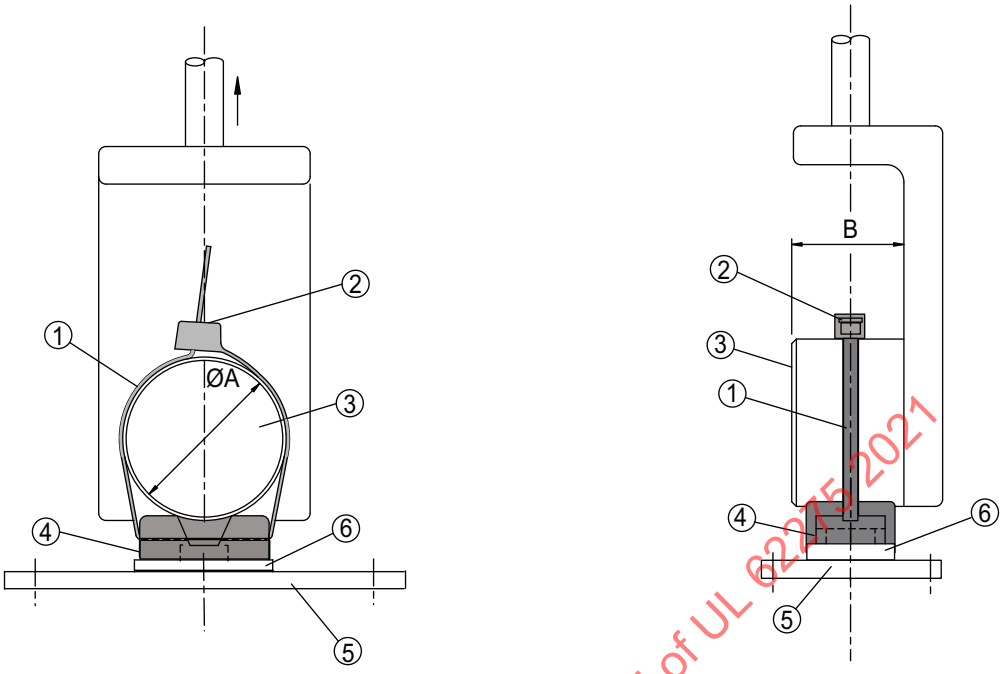
5 rigid support

6 Sliding table is allowed to slide in this direction to allow self-alignment under force.

A diameter of test mandrel

B width of test mandrel

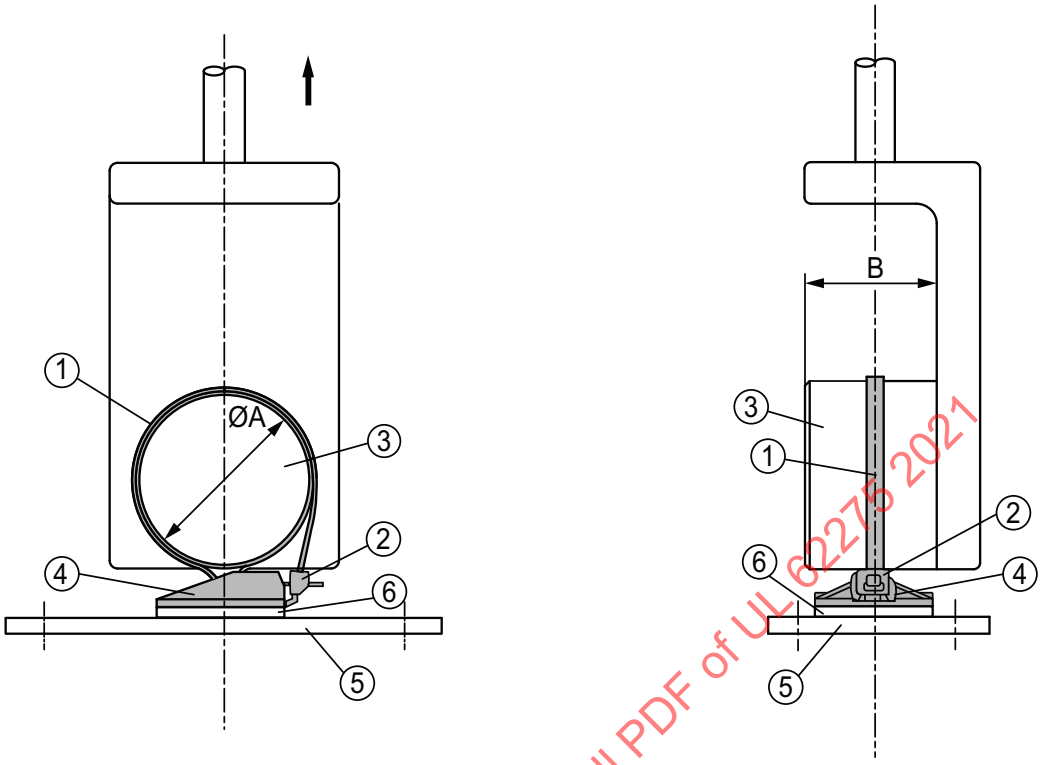
Figure 6c – Typical arrangement of test assembly for an integral screw-mount fixing device



Key

1 cable tie
2 locking device
3 mandrel
4 fixing device
5 rigid support
6 adhesive layer
A diameter of test mandrel
B width of test mandrel

Figure 6d – Typical arrangement of test assembly for separately supplied adhesive fixing device



su2714a

IEC

Key

1 cable tie
2 locking device
3 mandrel
4 fixing device
5 rigid support
6 adhesive layer
A diameter of test mandrel
B width of test mandrel

Figure 6e – Typical arrangement of test assembly for an integral adhesive fixing device

Figure 6

Typical arrangement of test assembly for fixing devices and for integral fixing devices

9.7.2 After-heat ageing

The test is conducted on a new set of ten non-metallic and composite samples for each product function (loop tensile strength, mechanical strength). Metallic fixing devices are not required to be subjected to this test.

Moisture stabilization according to 5.2 before heat ageing is not applicable for this test.

The fixing device or the integral assembly shall be fixed to a rigid support according to the manufacturer's instructions. The adhesive fixing device shall be adhered to a rigid panel, according to 5.10.

When testing for mechanical strength, the following applies:

– Separately supplied fixing devices shall be aged in a full draft circulating-air oven at the maximum declared temperature according to Table 4 increased by (15 ± 1) °C for 1 000$^{+48}_{0}$ h. Then the fixing device shall be conditioned according to 5.2. An appropriate cable tie shall be assembled to the fixing device and then to a non-split steel or aluminium mandrel according to 5.9.

– An integral assembly shall be installed on a non-split mandrel according to 5.9. The assembly shall be aged in a full draft circulating-air oven at the maximum declared temperature according to Table 4 increased by (15 ± 1) °C for 1 000$^{+48}_{0}$ h. Then the assembly shall be conditioned according to 5.2.

– For both separately supplied fixing devices and integral assemblies, a split mandrel can be used as long as the two parts are linked together to operate as a solid mandrel.

– For integral assemblies, the test fixture shall allow for self-alignment of the test load with the integral assembly during the test. In order to achieve self-alignment of the test load, a sliding mounting table shall be used. The sliding mounting table shall be able to move without a significant friction. If during the test the self-alignment does not occur, the test is considered invalid.

– Typical arrangements of the test assembly are shown in Figure 6.

– For a separately supplied fixing device and for an integral assembly according to 6.2.2, each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than 50 % of the declared mechanical strength.

– For a separately supplied fixing device and for an integral assembly classified according to 6.2.3, each sample shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached. This load is maintained for (60$^{+5}_{0}$) s.

When testing for loop tensile strength, the following applies:

– An integral assembly shall be installed on a non-split mandrel according to 5.9. The assembly shall be aged in a full draft circulating-air oven at the maximum declared temperature according to Table 4 increased by (15 ± 1) °C for 1 000$^{+48}_{0}$ h. Then the assembly shall be conditioned according to 5.2.

– Typical arrangements of the test assembly are shown in Figure 2.

– For an integral assembly classified according to 6.2.2, each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than 50% of the declared loop tensile strength.

– For an integral assembly classified according to 6.2.3, each sample shall be subjected to a tensile pull until the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0})s.

After the test, the fixing device or the integral assembly shall show no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

If during the test

– the fixing device or the integral assembly, excluding the adhesive ones, detaches from the rigid support without signs of disintegration, cracking or the like, it is not considered a failure but the test shall be repeated with a more appropriate fixing method.

– the adhesive fixing device or the adhesive integral assembly detaches from the rigid support, this is considered a failure.

9.7.2DV.1 D1 ***Modify Clause 9.7.2 by adding the following item to the third paragraph:***

When it is determined impractical to condition the samples according to 9.7.2 when mounted to the test fixture, the samples shall be conditioned separately. When conditioning separately, integral assemblies shall be installed on a mandrel of similar size to the test fixture and all samples may be installed on the same mandrel. After conditioning the samples shall be mounted to the test fixture prior to the appropriate tensile pull. When the samples are conditioned separately, if it is determined that the test results have been influenced by handling of the samples during assembly to the test fixture following conditioning, a separate set of samples shall be conditioned after consideration of a method that mitigates a reoccurrence.

9.7.2DV.2 D1 ***Modify Clause 9.7.2 by adding the following dashed item to the list in the fourth paragraph:***

– For a separately supplied fixing device and for an integral assembly classified according to 6.2.3DV.1.1 and 6.2.3DV.1.2, each sample shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached, minimum 220 Newtons. This load is maintained for 5 minutes.

9.7.2DV.3 D1 ***Modify Clause 9.7.2 by adding the following dashed item to the list in the fifth paragraph:***

– For an integral assembly classified according to 6.2.3DV.1.1 and 6.2.3DV.1.2, each sample shall be subjected to a tensile pull until the loop tensile strength declared by the manufacturer is reached, minimum 220 Newtons. This load is maintained for 5 minutes.

9.7.3 After temperature cycling

The test is carried out on a new set of ten samples for each product function (loop tensile strength, mechanical strength).

Moisture stabilization according to 5.2 before temperature cycling is not applicable for this test.

The fixing device or the integral assembly shall be fixed to a rigid support according to the manufacturer's instructions. The adhesive fixing device shall be adhered to a rigid panel according to 5.10.

When testing for mechanical strength, the following applies:

– Separately supplied fixing devices are subjected to the temperature cycling as specified in 9.5.3. An appropriate cable tie shall be assembled to the fixing device and then to a non-split steel or aluminium mandrel according to 5.9.

– An integral assembly shall be installed on a non-split mandrel according to 5.9. The assembly shall be subjected to the temperature cycling as specified in 9.5.3.

– For both separately supplied fixing devices and integral assemblies a split mandrel can be used as long as the two parts are linked together to operate as a solid mandrel.

– For integral assemblies, the test fixture shall allow for self-alignment of the test load with the integral assembly during the test. In order to achieve self-alignment of the test load, a sliding mounting table shall be used. The sliding mounting table shall be able to move without significant friction. If during the test the self-alignment does not occur, the test is considered invalid.

– Typical arrangements of the test assembly are shown in Figure 6.

– For a separately supplied fixing device and for an integral assembly according to 6.2.2, each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than 50% of the declared mechanical strength.

– For a separately supplied fixing device and for an integral assembly classified according to 6.2.3, each sample shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s.

When testing for loop tensile strength, the following applies:

– An integral assembly shall be installed on a non-split mandrel according to 5.9. The assembly shall be subjected to the temperature cycling as specified in 9.5.3.

– Typical arrangements of the test assembly are shown in Figure 2.

– For an integral assembly classified according to 6.2.2, each sample shall be subjected to a tensile pull. No individual value of the measured maximum force shall be less than 50 % of the declared loop tensile strength.

– For an integral assembly classified according to 6.2.3, each sample shall be subjected to a tensile pull until the loop tensile strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0})s.

After the test, the fixing device or the integral assembly shall show no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

If during the test:

– the fixing device or the integral assembly, excluding the adhesive ones, detaches from the rigid support without signs of disintegration, cracking or the like, it is not considered a failure but the test shall be repeated with a more appropriate fixing method.

– the adhesive fixing device or the adhesive integral assembly detaches from the rigid support, this is considered a failure.

9.7.3DV.1 D1 ***Modify Clause 9.7.3 by adding the following item to the third paragraph:***

– When it is determined impractical to condition the samples according to 9.7.3 when mounted to the test fixture, the samples shall be conditioned separately. When conditioning separately, integral assemblies shall be installed on a mandrel of similar size to the test fixture and all samples may be installed on the same mandrel. After conditioning the samples shall be mounted to the test fixture prior to the appropriate tensile pull. When the samples are conditioned separately, if it is determined that the test results have been influenced by handling of the samples during assembly to the test fixture following conditioning, a separate set of samples shall be conditioned after consideration of a method that mitigates a reoccurrence.

9.7.3DV.2 D2 ***Modify Clause 9.7.3 by adding the following dashed item to the list in the fourth paragraph:***

– For a separately supplied fixing device and for an integral assembly classified according to 6.2.3DV.1.1 and 6.2.3DV.1.2, each sample shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached, minimum 220 Newtons. This load is maintained for 5 minutes.

9.7.3DV.3 D2 ***Modify Clause 9.7.3 by adding the following dashed item to the list in the fifth paragraph:***

– For an integral assembly classified according to 6.2.3DV.1.1 and 6.2.3DV.1.2, each sample shall be subjected to a tensile pull until the loop tensile strength declared by the manufacturer is reached, minimum 220 Newtons. This load is maintained for 5 minutes.

9.8DV D1 ***Add Clause 9.8DV to Clause 9 as follows:***

9.8DV Adhesive relied upon for securement of fixing device

9.8DV.1 Scope

9.8DV.1.1 These requirements cover adhesives used to bond positioning devices to various substrates, where the adhesive is relied upon to maintain the proper functioning of the cable tie or fixing device with regard to the likelihood of electric shock, fire, and injury to persons.

9.8DV.1.2 The properties required of the adhesive shall be based upon an analysis of the function or functions of the adhesive in the end application. Bond strength (or impact strength) shall be considered as a critical property, and the evaluation test method shall be selected to relate as closely as possible to the end application.

9.8DV.2 Requirements

9.8DV.2.1 The initial values of the adhesive joint strength shall be determined by tests representing as closely as possible normal use. The effect of environmental conditions

that are experienced during normal and reasonably foreseeable abuse of the end product shall be determined. The same evaluation test method shall be used after exposure of the specimens to environmental conditions representative of such use. A critical property shall not be reduced more than 50 percent.

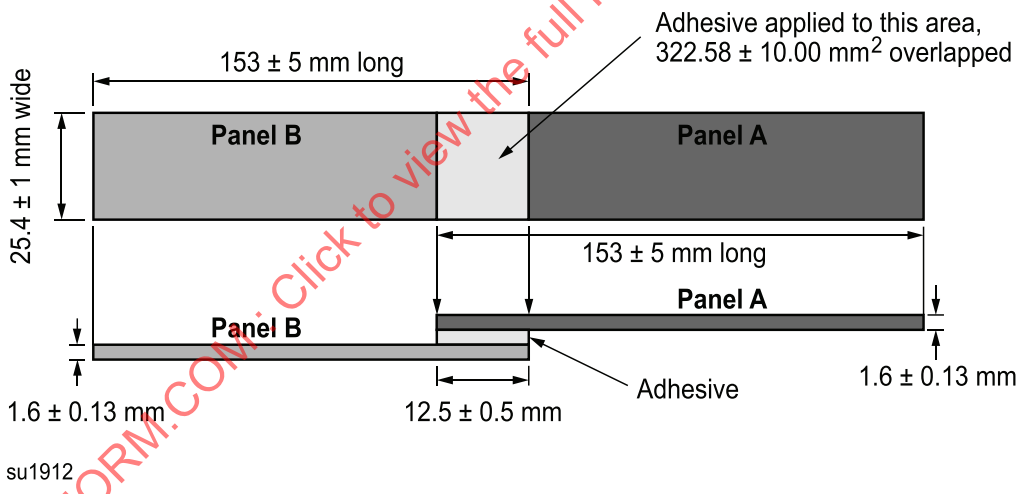
9.8DV.3 Method – General

9.8DV.3.1 Unless otherwise specified, all testing shall be conducted in a standard laboratory atmosphere at 25 ±5 °C (77 ±9 °F) and 50 ±5 percent relative humidity.

9.8DV.3.2 Test lap shear samples shall be prepared by the manufacturer and provided as shown in Figure 9.8DV.1. One substrate (Panel A) shall be moulded from the material from which fixing devices are produced, the other substrate (Panel B) moulded from material(s) to which the fixing devices are secured, as recommended by the manufacturer. The lap shear bonds shall be secured together using the adhesive system recommended for securing the fixing device to the surface(s). If the adhesive is intended to be supplied in a range of thicknesses, then samples in the minimum and maximum adhesive thickness shall be tested. The test shall be conducted in accordance with ASTM D1002.

Figure 9.8DV.1

Lap shear bond samples – Sample pattern and build-up construction



9.8DV.3.3 Specimen and surface preparations shall be in accordance with the manufacturer's specifications and consideration should be given to the adhesive's application pressure and duration, curing time prior to loading, and the application temperature shall be limited to the adhesive's temperature rating. The surface of the substrate shall be prepared so as to remove all contamination, such as mold releases on polymeric surfaces, rust, oxide films, oil, and dust on metal surfaces. Care should be taken with freshly cleaned surfaces so as not to allow surface contamination when the adhesive is not applied immediately.

9.8DV.4 As-received test

9.8DV.4.1 To determine the as-received strength of the adhesive bonds being evaluated, eight specimens shall be conditioned for 40 hours at 23.0 ±2 °C (73.0 ±4 °F) and at a relative humidity of 50 ±5 percent prior to testing.

9.8DV.4.2 The specimens shall be subjected to applicable tests to determine the value of the critical properties in the as-received condition. In the case of bond-strength evaluation, specimens that break at an obvious flaw remote from the adhesive line shall be discarded and a retest shall be made. The average value of the property shall be computed. This value shall be used for comparison with values of the same property after the environmental conditioning described in 9.8DV.5 – 9.8DV.8.

9.8DV.5 Effect of temperature

9.8DV.5.1 To determine the effect elevated temperatures have on the adhesive bonds being evaluated, five specimens shall be conditioned for 1000 hours at the oven temperature taken from the respective thermal-endurance-profile line in Figure 9.8DV.2, where the temperature index T is the measured normal operating temperature of the adhesive, but not less than 60 °C (140 °F).

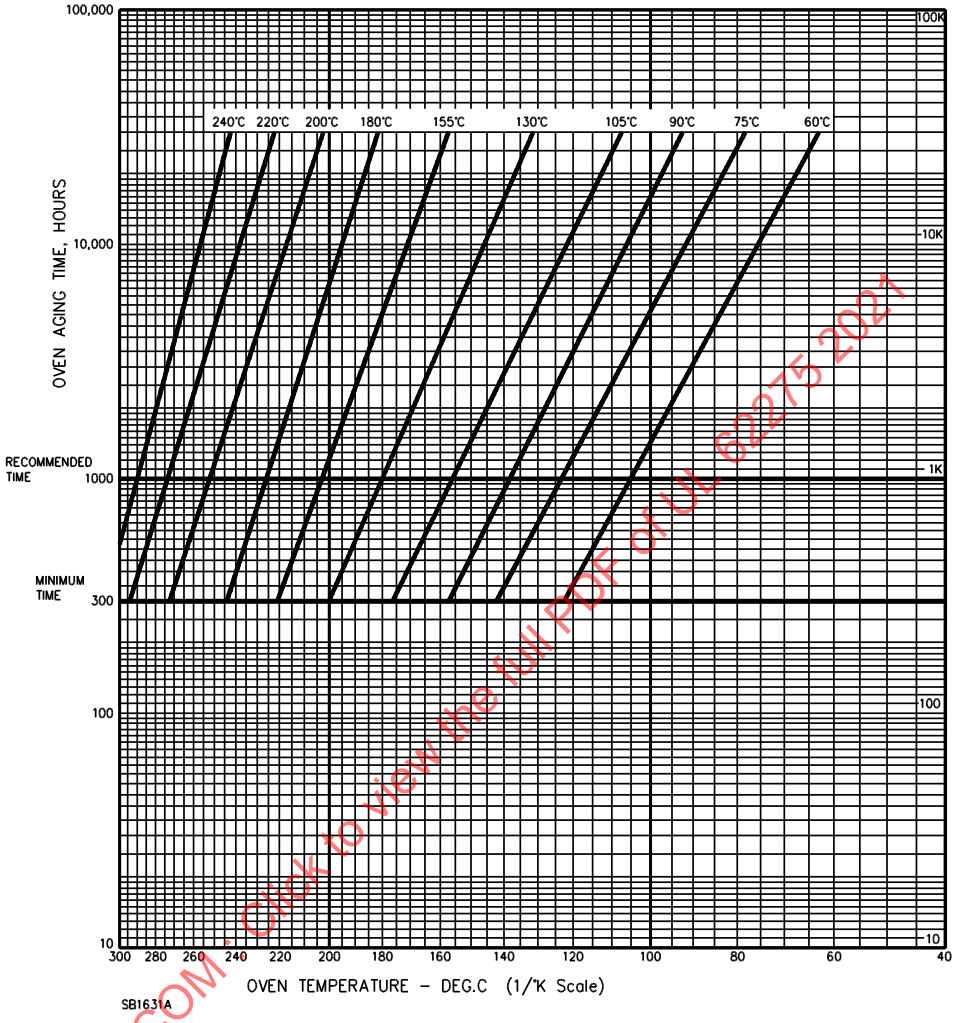
9.8DV.5.2 The effect-of-temperature test is not required on joints bonded by fusion techniques, such as solvent or ultrasonic welding and the like.

9.8DV.5.3 On the same thermal-endurance-profile line in Figure 9.8DV.2, a shorter or longer time at a higher or lower temperature, respectively, shall be employed only when agreeable to all concerned, and a period no less than 300 hours shall be used.

9.8DV.5.4 After the conditioning, the specimens shall be brought to and tested at room temperature to determine the critical property values. The average conditioned value for each property shall be at least 50 percent of the unconditioned value.

Figure 9.8DV.2

Conditioning time versus oven temperature for temperature index of adhesives



9.8DV.6 Effect of humidity

9.8DV.6.1 To determine the effect humidity has on the adhesive bonds being evaluated, five specimens shall be conditioned for 7 days at 95 – 100 percent relative humidity at 60 ±2 °C.

9.8DV.6.2 The effect-of-humidity test may be omitted for joints bonded by fusion techniques, such as solvent or ultrasonic welding and the like.

9.8DV.6.3 After the conditioning, the specimens shall be brought to and tested at room temperature to determine the critical property values. The average conditioned value for each critical property shall be at least 50 percent of the unconditioned value.

9.8DV.7 Effect of cold

9.8DV.7.1 To determine the effect cold has on the adhesive bonds being evaluated, three specimens shall be conditioned for 24 hours at minus 35 ±2 °C (minus 31 ±4 °F) for outdoor-use applications and at 0 ±2 °C (32 ±4 °F) for indoor-use applications. There shall be no visual signs of cracking or chipping of the bond between the two adhered parts of the specimens after this conditioning.

9.8DV.7.2 The effect-of-cold test may be omitted for joints bonded by fusion techniques, such as solvent or ultrasonic welding.

9.8DV.8 Effect of cyclic conditions

9.8DV.8.1 To determine the effect cyclic conditions have on the adhesive bonds being evaluated, five specimens shall be subjected to three complete cycles of the conditioning indicated in Table 9.8DV.1.

9.8DV.8.2 After the conditioning, the specimens shall be brought to and tested at room temperature to determine the critical property values. The average conditioned value of each property shall not be less than 50 percent of the unconditioned average value.

Table 9.8DV.1
Cycling conditions

For indoor end-use application	For outdoor end-use applications
24 hours at T followed immediately by at least 96 hours at 35 ±2 °C, 90 percent relative humidity, followed by 8 hours at 0 ±2 °C	A minimum of 24 hours immersed in 25 ±2 °C water, followed immediately by 24 hours at T followed by at least 96 hours at 35 ±2 °C, 90 percent relative humidity, followed by 8 hours at minus 35 ±2 °C.
NOTE: T is the rated temperature, but not less than 60 °C.	

9.8DV.9 Other test considerations

9.8DV.9.1 When the parts joined by the adhesive are subjected to periodic forces during intended operation, the assembly shall be subjected to an endurance test as applicable to the equipment, following exposure to the effect-of-temperature test described in 9.8DV.5.

9.8DV.9.2 In some applications, the parts joined by the adhesive are subjected to other environmental conditions. The resistance of adhesive-bonded joints to various corrosive media, chemical reagents, oils, fuels, and the like shall be determined by subjecting the joined parts to the applicable conditionings prior to the mechanical strength testing.

9.8DV.9.3 One of the substrates subjected to the lap sheer test described above shall be subjected to the applicable mechanical strength and/or loop tensile strength tests described in 9.7. The substrate selected shall have the highest temperature rating.

10 Contribution to fire

Metallic cable ties and integral assemblies with a non-metallic or organic coating, as well as non-metallic and composite cable ties and integral assemblies classified according to 6.4.2 shall have adequate resistance to flame propagation.

Compliance is checked by the following test:

The sample shall be installed on a solid steel or aluminium mandrel with dimensions as specified in 5.9. The cable tie shall be mounted manually without tension. Then, the remaining end of the tie shall be cut away.

Using an arrangement as shown in Figure 7, the sample shall be subjected to the needle flame test as specified in IEC 60695-11-5:2016, with the following additional information:

– the flame shall be applied to the face of the sample for a maximum of 30 s or until such time as the sample has separated from the mandrel;

– the underlying layer shall consist of three layers of tissue paper of dimensions such that product material or broken product falls on it while testing.

The sample shall be deemed to have passed the test if:

– 30 s after the test flame is removed, there is no flaming of the sample, and

– there is no ignition of the tissue paper.

For a metallic cable tie having a non-metallic coating, and classified as non-flame propagating according to 6.4.2, samples having a combination of the minimum coating thickness and minimum metal thickness, and samples having a combination of the maximum coating thickness and minimum metal thickness shall be tested.

10DV D2 *Modify Clause 10 by replacing it with the following:*

10DV.1 Non-metallic and composite cable ties and metallic cable ties having a non-metallic or organic coating that are classified according to 6.4.2, shall have adequate resistance to flame propagation. Integral assemblies shall be tested as a cable tie.

Compliance is checked by the test in 10DV.3 for cable ties.

10DV.2 For a line of non-metallic or composite cable ties, or metallic cable ties having a non-metallic or organic coating that includes a range of colors, the test shall be conducted on the following samples. The results of tests conducted on these samples are considered representative of a full range of colors:

a) Samples containing no color pigment (natural);

b) Samples of both the lightest and the darkest colored products containing the heaviest color pigment loading; and

c) Samples containing the heaviest pigment loading if a color other than the lightest or darkest colors.

NOTE: Typically, samples in natural, white, black, and red have been found to fulfill the sample requirement.

10DV.3 The cable tie shall be installed on a solid steel or aluminum mandrel with dimensions as specified in 5.9. The cable tie shall be mounted manually without tension. Then, the remaining end of the tie shall be cut away.

Using an arrangement as shown in Figure 7, the sample shall be submitted to the needle flame test as specified in IEC 60695-11-5, with the following additional information:

– the flame shall be applied to the face of the sample for a maximum of 30 seconds or until such time as the sample has separated from the mandrel;

– the underlying layer shall consist of three layers of tissue paper of dimensions such that product material or broken product falls on it while testing.

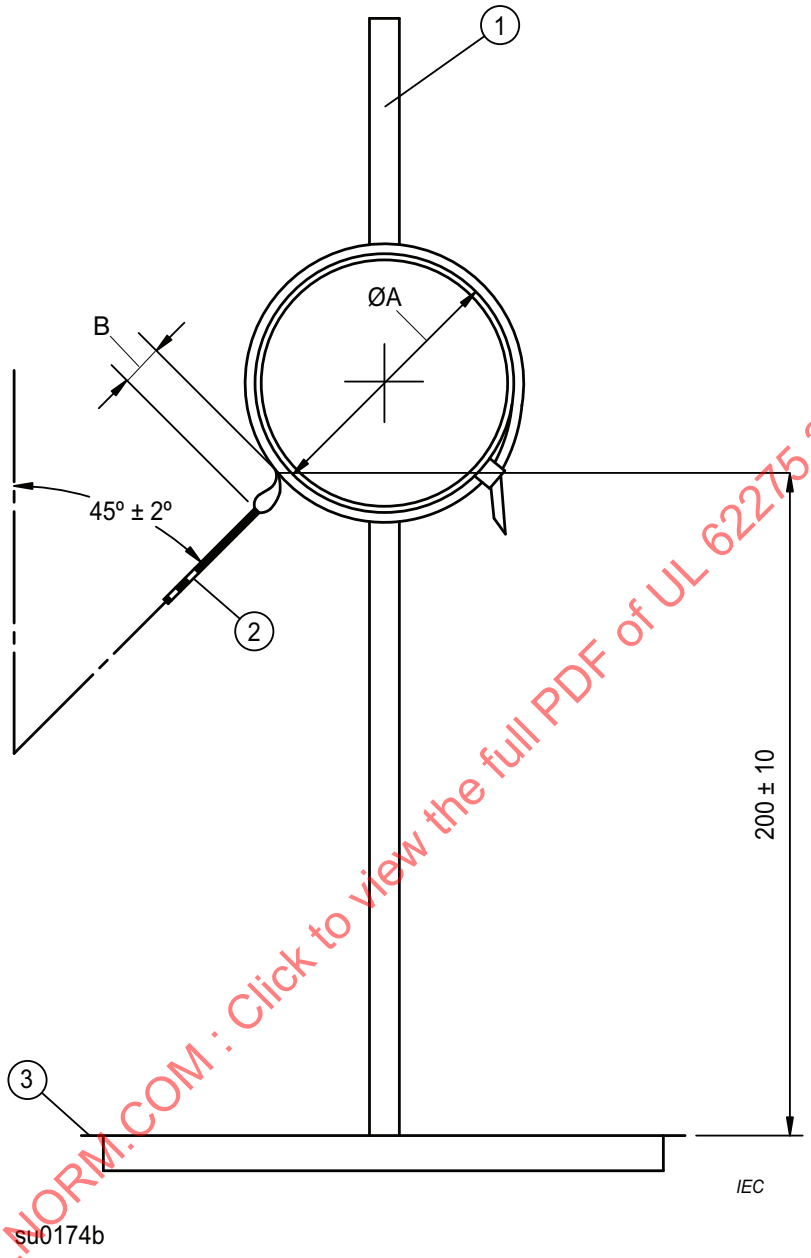
The sample shall be deemed to have passed the test if:

– 30 seconds after the test flame is removed, there is no flaming of the sample; and

– there is no ignition of the tissue paper.

For a metallic cable tie having a non-metallic or organic coating, samples having the combination of the minimum coating thickness and minimum metal thickness, and samples having a combination of the maximum coating thickness and minimum metal thickness, shall be tested.

Dimensions in millimetres



Key

1 stand

2 burner

3 tissue paper

A diameter of test mandrel

B distance between burner and test sample, B = (5 ± 1) mm

When not applied to the sample, the flame height is (12 ± 1) mm measured from a vertical position of the burner.

Figure 7

Arrangement for the needle flame test

Figure 7DV DE *Modify Figure 7 by adding the following note:*

NOTE 1DV – Flame height is 12 mm.

11 Environmental influences

11.1 Resistance to ultraviolet light

11.1.1 Cable ties and fixing devices classified according to 6.5.1.2 shall be resistant to ultraviolet light.

Compliance is checked by the following.

For cable ties and fixing devices classified according to 6.5.1.2, a set of ten samples installed on a mandrel according to 5.9 shall be subjected to ultraviolet light conditioning according to 11.1.2. When the product is provided in more than one colour, the colour having the heaviest organic pigment loading shall be subjected to this testing. All sets tested are considered representative of the material's entire colour range.

NOTE In determining the product types and sample set for testing, consideration is given to products coloured red or yellow which are known to have particular critical effects.

Moisture stabilization according to 5.2 before ultraviolet light exposure is not applicable for this test.

Samples shall be mounted on the inside of the ultraviolet light apparatus so that the samples do not touch each other. Mandrels for cable ties shall be positioned in such a way that the cable tie locking device is placed in the position facing the light source. Mandrels to which a fixing device is mounted shall be positioned in such a way that the fixation surface for the cable tie is perpendicular to the light source.

If the fixing device, cable tie and mandrel assembly is not able to be mounted as described in the ultraviolet light apparatus, the fixing device is permitted to be separately exposed. After exposure, the samples shall be able to be assembled for conducting the test.

After the first 250 h of exposure, and after each subsequent 250 h exposure period, the specimens are to be repositioned in the equipment in order to compensate for exposure variability due to placement with respect to the light source. Repositioning at 200 h intervals is acceptable. See Figure 8 for recommended rotation. Some flexibility in practice is needed due to variations in the samples under test.

Periodic repositioning of samples is not necessary if the measured irradiance at positions furthest from the point of maximum irradiance is at least 90 % of the maximum measured irradiance

11.1.1DV D1 *Modify Clause 11.1.1 by adding the following to the third paragraph:*

Fixing devices are to be mounted to a plate as intended during use or otherwise positioned so the exposed portion of the device after installation faces the light and water source.

11.1.2 *The samples are to be exposed for 1 000 h to xenon-arc, method A, cycle 1 in accordance with ISO 4892-2:2013. There shall be continuous exposure to light and intermittent exposure to water spray. The cycle shall consist of 102 min without water spray and 18 min with water spray. The apparatus shall operate with a water-cooled or air-cooled xenon-arc lamp, borosilicate glass inner and outer optical filters, a spectral irradiance of 0,51 W/(m^2·nm) at 340 nm and a blackpanel temperature of (65 ± 3) °C. The irradiance is measured at the rack where the blackpanel is placed. The temperature of the chamber shall be (45 ± 3) °C. The relative humidity in the chamber shall be (50 ± 5) %.*

NOTE In some countries, such as Japan, ultraviolet-light exposure according to ISO 4892-4 is acceptable with specific test parameters.

11.1.3 *Ultraviolet light conditioning is not required for a metallic cable tie or fixing device or for a metallic cable tie having a non-metallic coating when the non-coated version complies with the requirements in 11.2.*

11.1.4 *Following the exposure in 11.1.2 and stabilization for a period according to 5.2, the following applies.*

Each sample of a cable tie, a fixing device that is integrally moulded with a cable tie, or a fixing device supplied separately and classified according to 6.2.2, shall be subjected to a tensile pull. No individual value shall be less than 50 % of the loop tensile strength declared according to 6.2 or the declared mechanical strength for a fixing device.

Each sample of a cable tie, a fixing device that is integrally moulded with a cable tie, or a fixing device supplied separately and classified according to 6.2.3, shall be subjected to a tensile pull until the load equivalent to the loop tensile strength for a cable tie or mechanical strength for a fixing device declared by the manufacturer is reached. This load is maintained for (60_{0}^{+5}) s. The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1. After the test, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

Each sample of a fixing device shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s. After the test, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

11.1.4DV D1 *Modify Clause 11.1.4 by replacing it with the following:*

11.1.4DV.1 Following the exposure in 11.1.2 and stabilization in accordance with 5.2, the requirements in 11.1.4DV.2 – 11.1.4DV.10 apply.

11.1.4DV.2 Each sample of a cable tie classified according to 6.2.2 (Type 1) and according to 6.2.2DV.1 (Type 11), shall be subjected to a tensile pull according to 9.5.1.

11.1.4DV.3 No individual value shall be less than 50 percent of the loop tensile strength declared according to 6.2.

11.1.4DV.4 Each sample of a cable tie classified according to 6.2.3 (Type 2) and according to 6.2.3DV.1 (Type 21), shall be subjected to a tensile pull according to 9.6.1 until the load equivalent to the loop tensile strength declared by the manufacturer is reached. This load shall be maintained for 60_{0}^{+5} seconds

11.1.4DV.5 The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1.

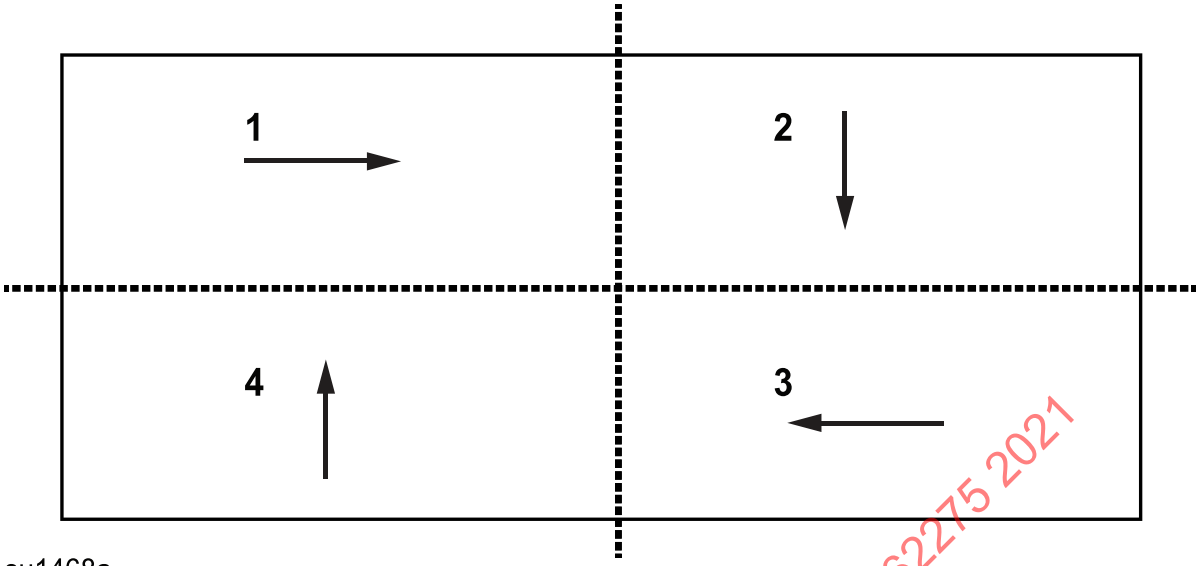
11.1.4DV.6 A cable tie classified according to 6.2.3DV.1.1 (Type 2S), or classified according to 6.2.3DV.1.2 , shall maintain this load for 5 minutes. See 7.3DV.7.

11.1.4DV.7 Each sample of a fixing device classified as Type 2 or 21 shall be assembled according to 9.7.1 as appropriate and subjected to a tensile pull according to 9.7.1 until the mechanical strength declared by the manufacturer is reached. This load shall be maintained for 60_{0}^{+5} seconds.

11.1.4DV.8 A fixing device classified Type 2S or 21S shall maintain this load for 5 minutes. See 7.3DV.7.

11.1.4DV.9 For Type 2, 2S, 21, or 21S devices, after the test, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected vision.

11.1.4DV.10 For Type 1 and 11 devices, each sample shall be assembled according to 9.7.1 as appropriate and subjected to the tensile pull specified in 9.7.1 No individual value shall be less than 50 percent of the declared mechanical strength of the fixing device.



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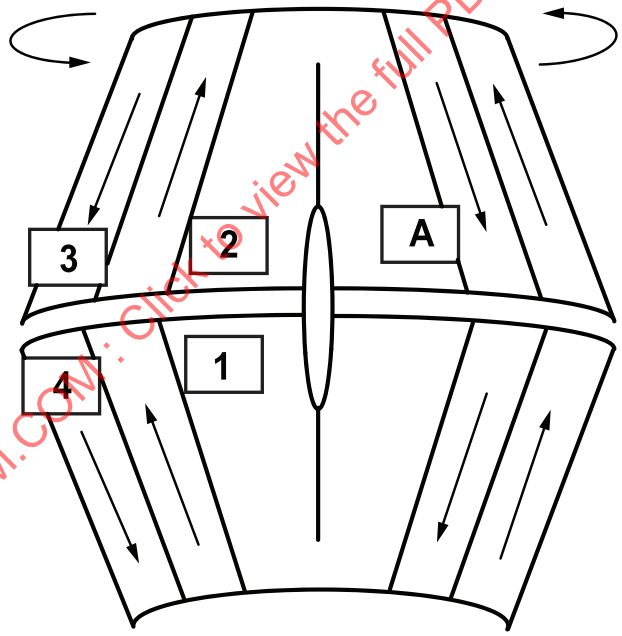
Representative quadrants on flat panel.

Arrows represent relative position and direction of sample placement, and rotation sequence.

Figure 8a) Static flat panel apparatus



su1468b

Interior view of sample mounting panels (1 to 4) of typical rotating cylinder facing light source A.

Arrows represent relative position and direction of sample placement, and rotation sequence.

The surface of the sample facing the light source should remain constant throughout the full duration of the exposure.

Figure 8b) Cylinder-type apparatus

Figure 8

Recommended sample repositioning for ultraviolet light and water exposure