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Edition 4.0 2022-11
COMMENTED VERSION

INTERNATIONAL STANDARD

colour inside

Cable management systems – Cable ties for electrical installations

IEC 62275:2022-11 CMV(en)

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Cable management systems – Cable ties for electrical installations

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CABLE MANAGEMENT SYSTEMS – CABLE TIES FOR ELECTRICAL INSTALLATIONS

FOREWORD

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This commented version (CMV) of the official standard IEC 62275:2022 edition 4.0 allows the user to identify the changes made to the previous IEC 62275:2018 edition 3.0. Furthermore, comments from IEC SC 23A experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 62275 has been prepared by subcommittee 23A: Cable management systems, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2018. This edition constitutes a technical revision.

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

a) scope clarification,
b) new definitions,
c) deletion of the exception for the stabilization of the moisture content,
d) possibility to carry out tensile strength tests with dead weights,
e) differentiation of rubber and acrylic adhesive fixings,
f) clarification for mechanical testing of integral devices,
g) clarifications on Table 6,
h) clarifications in 9.1,
i) the minimum installation temperature test for cable ties is carried out only when the declared minimum temperature is lower than 0 °C,
j) a requirement that metallic cable ties be classified according to 6.2.3,
k) definition of colours to be tested for contribution to fire,
l) addition of a "some countries" note in Clause 10,
m) clarification of the mounting of fixing devices in the resistance to ultraviolet light test,
n) clarification on the testing of integral devices in the resistance to ultraviolet light test.

The text of this International Standard is based on the following documents:

Draft	Report on voting
23A/1025/FDIS	23A/1029/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document, 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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 as a means used for managing or securing the ~~management and support of~~ 1 wiring systems in electrical installations. Cable ties and associated fixing devices can also be suitable for other applications, such as support of wiring systems, 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.

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

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

ISO 4892-2:2013, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*
ISO 4892-2:2013/AMD1:2021

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

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

3.6
environmental influence
effect of environmental hazards such as 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 nor releases moisture when exposed to a surrounding environment of 23 °C and 50 % relative humidity

3.11
integral ~~assembly~~ device 2
single component, as produced, incorporating a cable tie and a fixing device that are not separable

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

3.13
type test 3
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.14
bundle 4
collection of wires or cables gathered or tied together

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~~2018 in order to comply with IEC 62275:2022, Edition 4 (i.e., this document).

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~~ considered 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 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^{0}_{-7}
1,4 < RT	35^{0}_{-7}
All thicknesses ~~of materials known to have~~ for low hygroscopic ~~characteristics~~ polymers	2 ± 1/3

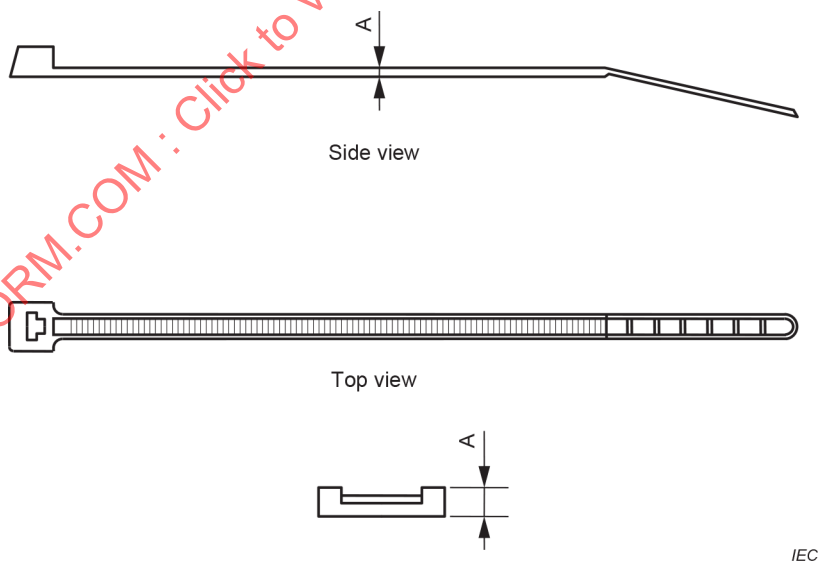
The reference thickness of a cable tie is measured at the midpoint of the strap. The reference thickness of a fixing device shall be the smallest cross-section in the area that interfaces with the cable tie or as declared by the manufacturer. See Figure 1.

~~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.~~ **5**



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~~ can 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. Dead weights can be used for conducting loop tensile strength tests for cable ties and integral devices classified according to 6.2.3, provided that no sudden application of force occurs. **6**

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.

5.8 An integral ~~assembly~~ device shall be tested as a complete sample. The integral ~~assembly~~ device 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~~ Table 6, 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 particular mounting orientation represents the most onerous condition, the results of the 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

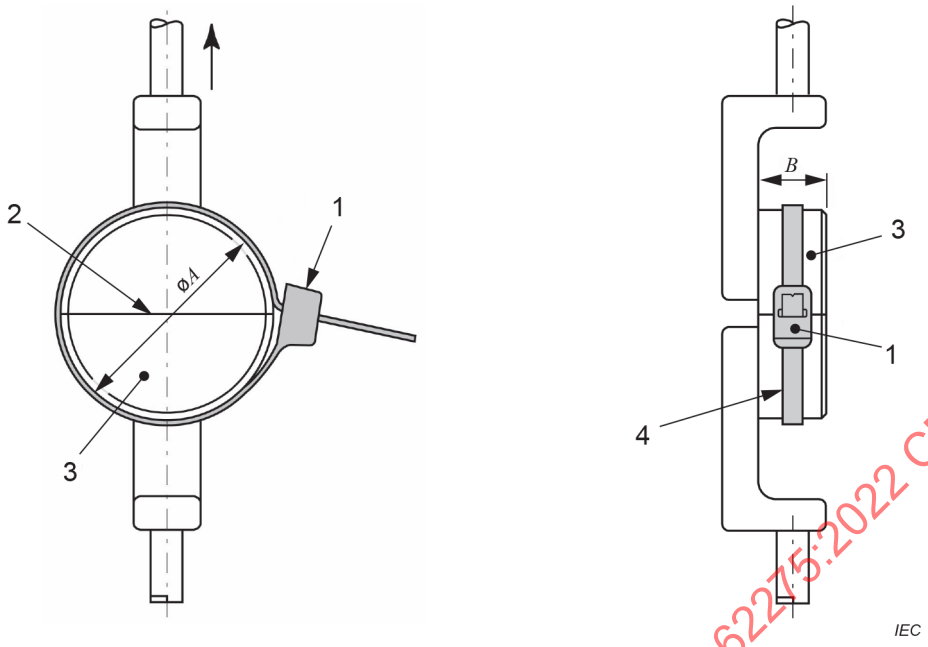
For the loop tensile strength tests, the mandrel shall be split in two equal parts ~~and the cable ties positioned as shown in Figure 2a)~~.

A metallic cable tie having a parallel entry strap shall be mounted to the mandrel as shown in Figure 2 a). Non-metallic or composite cable ties having a parallel entry strap shall be mounted to the mandrel as shown in Figure 2 b). **7**

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.

For integral devices, when it is determined impractical to condition the samples mounted to a rigid support, samples shall be conditioned separately. When conditioning separately, they shall be installed on a solid mandrel of similar size to the test fixture and the entire sample set may be installed on the same mandrel. After conditioning, each sample shall be mounted to the rigid support test fixture prior to the appropriate tensile pull. 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. **8**



Key

1 locking device (head)

2 split line

3 mandrel

4 cable tie

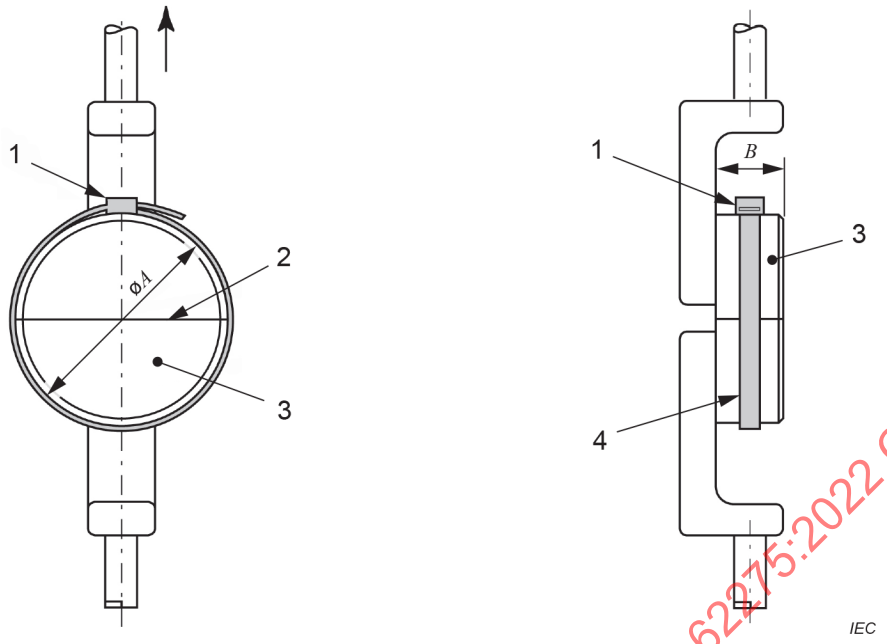
A diameter of test mandrel

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 2 a) – 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 ~~– 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 2 b) – Typical arrangement for non-metallic and composite 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

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

– any bare metal surface,

– enamel painted metal surface,

– epoxy painted metal surface,

– polyester painted metal surface.

The installation on other surfaces ~~requires testing on these materials~~ and other painted surfaces shall be tested.

5.11 Tests for acrylic adhesive fixing devices and integral devices on stainless steel or aluminium bare panel cover the installation on any bare metal surface. The installation on other surfaces shall be tested. **9**

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

5.13 Unless specified otherwise by the manufacturer, the samples are to be held to the panel for a period of 5^{+1}_{0} s 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~~ preconditioning period recommended by the manufacturer shall be respected.

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 only requires the evaluation according to 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.

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

Metallic cable ties and fixing devices shall be classified according to 6.2.3. **10**

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.

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

An integral ~~assembly~~ device shall have a single type classification, according to 6.2.2 or 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.

6.3.2 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

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

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

6.4.1 Flame propagating

NOTE Owing 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~~ devices 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

6.5.2.2 Resistant to corrosion

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 to mark a cable tie or fixing device with the identifying symbol (for example, due to the small size of the cable tie or fixing device), 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.

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

Laser marking directly on the product and marking made by moulding, pressing or engraving are not subjected to the test set out in the paragraphs below.

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.

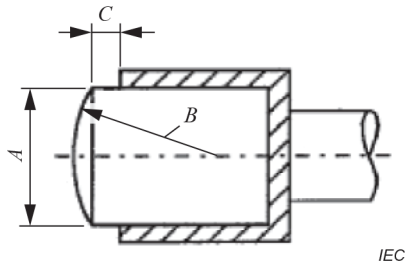
When using the liquid specified for the test, precautions as stated in the relative material safety datasheet provided by the chemical supplier shall be taken to safeguard the laboratory technicians.

After the test with water, the marking surface to be tested shall be dried.

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 cotton wool covered by a piece of cotton medical gauze. The 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.



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.

Table 6 – Literature information

Information	Cable ties	Fixing devices	Integral ~~assemblies~~ devices
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 for non-metallic and composite according to 6.3.2	X	X	X
Minimum temperature during installation for non-metallic and composite 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
Material of the surfaces to which the adhesive fixing device is intended to be affixed according to 5.10 to 5.12		X	X
Manufacturer's recommendations for surface preparations, adhesive application temperature range, and curing time prior to loading for adhesive fixing devices and integral devices **11**		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 7~~ Table 6 is required to be placed on the packaging accompanying the product: CA, US, MX and RU.

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.

9 Mechanical properties

9.1 Requirements

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

An integral ~~assembly~~ device 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 1 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.

NOTE 2 Loop tensile strength test is used to evaluate UV resistance in 11.1 and resistance to corrosion in 11.2.

The loop tensile strength test for cable ties and the mechanical strength test for fixing devices are always carried out at ambient temperature. Minimum application temperature and maximum application temperature are verified by other tests such as impact, ageing and temperature cycling. **12**

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

The test is carried out only for cable ties with a declared minimum installation temperature lower than 0 °C. **13**

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.

9.4 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.

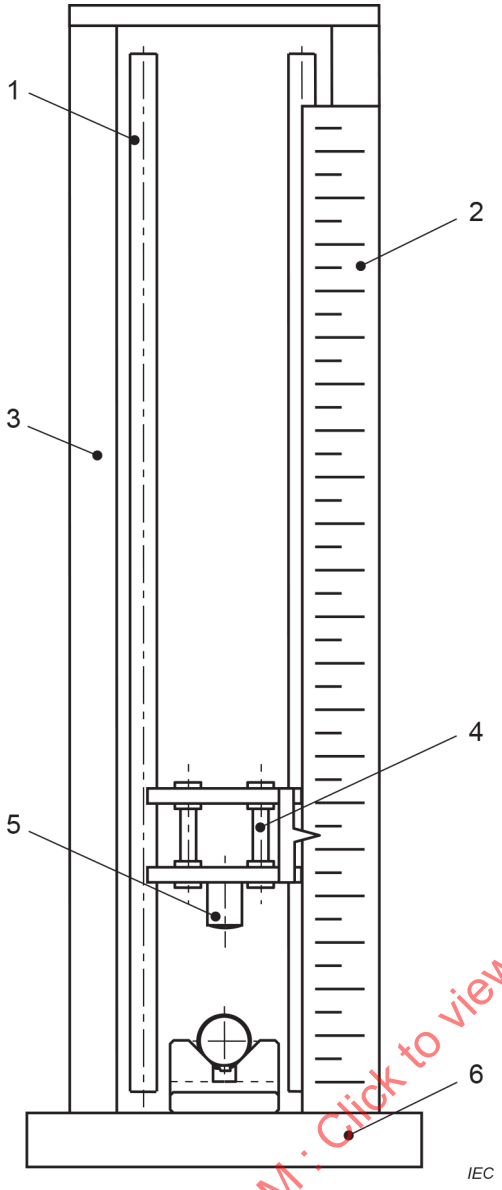


Figure 4 a) – Test apparatus assembly

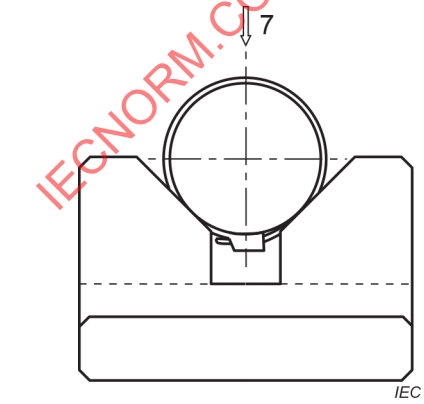


Figure 4 b) – Test mandrel with supporting V-block

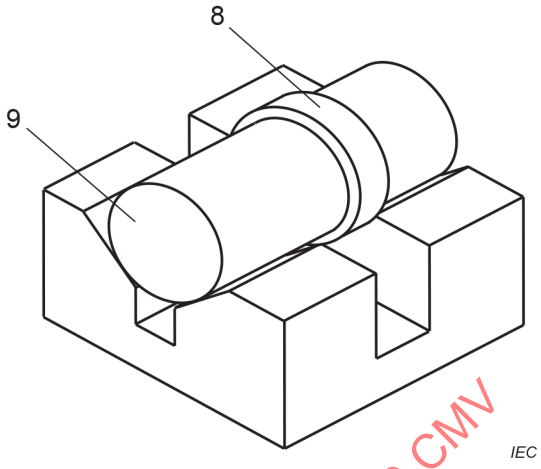


Figure 4 c) – Position of tie strap

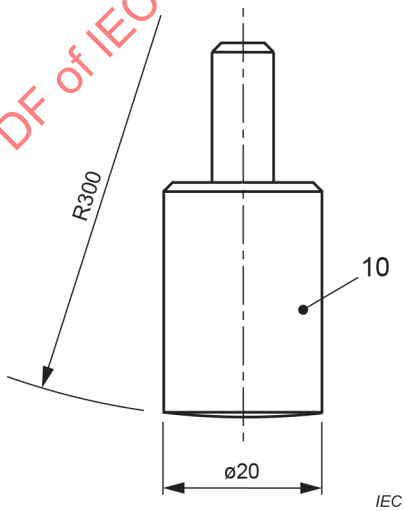


Figure 4 d) – Hammer details

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 is 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

9.5.1 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. 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. 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 $\left(1000\,^{+48}_{0}\right)$ *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 non-metallic or composite **14** *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* $\left(18^{+2}_{0}\right)$ *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

9.6.1 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 $\left(60^{+5}_{0}\right)$ *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~~ load shall be ~~tested~~ maintained **15** *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.

9.6.2 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 $\left(1000^{+48}_{0}\right)$ *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 $\left(60^{+5}_{0}\right)$ *s.*

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

9.6.3 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 $\left(60^{+5}_{0}\right)$ *s.*

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

9.6.4 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;*

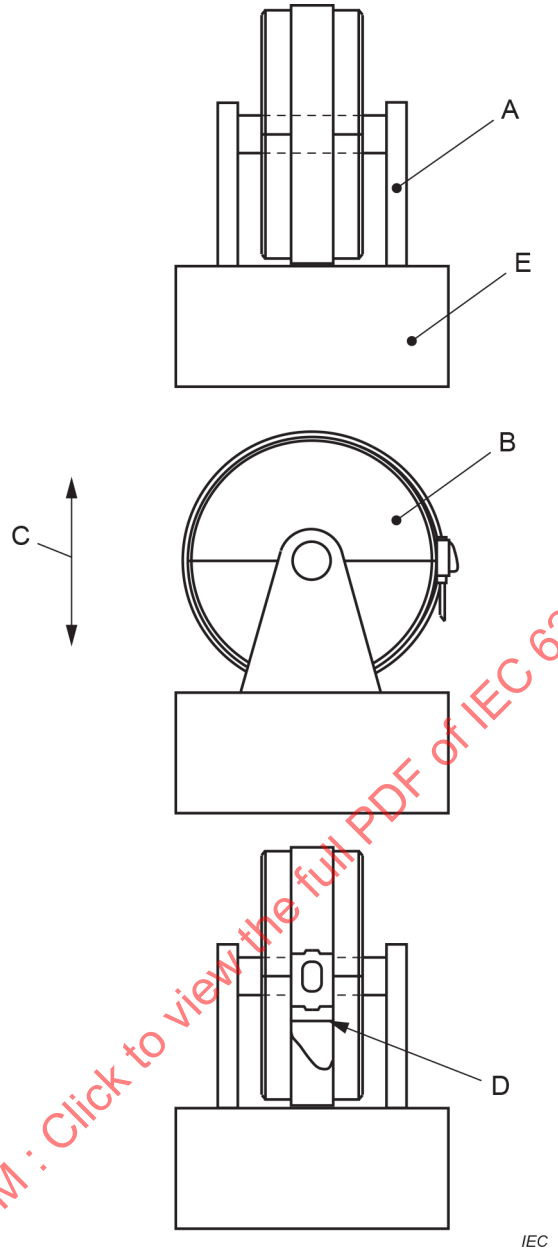
– *maximum peak amplitude: 0,35 mm (0,7 mm from peak to peak);*

– *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 $\left(60^{+5}_{0}\right)$ *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.



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~~ devices

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~~ device 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 to 5.12.

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~~ device 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~~ devices, the test fixture shall allow for self-alignment of the test load with the integral ~~assembly~~ device 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~~ device 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 mechanical strength.*
- *For a separately supplied fixing device and for an integral ~~assembly~~ device 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 $\left(60^{+5}_{0}\right)$ s.*

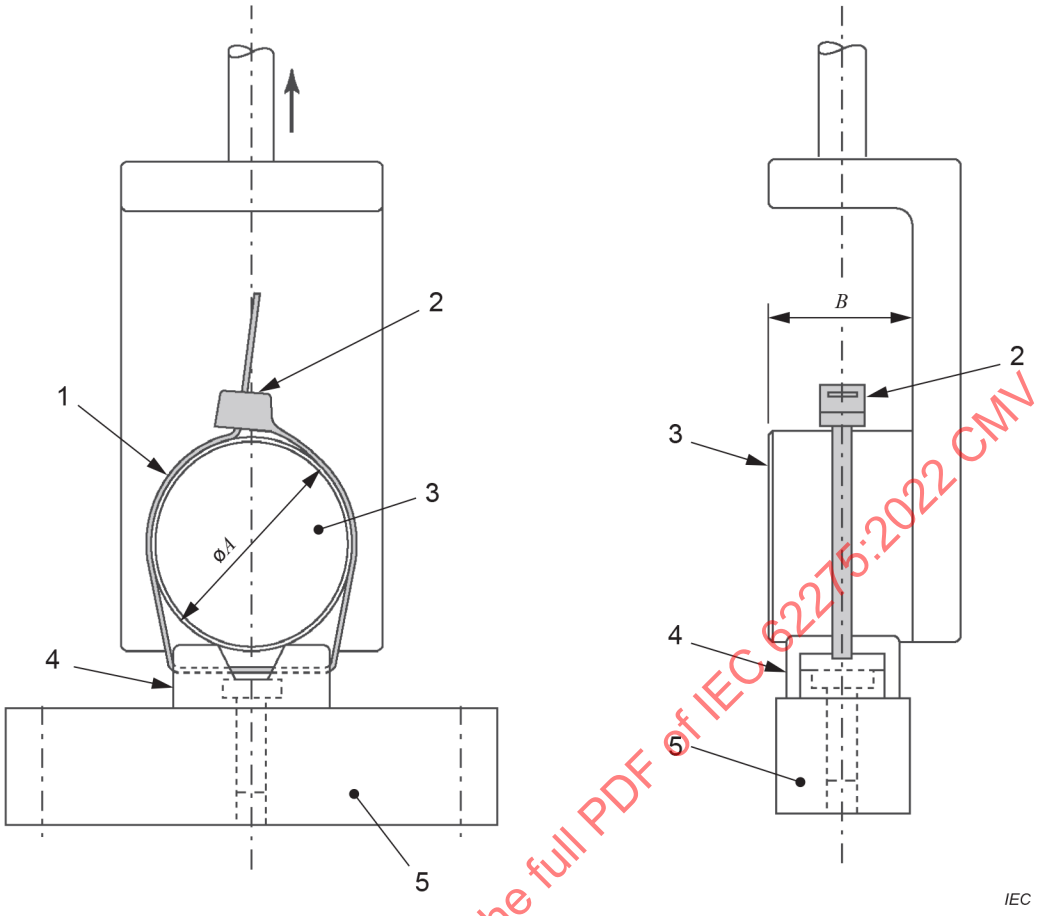
When testing for loop tensile strength, the following applies:

- *An integral ~~assembly~~ device 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~~ device 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~~ device 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 $\left(60^{+5}_{0}\right)$ s.*

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

If during the test:

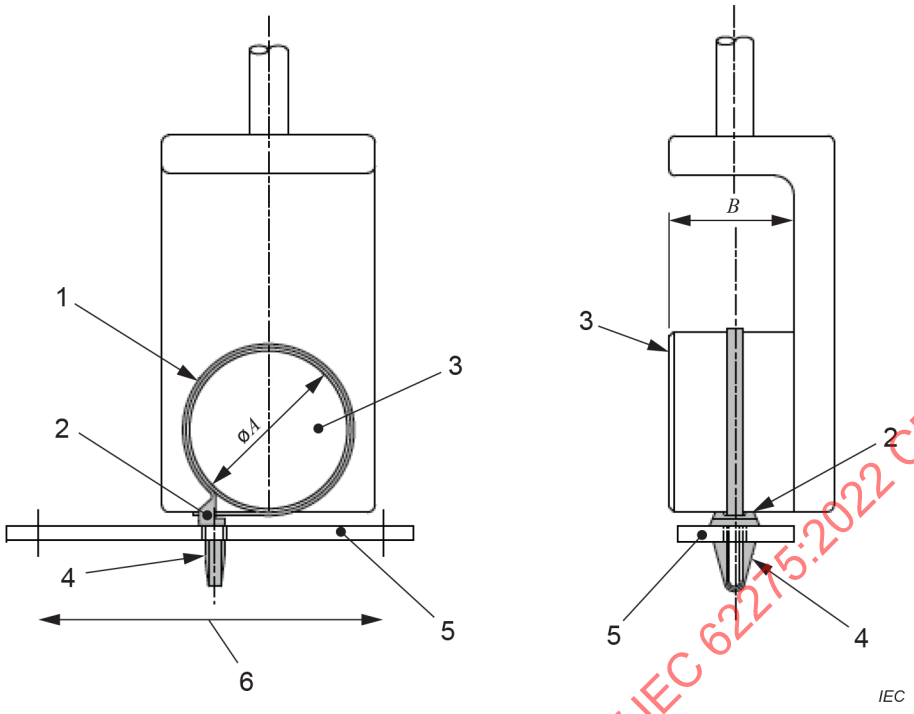
- *the fixing device or the integral ~~assembly~~ device, excluding the adhesive ones, detaches from the rigid support without signs of disintegration, cracking or the like, it is not considered a failure, but the test shall be repeated with a more appropriate fixing method.*
- *the adhesive fixing device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



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

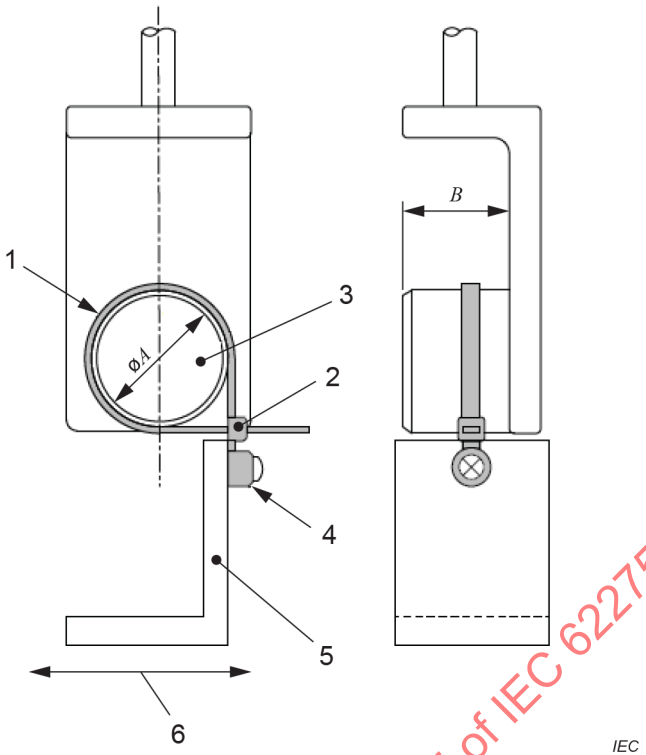
Figure 6 a) – Typical arrangement of test assembly for separately supplied fixing device



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

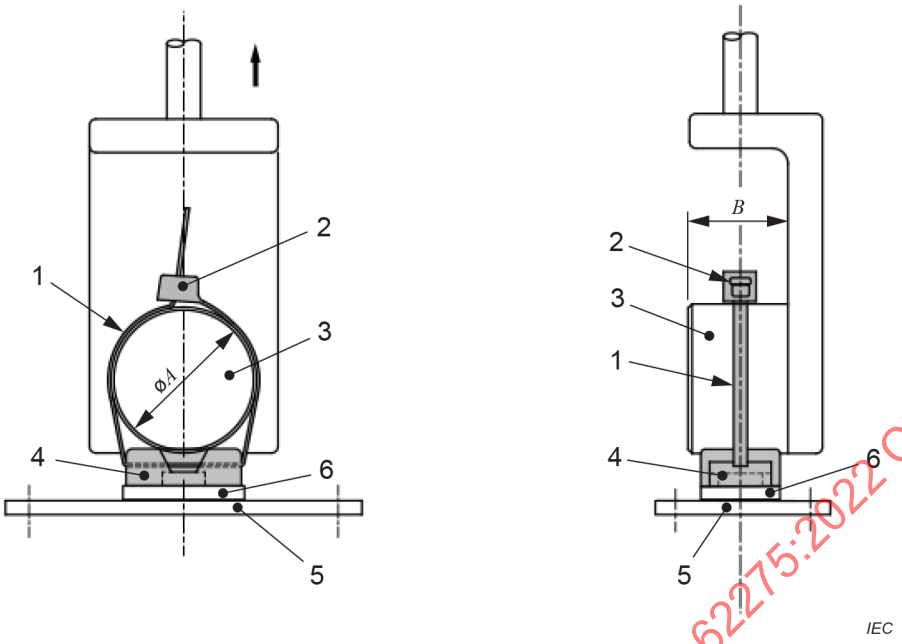
Figure 6 b) – Typical arrangement of test assembly for an integral push-mount fixing device



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

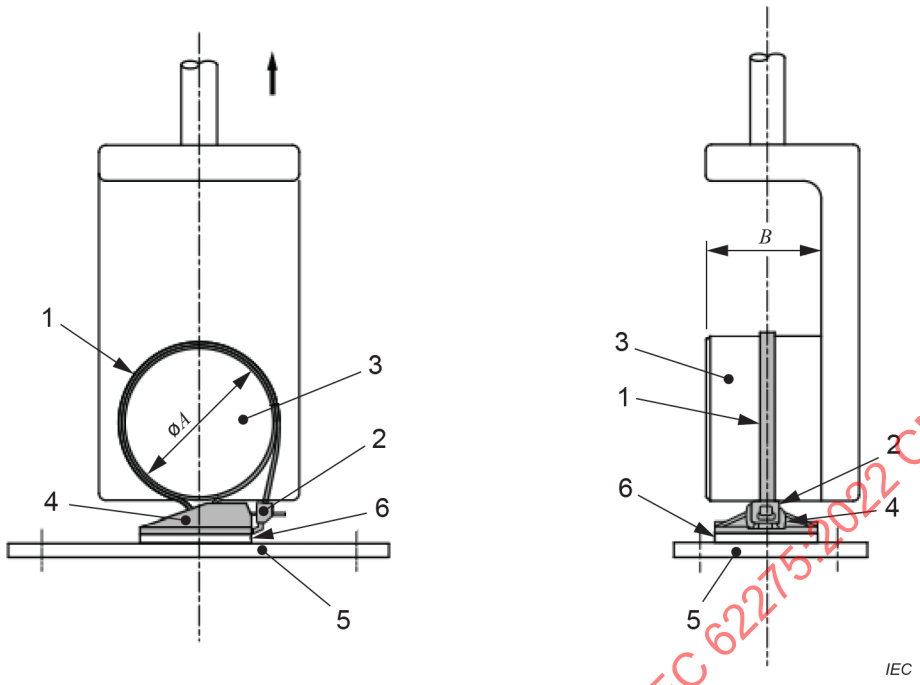
Figure 6 c) – Typical arrangement of test assembly for an integral screw-mount fixing device



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 6 d) – Typical arrangement of test assembly for separately supplied adhesive 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 6 e) – 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~~ device 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 to 5.12.

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* 1000^{+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~~ device 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* 1000^{+48}_{0} *h. Then the assembly shall be conditioned according to 5.2.*

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

– *For integral ~~assemblies~~ devices, the test fixture shall allow for self-alignment of the test load with the integral ~~assembly~~ device 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~~ device 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 mechanical strength.*

– *For a separately supplied fixing device and for an integral ~~assembly~~ device 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* $\left(60^{+5}_{0}\right)$ *s.*

When testing for loop tensile strength, the following applies:

– *An integral ~~assembly~~ device 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* 1000^{+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~~ device 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~~ device 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* $\left(60^{+5}_{0}\right)$ *s.*

After the test, the fixing device or the integral ~~assembly~~ device 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~~ device, 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~~ device detaches from the rigid support, this is considered a failure.*

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~~ device 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 to 5.12.

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~~ device 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~~ devices a split mandrel can be used as long as the two parts are linked together to operate as a solid mandrel.*
- *For integral ~~assemblies~~ devices, the test fixture shall allow for self-alignment of the test load with the integral ~~assembly~~ device 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~~ device 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 mechanical strength.*
- *For a separately supplied fixing device and for an integral ~~assembly~~ device 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 $\left(60^{+5}_{0}\right)$ s.*

When testing for loop tensile strength, the following applies:

- *An integral ~~assembly~~ device 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~~ device 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~~ device 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 $\left(60^{+5}_{0}\right)$ s.*

After the test, the fixing device or the integral ~~assembly~~ device 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~~ device, 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~~ device detaches from the rigid support, this is considered a failure.*

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~~ Non-metallic and composite cable ties and metallic cable ties having a non-metallic or organic coating as well as integral devices that are classified according to 6.4.2, shall have adequate resistance to flame propagation.

Compliance is checked by the following test for cable ties of the following colours:

a) samples containing no colour pigment (natural);

b) samples of both the lightest and the darkest coloured products containing the heaviest colour pigment loading;

c) samples containing the heaviest pigment loading if a product is in a colour other than the lightest or darkest colours.

The results of tests conducted on these samples are considered representative of a full range of colours but not of blends that contain additives such as carbon black. **16**

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:

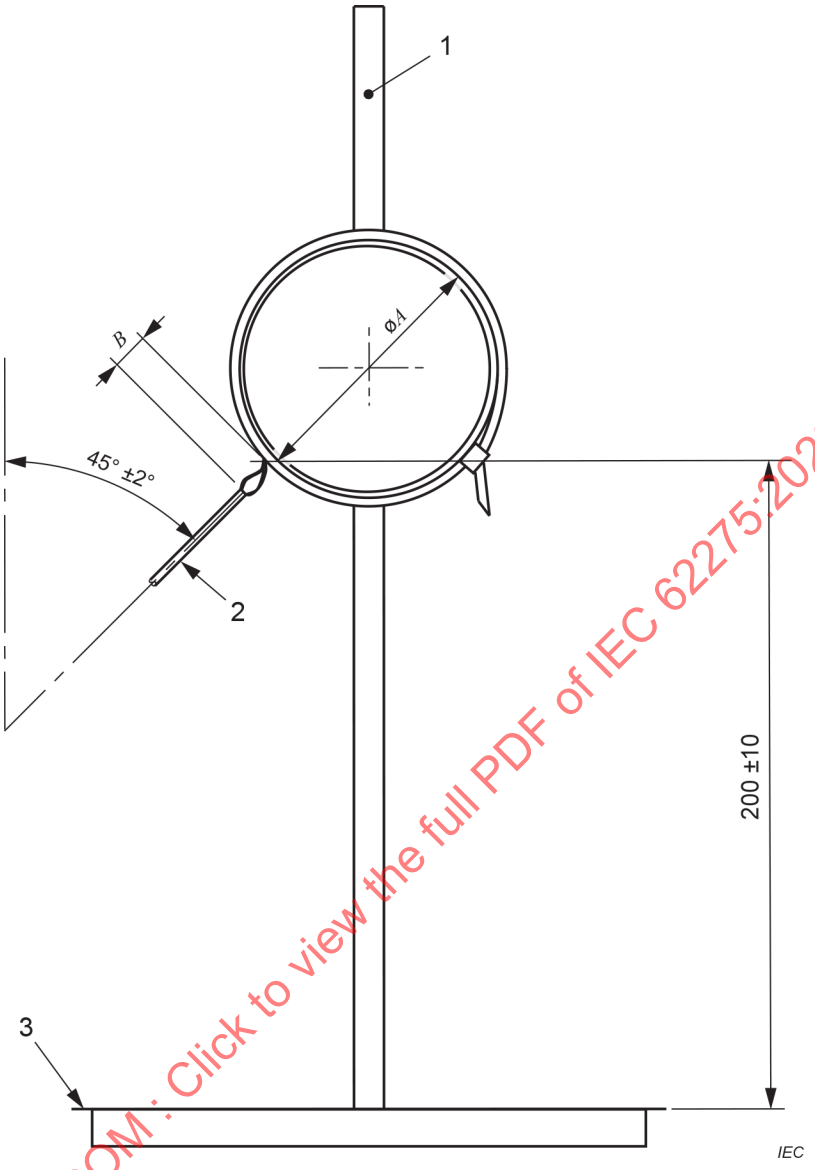
– *30 s after the test flame is removed, there is no flaming of the sample, and*

– *there is no ignition of the tissue paper.*

For a metallic cable tie having a non-metallic or organic 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.

NOTE In some countries, such as Canada, Mexico and the United States, a material classification HB according to IEC 60695-11-10 based on a nominal 1,5 mm thickness is considered as an alternative to the test. See UL 62275/CSA C22.2 No.62275. **17**

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

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 test.

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. Fixing devices shall 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. **18**

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.

11.1.2 *The samples ~~are to~~ shall 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~~ black standard temperature of (65 ± 3) °C. The irradiance is measured at the rack where the ~~blackpanel~~ black standard is placed. The temperature of the chamber shall be (~~45~~ 38 ± 3) °C. The relative humidity in the chamber shall be (50 ± ~~5~~ 10) %.*

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 set out 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, or an integral device classified according to 6.2.2, shall be subjected to a tensile pull. No individual value shall be less than:

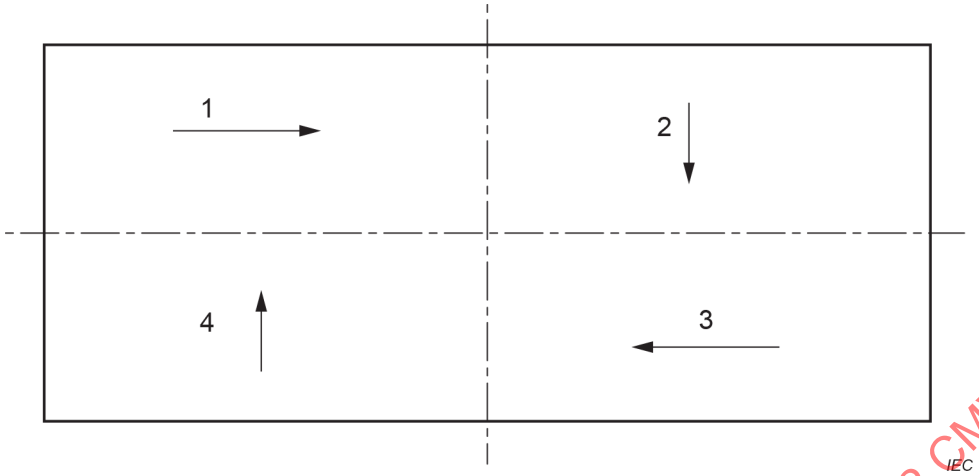
a) 50 % of the declared loop tensile strength for a cable tie or

b) 50 % of the declared mechanical strength for a fixing device or a fixing device portion of the integral device. **19**

Each sample of a cable tie, ~~a fixing device that is integrally moulded with a cable tie, or a fixing device supplied separately and~~ a fixing device or an integral device classified according to 6.2.3, shall be subjected to a tensile pull until the load equivalent to the declared loop tensile strength for a cable tie or the declared mechanical strength for a fixing device ~~declared by the manufacturer~~ or a fixing device portion of the integral device is reached.

This load is maintained for $\left(60^{+5}_{0}\right)$ s. The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1 or 9.7.1 as appropriate. After the test, there shall be no sign of disintegration, nor shall there be any crack visible to normal or corrected vision.

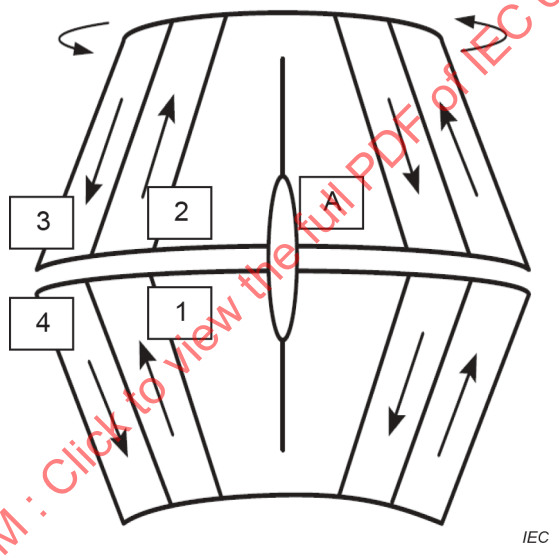
~~*Each sample of a fixing device shall be subjected to a tensile pull until the mechanical strength declared by the manufacturer is reached. This load is maintained for (60^{+5}_{0}) s. After the test, there shall be no sign of disintegration nor shall there be any crack visible to normal or corrected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



Representative quadrants on flat panel.

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

Figure 8 a) – Static flat panel apparatus



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 8 b) – Cylinder-type apparatus

Figure 8 – Recommended sample repositioning for ultraviolet light and water exposure

11.2 Resistance to corrosion

Cable ties and fixing devices classified as resistant to corrosion according to 6.5.2.2 shall have adequate resistance to corrosion.

Compliance is checked by the following test:

Moisture stabilization according to 5.2 before salt spray exposure is not applicable for this test.

Samples shall be exposed to a neutral salt spray (NSS) in accordance with ISO 9227:2017 for 192 h followed by 12 h at (40 ± 2) °C. Samples of non-metallic coated devices shall be subjected to heat age conditioning in accordance with 9.5.2, 9.6.2 or 9.7.2 as appropriate before exposure to the salt spray.

The samples shall then be rinsed in demineralized water. Metallic cable ties and fixing devices shall be dried. Composite cable ties and fixing devices shall be stabilized according to 5.2.

After the test, the samples shall show no cracks visible to normal or corrected vision. Any traces of rust on sharp edges and a yellowish film may be removed by rubbing. There shall be no red rust visible to normal or corrected vision.

Each sample of a composite cable tie classified according to 6.2.2 (Type 1), shall be subjected to the tensile pull according to 9.5.1. No individual value shall be less than 50 % of the loop tensile strength declared according to 6.2.

Each sample of a metallic or composite cable tie classified according to 6.2.3 (Type 2), shall be subjected to the 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 $\left(60\,^{+5}_{0}\right)$ *s.*

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

Each sample of a fixing device shall be subjected to the tensile pull according to 9.7.1.

After the test, there shall be no sign of disintegration of a fixing device or any crack visible to normal or corrected vision.

Testing of products constructed of stainless steel having a chromium content of 16 % or more is not required.

A metallic cable tie having a non-metallic coating that is depended upon to provide resistance to corrosion, and that is declared as having resistance to ultraviolet light, shall be subjected to the conditioning in 11.1 followed by the appropriate requirements in 11.2 for metallic cable ties.

The requirements in 11.2 are not applicable for a metallic cable tie with a non-metallic coating when the uncoated version has been determined to meet the requirements in 11.2.

12 Electromagnetic compatibility

Products covered by this document are, in normal use, passive with respect to electromagnetic influences (emission and immunity). Therefore, no tests have been specified.

Annex A
(normative)

Compliance checks to be carried out for cable ties and fixing devices currently complying with IEC 62275:~~2013~~2018 (Edition 3) in order to comply with IEC 62275:2022 (Edition 4) (i.e., this document)

Annex A relates to requirements of IEC 62275 Edition 4 (i.e., this document). Table A.1 specifies where compliance checks are required and where compliance checks are not required in order that cable ties and fixing devices can be declared to meet the requirements of this document if they already comply with IEC 62275:~~2013~~2018.

Table A.1 – Required compliance checks

Test reference clause/ subclause	Description	Compliance check
Marking and documentation		
7.1	Marking of cable ties and fixing devices	Not required
7.2	Durability and legibility marking	Not required
7.3	Literature declaration	~~Only required for adhesive fixing devices~~ Not required
Construction		
8	Surface and edges	Not required
Mechanical properties		
9.2	Installation test	Not required
9.3	Minimum installation temperature test for cable ties	Not required
9.4	Minimum operating temperature test for cable ties	Not required
9.5.1	Loop tensile strength test for cable ties classified according to 6.2.2. As-received condition	Not required
9.5.2	Loop tensile strength test for cable ties classified according to 6.2.2. After heat ageing	Not required
9.5.3	Loop tensile strength test for cable ties classified according to 6.2.2. After temperature cycling	Not required
9.6.1	Loop tensile strength test for cable ties classified according to 6.2.3. As-received condition	Not required
9.6.2	Loop tensile strength test for cable ties classified according to 6.2.3. After heat ageing	Not required
9.6.3	Loop tensile strength test for cable ties classified according to 6.2.3. After temperature cycling	Not required
9.6.4	Loop tensile strength test for cable ties classified according to 6.2.3. After vibration test for metallic cable ties	Not required
9.7.1	Mechanical strength test for fixing devices. As-received condition	Only required for adhesive fixing devices and integral devices other than rubber
9.7.2	Mechanical strength test for fixing devices. After heat ageing	Only required for adhesive fixing devices and integral devices other than rubber
9.7.3	Mechanical strength test for fixing devices. After temperature cycling	Only required for adhesive fixing devices and integral devices other than rubber
Contribution to fire		
10	Needle flame test	Not required

Environmental influences		
11.1	Resistance to ultraviolet light	Not required
11.2	Resistance to corrosion (for metallic and composite components)	Not required

Bibliography

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

IEC 62275:~~2013~~2018, *Cable management systems – Cable ties for electrical installations*

UL 62275 / CSA C22.2 No. 62275, *Cable management systems – Cable ties for electrical installations*

UL 746C / CAN/CSA C22.2, *Polymeric Materials – Use in Electrical Equipment Evaluations*

List of comments

1 This change clarifies the scope by detailing better the intended use of cable ties.

2 The term integral assembly is replaced by integral device as it describes better this item. The definition is improved.

3 This new definition is added for clarification.

4 This new definition is added for clarification.

5 This alternative procedure for moisture stabilization is deleted as it could lead to reproducibility problems and has reduced added value.

6 It is added the possibility to carry out tests with dead weights to make tests easy.

7 This change improves understanding of different positioning of cables ties for the tensile strength test depending on the positioning of the entry strap in the cable tie.

8 This addition includes additional information for tests on integral devices.

9 Subclause 5.11 takes into account the different behaviour of rubber adhesive and acrylic adhesive fixings on different surfaces.

10 This change includes additional requirements for metallic fixing devices.

11 Changes in Table 6 provide clarification on the information to be given by the manufacturer.

12 This addition provides clarification.

13 It is considered that this test is meaningless for cable ties with a declared minimum installation temperature of 0 ºC or higher.

14 This change clarifies that the test is not required for metallic cable ties.

15 This change provides clarification for the test.

16 This addition clarifies the colours to be tested for contribution to fire.

17 This note provides additional information for some countries.

18 This addition provides clarification on testing of fixing devices for resistance to ultraviolet light test.

19 This addition provides clarification on pass criteria for fixing devices and integral devices in the resistance to ultraviolet light.

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IEC 62275

Edition 4.0 2022-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Cable management systems – Cable ties for electrical installations

Systèmes de câblage – Colliers pour installations électriques

IEC 62275:2022-11(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CABLE MANAGEMENT SYSTEMS – CABLE TIES FOR ELECTRICAL INSTALLATIONS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC 62275 has been prepared by subcommittee 23A: Cable management systems, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2018. This edition constitutes a technical revision.

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

a) scope clarification,
b) new definitions,
c) deletion of the exception for the stabilization of the moisture content,
d) possibility to carry out tensile strength tests with dead weights,
e) differentiation of rubber and acrylic adhesive fixings,
f) clarification for mechanical testing of integral devices,
g) clarifications on Table 6,
h) clarifications in 9.1,

i) the minimum installation temperature test for cable ties is carried out only when the declared minimum temperature is lower than 0 °C,

j) a requirement that metallic cable ties be classified according to 6.2.3,

k) definition of colours to be tested for contribution to fire,

l) addition of a "some countries" note in Clause 10,

m) clarification of the mounting of fixing devices in the resistance to ultraviolet light test,

n) clarification on the testing of integral devices in the resistance to ultraviolet light test.

The text of this International Standard is based on the following documents:

Draft	Report on voting
23A/1025/FDIS	23A/1029/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document, 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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 as a means used for managing or securing the wiring systems in electrical installations. Cable ties and associated fixing devices can also be suitable for other applications, such as support of wiring systems, 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.

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

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

ISO 4892-2:2013, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*
ISO 4892-2:2013/AMD1:2021

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

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. 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

3.6
environmental influence
effect of environmental hazards such as 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 nor releases moisture when exposed to a surrounding environment of 23 °C and 50 % relative humidity

3.11
integral device
single component, as produced, incorporating a cable tie and a fixing device that are not separable

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

3.13
type test
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.14
bundle
collection of wires or cables gathered or tied together

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 62275:2018 in order to comply with IEC 62275:2022, Edition 4 (i.e., this document).

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 considered 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.

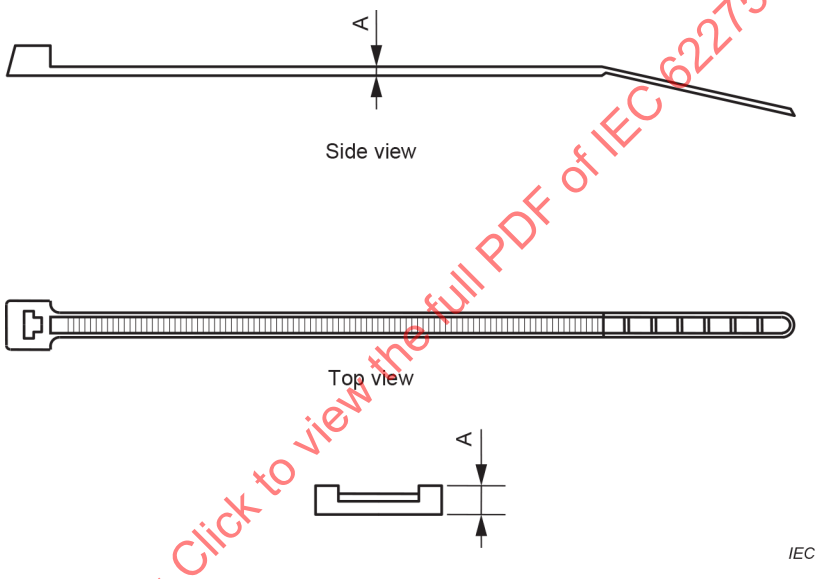
5.2 Unless otherwise specified, tests on non-metallic and composite components shall commence when the samples have been removed from their packaging and then stabilized at a temperature of (23 ± 5) °C and at a relative humidity of (50 ± 5) %, for a period as indicated in Table 1.

NOTE This stabilization intends to achieve equilibrium 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^{0}_{-7}
1,4 < RT	35^{0}_{-7}
All thicknesses for low hygroscopic polymers	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.



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 can 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. Dead weights can be used for conducting loop tensile strength tests for cable ties and integral devices classified according to 6.2.3, provided that no sudden application of force occurs.

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.

5.8 An integral device shall be tested as a complete sample. The integral device 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 6, 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 particular mounting orientation represents the most onerous condition, the results of the 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

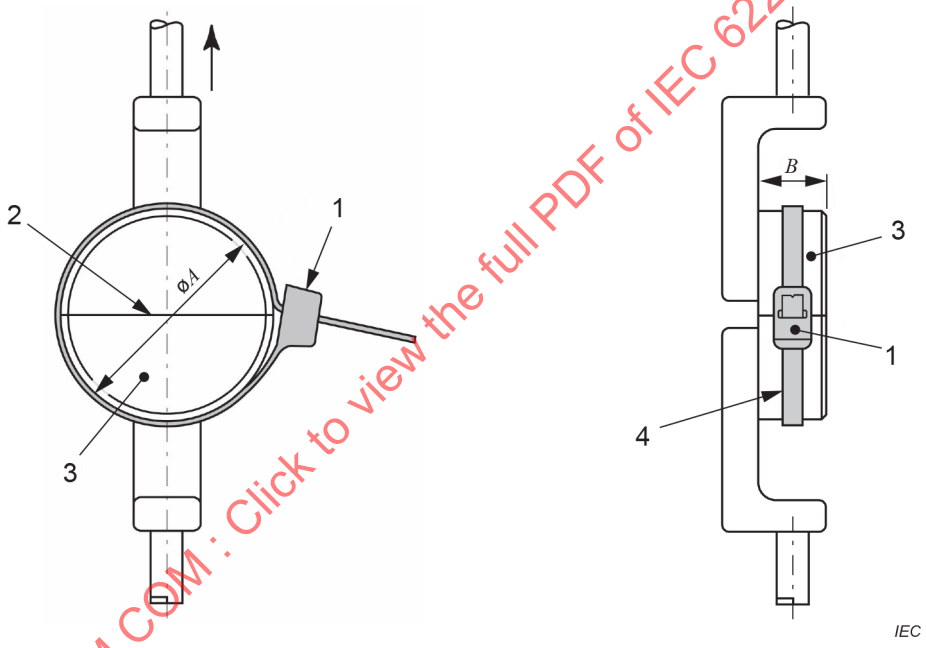
For the loop tensile strength tests, the mandrel shall be split in two equal parts.

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

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.

For integral devices, when it is determined impractical to condition the samples mounted to a rigid support, samples shall be conditioned separately. When conditioning separately, they shall be installed on a solid mandrel of similar size to the test fixture and the entire sample set may be installed on the same mandrel. After conditioning, each sample shall be mounted to the rigid support test fixture prior to the appropriate tensile pull. 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.



Key

1 locking device (head)

2 split line

3 mandrel

4 cable tie

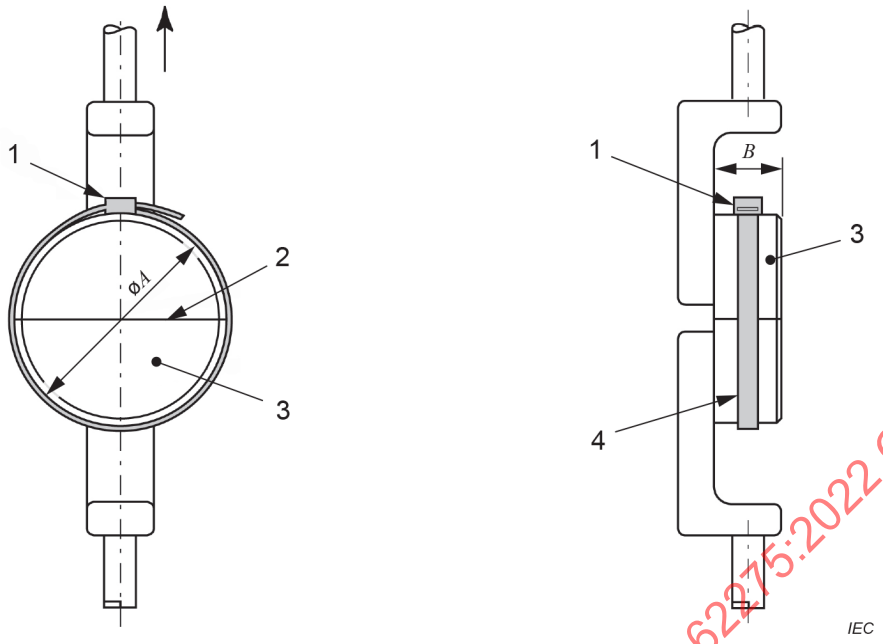
A diameter of test mandrel

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 2 a) – 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



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 2 b) – Typical arrangement for non-metallic and composite 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

5.10 Tests for rubber adhesive fixing devices and integral devices on stainless steel or aluminium bare panel cover installation on the following surfaces:

– any bare metal surface,
– enamel painted metal surface,
– epoxy painted metal surface,
– polyester painted metal surface.

The installation on other surfaces and other painted surfaces shall be tested.

5.11 Tests for acrylic adhesive fixing devices and integral devices on stainless steel or aluminium bare panel cover the installation on any bare metal surface. The installation on other surfaces shall be tested.

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

5.13 Unless specified otherwise by the manufacturer, the samples are to be held to the panel for a period of 5^{+1}_{0} s 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 preconditioning period recommended by the manufacturer shall be respected.

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 only requires the evaluation according to 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.

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

Metallic cable ties and fixing devices shall be classified according to 6.2.3.

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.

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

An integral device shall have a single type classification, according to 6.2.2 or 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.

6.3.2 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

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

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

6.4.1 Flame propagating

NOTE Owing 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 devices 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

6.5.2.2 Resistant to corrosion

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 to mark a cable tie or fixing device with the identifying symbol (for example, due to the small size of the cable tie or fixing device), 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.

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

Laser marking directly on the product and marking made by moulding, pressing or engraving are not subjected to the test set out in the paragraphs below.

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.

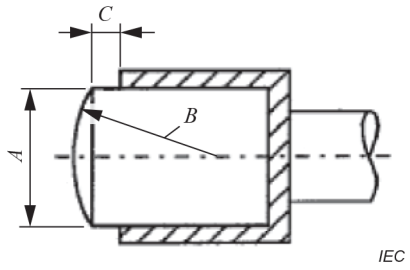
When using the liquid specified for the test, precautions as stated in the relative material safety datasheet provided by the chemical supplier shall be taken to safeguard the laboratory technicians.

After the test with water, the marking surface to be tested shall be dried.

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 cotton wool covered by a piece of cotton medical gauze. The 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.



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.

Table 6 – Literature information

Information	Cable ties	Fixing devices	Integral devices
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 for non-metallic and composite according to 6.3.2	X	X	X
Minimum temperature during installation for non-metallic and composite 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
Material of the surfaces to which the adhesive fixing device is intended to be affixed according to 5.10 to 5.12		X	X
Manufacturer's recommendations for surface preparations, adhesive application temperature range, and curing time prior to loading for adhesive fixing devices and integral devices		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, MX and RU.

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.

9 Mechanical properties

9.1 Requirements

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

An integral device 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 1 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.

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.

NOTE 2 Loop tensile strength test is used to evaluate UV resistance in 11.1 and resistance to corrosion in 11.2.

The loop tensile strength test for cable ties and the mechanical strength test for fixing devices are always carried out at ambient temperature. Minimum application temperature and maximum application temperature are verified by other tests such as impact, ageing and temperature cycling.

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

The test is carried out only for cable ties with a declared minimum installation temperature lower than 0 °C.

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.

9.4 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.

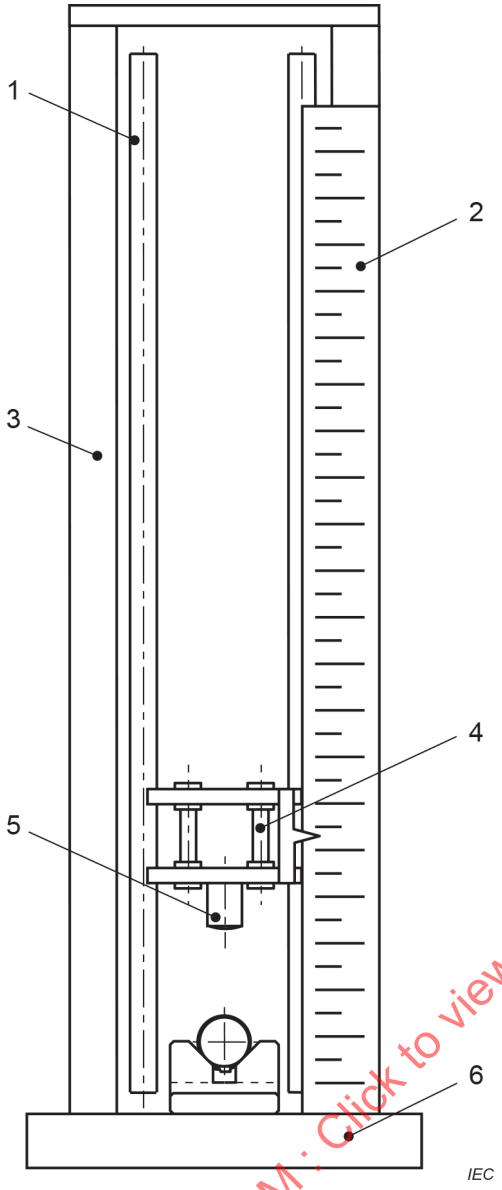


Figure 4 a) – Test apparatus assembly

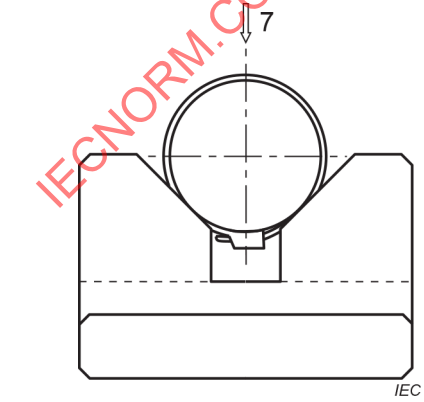


Figure 4 b) – Test mandrel with supporting V-block

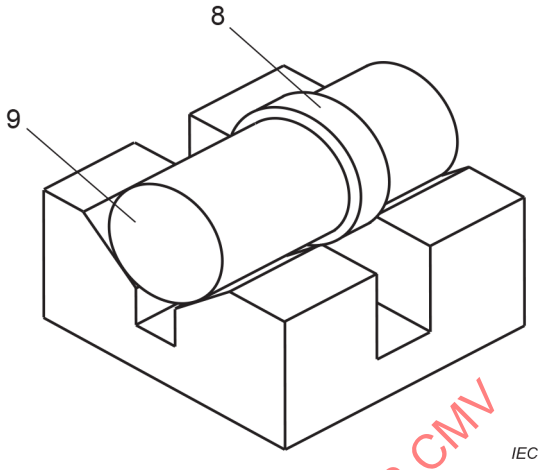


Figure 4 c) – Position of tie strap

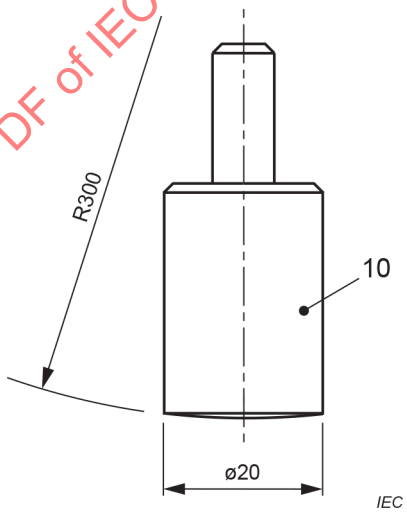


Figure 4 d) – Hammer details

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 is 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

9.5.1 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. 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. 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 $\left(1000\,^{+48}_{0}\right)$ *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 non-metallic or composite 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* $\left(18^{+2}_{0}\right)$ *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

9.6.1 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 $\left(60^{+5}_{0}\right)$ *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 load shall be maintained 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.

9.6.2 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 $\left(1000^{+48}_{0}\right)$ *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 $\left(60^{+5}_{0}\right)$ *s.*

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

9.6.3 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 $\left(60^{+5}_{0}\right)$ *s.*

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

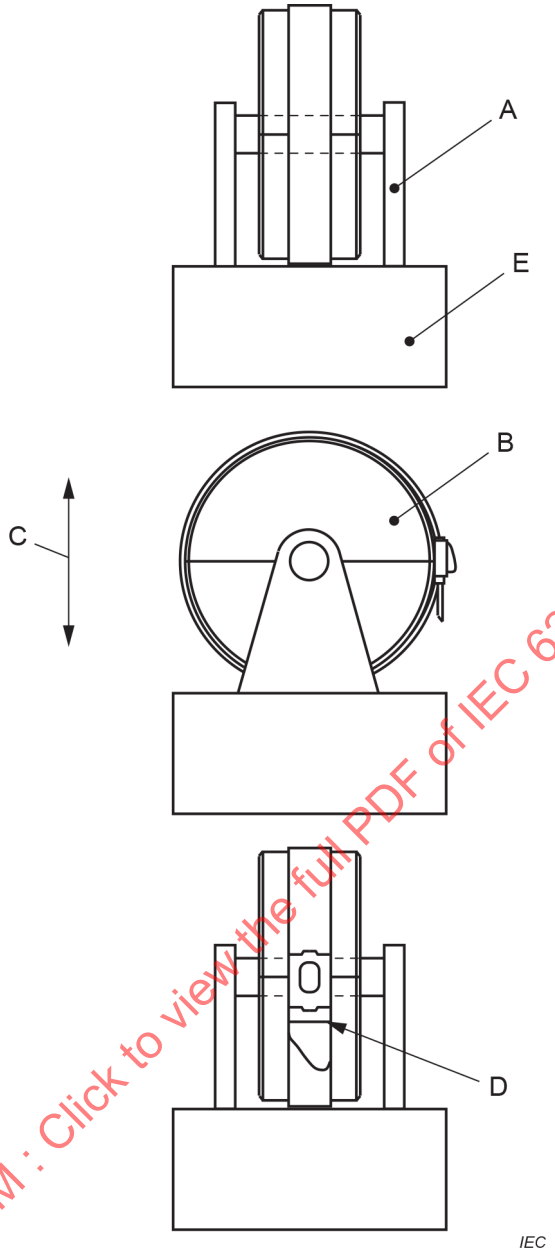
9.6.4 After vibration test for metallic cable ties

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 $\left(60^{+5}_{0}\right)$ *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.



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 devices

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 device 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 to 5.12.

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 device 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 devices, the test fixture shall allow for self-alignment of the test load with the integral device 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 device 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 mechanical strength.*
- *For a separately supplied fixing device and for an integral device 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* $\left(60^{+5}_{0}\right)$ *s.*

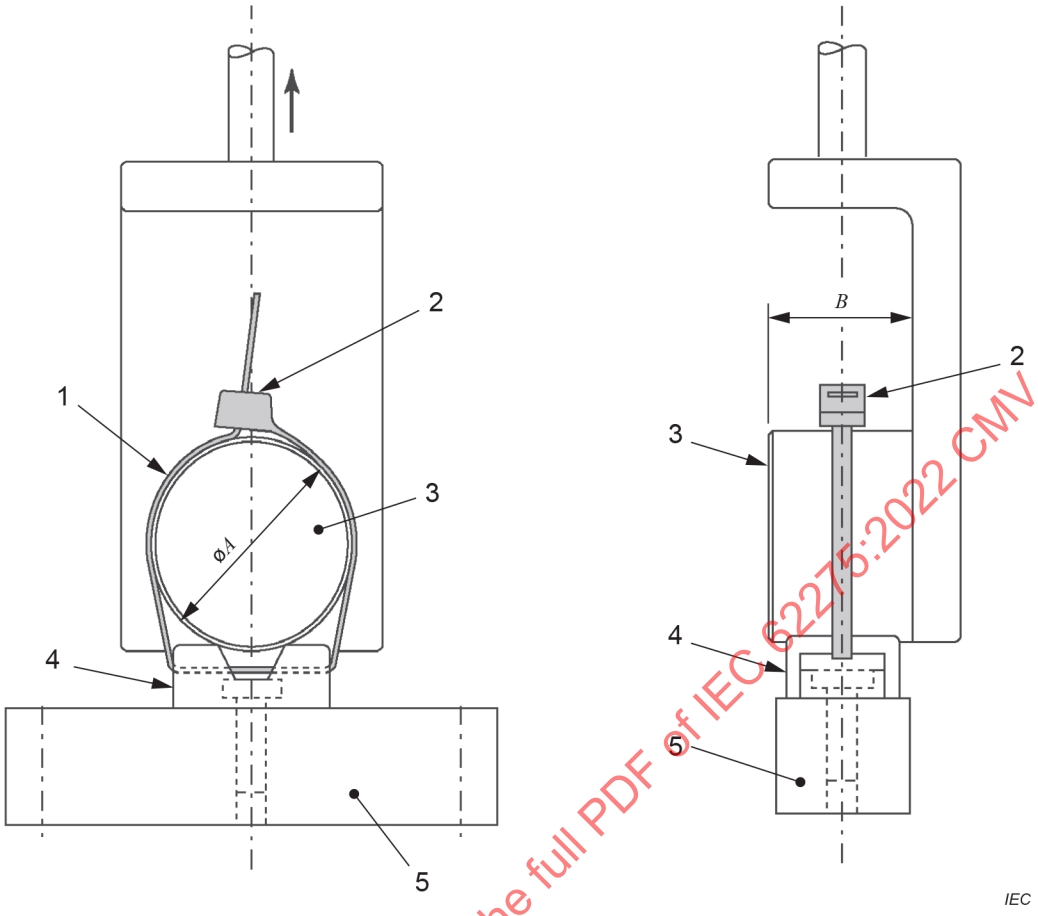
When testing for loop tensile strength, the following applies:

- *An integral device 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 device 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 device 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* $\left(60^{+5}_{0}\right)$ *s.*

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

If during the test:

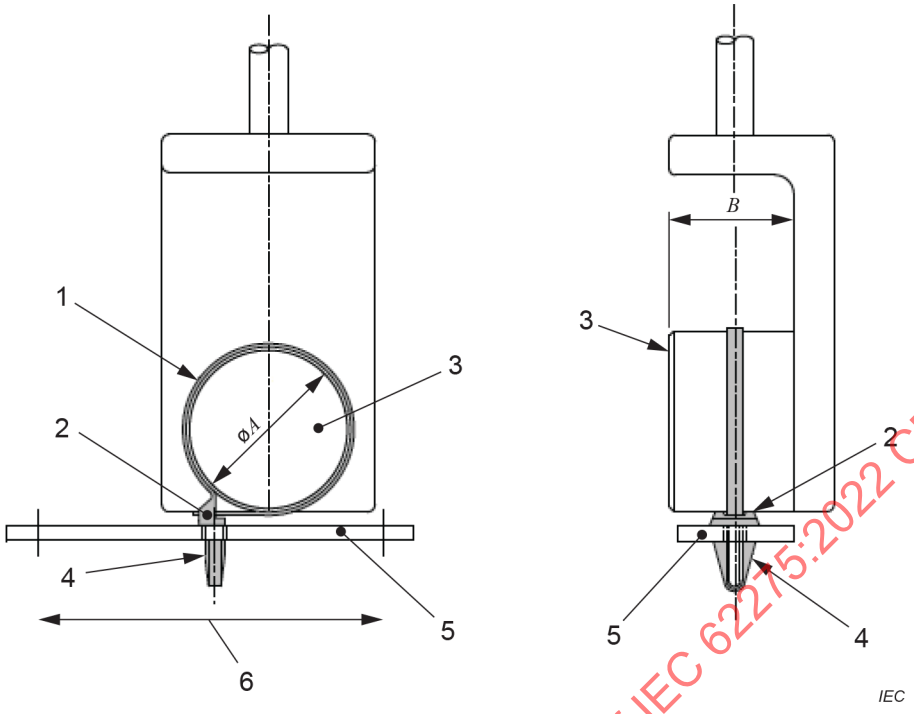
- *the fixing device or the integral device, excluding the adhesive ones, detaches from the rigid support without signs of disintegration, cracking or the like, it is not considered a failure, but the test shall be repeated with a more appropriate fixing method.*
- *the adhesive fixing device or the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



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

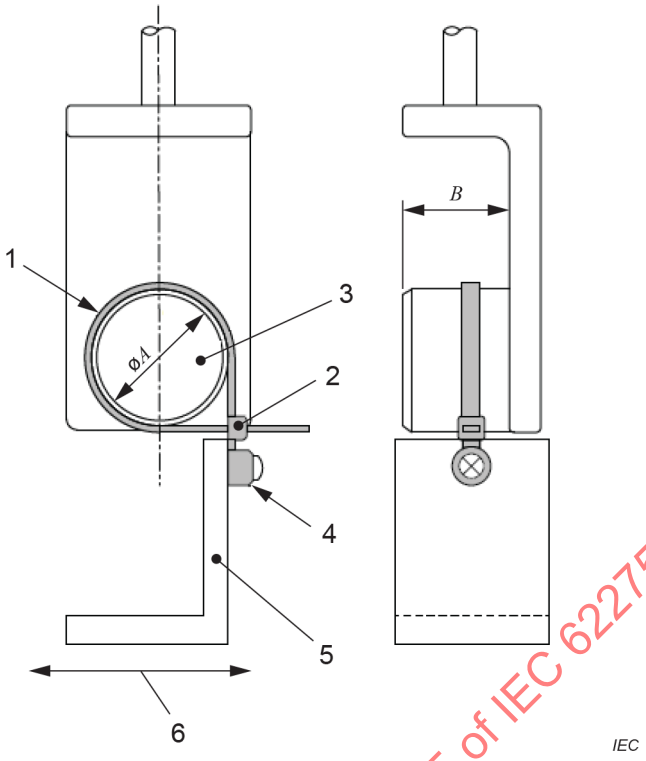
Figure 6 a) – Typical arrangement of test assembly for separately supplied fixing device



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

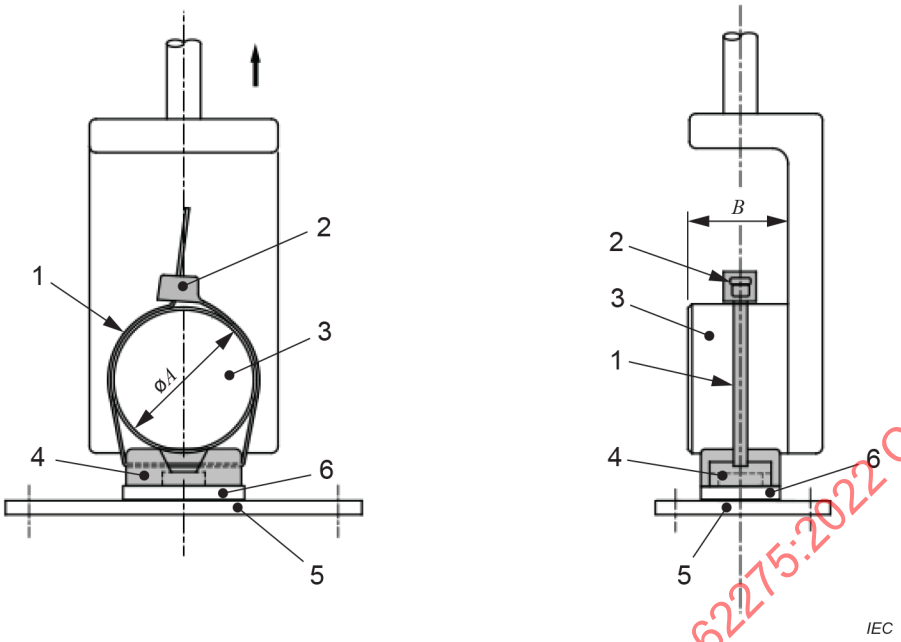
Figure 6 b) – Typical arrangement of test assembly for an integral push-mount fixing device



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

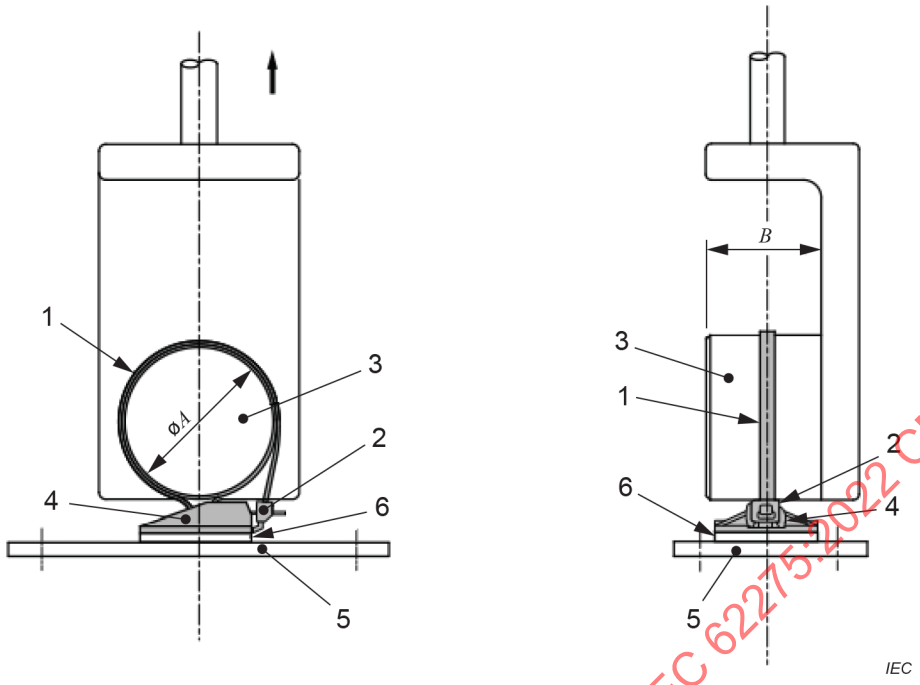
Figure 6 c) – Typical arrangement of test assembly for an integral screw-mount fixing device



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 6 d) – Typical arrangement of test assembly for separately supplied adhesive 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 6 e) – Typical arrangement of test assembly for an integral adhesive fixing device

Figure 6 – Typical arrangement of test assembly for fixing devices and for integral 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 device 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 to 5.12.

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* 1000^{+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 device 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* 1000^{+48}_{0} *h. Then the assembly shall be conditioned according to 5.2.*

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

– *For integral devices, the test fixture shall allow for self-alignment of the test load with the integral device 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 device 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 mechanical strength.*

– *For a separately supplied fixing device and for an integral device 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* $\left(60^{+5}_{0}\right)$ *s.*

When testing for loop tensile strength, the following applies:

– *An integral device 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* 1000^{+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 device 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 device 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* $\left(60^{+5}_{0}\right)$ *s.*

After the test, the fixing device or the integral device 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 device, 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 device detaches from the rigid support, this is considered a failure.*

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 device 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 to 5.12.

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 device 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 devices a split mandrel can be used as long as the two parts are linked together to operate as a solid mandrel.*
- *For integral devices, the test fixture shall allow for self-alignment of the test load with the integral device 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 device 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 mechanical strength.*
- *For a separately supplied fixing device and for an integral device 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 $\left(60^{+5}_{0}\right)$ s.*

When testing for loop tensile strength, the following applies:

- *An integral device 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 device 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 device 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 $\left(60^{+5}_{0}\right)$ s.*

After the test, the fixing device or the integral device 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 device, 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 device detaches from the rigid support, this is considered a failure.*

10 Contribution to fire

Non-metallic and composite cable ties and metallic cable ties having a non-metallic or organic coating as well as integral devices that are classified according to 6.4.2, shall have adequate resistance to flame propagation.

Compliance is checked by the following test for cable ties of the following colours:

a) samples containing no colour pigment (natural);

b) samples of both the lightest and the darkest coloured products containing the heaviest colour pigment loading;

c) samples containing the heaviest pigment loading if a product is in a colour other than the lightest or darkest colours.

The results of tests conducted on these samples are considered representative of a full range of colours but not of blends that contain additives such as carbon black.

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:

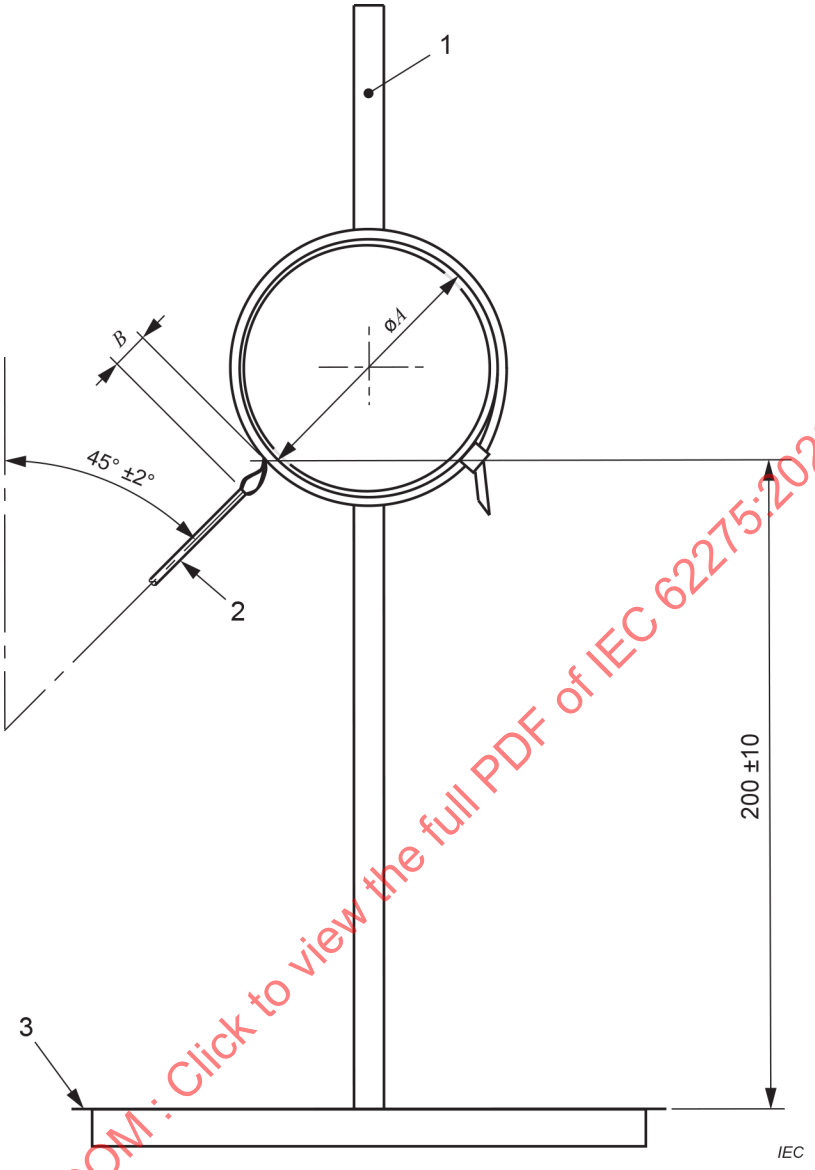
– *30 s after the test flame is removed, there is no flaming of the sample, and*

– *there is no ignition of the tissue paper.*

For a metallic cable tie having a non-metallic or organic 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.

NOTE In some countries, such as Canada, Mexico and the United States, a material classification HB according to IEC 60695-11-10 based on a nominal 1,5 mm thickness is considered as an alternative to the test. See UL 62275/CSA C22.2 No.62275.

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

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 test.

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. Fixing devices shall 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.

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.

11.1.2 *The samples shall be exposed for 1 000 h to xenon-arc, method A, cycle 1 in accordance with ISO 4892-2. 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 black standard temperature of (65 ± 3) °C. The irradiance is measured at the rack where the black standard is placed. The temperature of the chamber shall be (38 ± 3) °C. The relative humidity in the chamber shall be (50 ± 10) %.*

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 set out in 11.1.2 and stabilization for a period according to 5.2, the following applies:*

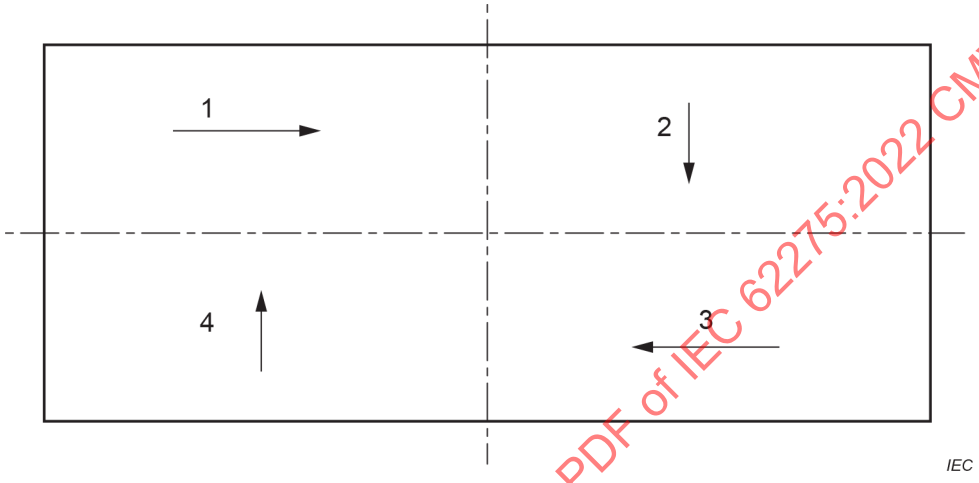
Each sample of a cable tie, a fixing device, or an integral device classified according to 6.2.2, shall be subjected to a tensile pull. No individual value shall be less than:

a) 50 % of the declared loop tensile strength for a cable tie or

b) 50 % of the declared mechanical strength for a fixing device or a fixing device portion of the integral device.

Each sample of a cable tie, a fixing device, or an integral device classified according to 6.2.3, shall be subjected to a tensile pull until the load equivalent to the declared loop tensile strength for a cable tie or the declared mechanical strength for a fixing device or a fixing device portion of the integral device is reached.

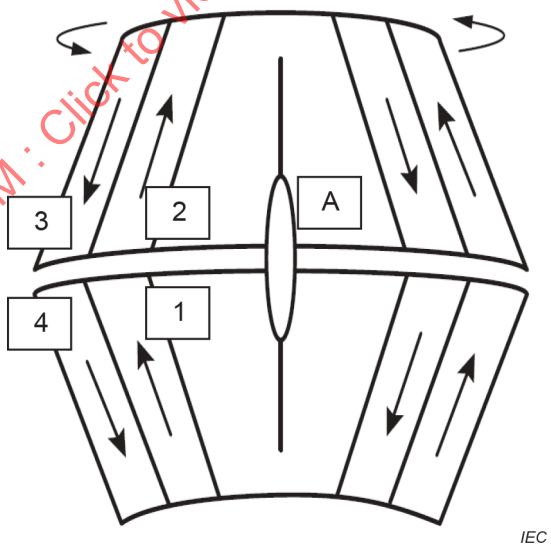
This load is maintained for $\left(60^{+5}_{0}\right)$ *s. The samples shall be deemed to have passed the test if the samples perform according to the requirements in 9.6.1 or 9.7.1 as appropriate. After the test, there shall be no sign of disintegration, nor shall there be any crack visible to normal or corrected vision.*



Representative quadrants on flat panel.

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

Figure 8 a) – Static flat panel apparatus



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 8 b) – Cylinder-type apparatus

Figure 8 – Recommended sample repositioning for ultraviolet light and water exposure

11.2 Resistance to corrosion

Cable ties and fixing devices classified as resistant to corrosion according to 6.5.2.2 shall have adequate resistance to corrosion.

Compliance is checked by the following test:

Moisture stabilization according to 5.2 before salt spray exposure is not applicable for this test.

Samples shall be exposed to a neutral salt spray (NSS) in accordance with ISO 9227:2017 for 192 h followed by 12 h at (40 ± 2) °C. Samples of non-metallic coated devices shall be subjected to heat age conditioning in accordance with 9.5.2, 9.6.2 or 9.7.2 as appropriate before exposure to the salt spray.

The samples shall then be rinsed in demineralized water. Metallic cable ties and fixing devices shall be dried. Composite cable ties and fixing devices shall be stabilized according to 5.2.

After the test, the samples shall show no cracks visible to normal or corrected vision. Any traces of rust on sharp edges and a yellowish film may be removed by rubbing. There shall be no red rust visible to normal or corrected vision.

Each sample of a composite cable tie classified according to 6.2.2 (Type 1), shall be subjected to the tensile pull according to 9.5.1. No individual value shall be less than 50 % of the loop tensile strength declared according to 6.2.

Each sample of a metallic or composite cable tie classified according to 6.2.3 (Type 2), shall be subjected to the 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 $\left(60^{+5}_{0}\right)$ *s.*

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

Each sample of a fixing device shall be subjected to the tensile pull according to 9.7.1.

After the test, there shall be no sign of disintegration of a fixing device or any crack visible to normal or corrected vision.

Testing of products constructed of stainless steel having a chromium content of 16 % or more is not required.

A metallic cable tie having a non-metallic coating that is depended upon to provide resistance to corrosion, and that is declared as having resistance to ultraviolet light, shall be subjected to the conditioning in 11.1 followed by the appropriate requirements in 11.2 for metallic cable ties.

The requirements in 11.2 are not applicable for a metallic cable tie with a non-metallic coating when the uncoated version has been determined to meet the requirements in 11.2.

12 Electromagnetic compatibility

Products covered by this document are, in normal use, passive with respect to electromagnetic influences (emission and immunity). Therefore, no tests have been specified.

Annex A
(normative)

Compliance checks to be carried out for cable ties and fixing devices currently complying with IEC 62275:2018 (Edition 3) in order to comply with IEC 62275:2022 (Edition 4) (i.e., this document)

Annex A relates to requirements of IEC 62275 Edition 4 (i.e., this document). Table A.1 specifies where compliance checks are required and where compliance checks are not required in order that cable ties and fixing devices can be declared to meet the requirements of this document if they already comply with IEC 62275:2018.

Table A.1 – Required compliance checks

Test reference clause/ subclause	Description	Compliance check
Marking and documentation		
7.1	Marking of cable ties and fixing devices	Not required
7.2	Durability and legibility marking	Not required
7.3	Literature declaration	Not required
Construction		
8	Surface and edges	Not required
Mechanical properties		
9.2	Installation test	Not required
9.3	Minimum installation temperature test for cable ties	Not required
9.4	Minimum operating temperature test for cable ties	Not required
9.5.1	Loop tensile strength test for cable ties classified according to 6.2.2. As-received condition	Not required
9.5.2	Loop tensile strength test for cable ties classified according to 6.2.2. After heat ageing	Not required
9.5.3	Loop tensile strength test for cable ties classified according to 6.2.2. After temperature cycling	Not required
9.6.1	Loop tensile strength test for cable ties classified according to 6.2.3. As-received condition	Not required
9.6.2	Loop tensile strength test for cable ties classified according to 6.2.3. After heat ageing	Not required
9.6.3	Loop tensile strength test for cable ties classified according to 6.2.3. After temperature cycling	Not required
9.6.4	Loop tensile strength test for cable ties classified according to 6.2.3. After vibration test for metallic cable ties	Not required
9.7.1	Mechanical strength test for fixing devices. As-received condition	Only required for adhesive fixing devices and integral devices other than rubber
9.7.2	Mechanical strength test for fixing devices. After heat ageing	Only required for adhesive fixing devices and integral devices other than rubber
9.7.3	Mechanical strength test for fixing devices. After temperature cycling	Only required for adhesive fixing devices and integral devices other than rubber
Contribution to fire		
10	Needle flame test	Not required
Environmental influences		
11.1	Resistance to ultraviolet light	Not required
11.2	Resistance to corrosion (for metallic and composite components)	Not required

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UL 62275 / CSA C22.2 No. 62275, *Cable management systems – Cable ties for electrical installations*

UL 746C / CAN/CSA C22.2, *Polymeric Materials – Use in Electrical Equipment Evaluations*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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SYSTÈMES DE CÂBLAGE – COLLIERS POUR INSTALLATIONS ÉLECTRIQUES

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L'IEC 62275 a été établie par le sous-comité 23A: Systèmes de câblage, du comité d'études 23 de l'IEC: Petit appareillage. Il s'agit d'une Norme internationale.

Cette quatrième édition annule et remplace la troisième édition parue en 2018. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) une clarification du domaine d'application;
b) de nouvelles définitions;
c) la suppression de l'exception relative au conditionnement pour atteindre la reprise d'humidité;
d) la possibilité d'effectuer des essais de tenue à la traction avec des poids morts;

e) la différenciation des fixations adhésives en caoutchouc et en acrylique;

f) une clarification pour les essais mécaniques des accessoires intégrés;

g) des clarifications du Tableau 6;

h) des clarifications de 9.1;

i) l'essai des colliers à la température minimale d'installation est effectué uniquement lorsque la température minimale déclarée est inférieure à 0 °C;

j) une exigence selon laquelle les colliers métalliques sont classés conformément à 6.2.3;

k) la définition des couleurs à soumettre à essai en matière de contribution au feu;

l) l'ajout d'une note "Dans certains pays" à l'Article 10;

m) la clarification du montage des accessoires de fixation dans l'essai de tenue au rayonnement ultraviolet;

n) la clarification de l'essai des accessoires intégrés dans l'essai de tenue au rayonnement ultraviolet.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
23A/1025/FDIS	23A/1029/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

Les différentes pratiques suivantes, à caractère moins permanent, existent dans les pays indiqués ci-après:

– 6.2.2: des classifications de type supplémentaires sont applicables lorsque des matériaux de moulage préqualifiés sont utilisés (Canada, Etats-Unis);

– 6.2.3: des classifications de type supplémentaires sont applicables lorsque des matériaux de moulage préqualifiés sont utilisés (Canada, Etats-Unis);

– 7.3: certaines informations de marquage sont exigées sur l'emballage (Canada, Etats-Unis et Russie).

Dans le présent document, les caractères d'imprimerie suivants sont utilisés:

– exigences proprement dites: caractères romains;

– *spécifications d'essais: caractères italiques*;

– notes: petits caractères romains.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

SYSTÈMES DE CÂBLAGE – COLLIERS POUR INSTALLATIONS ÉLECTRIQUES

1 Domaine d'application

Le présent document spécifie les exigences pour les colliers métalliques, non métalliques et composites, ainsi que pour leurs accessoires de fixation associés, comme un moyen utilisé pour l'aménagement et la fixation des systèmes de câblage dans les installations électriques. Les colliers et leurs accessoires de fixation associés peuvent également être utilisés pour d'autres applications, comme le soutien des systèmes de câblage et, dans ce cas, des exigences supplémentaires peuvent s'appliquer.

Le présent document ne contient pas d'exigences concernant l'évaluation des propriétés d'isolation électrique du collier ou de la protection mécanique des câbles assurée par le collier. Le présent document contient des exigences relatives à l'interface mécanique d'un accessoire de fixation adhésif sur une surface rigide. Il ne traite pas du comportement mécanique de la surface rigide elle-même.

Le présent document ne traite pas de l'interface mécanique (par exemple la vis de montage), d'un accessoire de fixation autre que l'adhésif sur une surface rigide.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60068-2-6:2007, *Essais d'environnement – Partie 2-6: Essais – Essai Fc: Vibrations (sinusoïdales)*

IEC 60216-4-1:2006, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens* (disponible en anglais seulement)

IEC 60695-11-5:2016, *Essais relatifs aux risques du feu – Partie 11-5: Flammes d'essai – Méthode d'essai au brûleur-aiguille – Appareillage, dispositif d'essai de vérification et lignes directrices*

ISO 4892-2:2013, *Plastiques – Méthodes d'exposition à des sources lumineuses de laboratoire – Partie 2: Lampes à arc au xénon*
ISO 4892-2:2013/AMD1:2021

ISO 9227:2017, *Essais de corrosion en atmosphères artificielles – Essais aux brouillards salins*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/

- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
collier
bande ou longueur de matériau, employant un dispositif de fermeture, utilisé pour rassembler ou attacher ensemble des faisceaux de câbles, fixer et/ou soutenir les câbles

Note 1 à l'article: Les colliers de Type 1 et de Type 2 sont classés en 6.2.2 et 6.2.3.

Note 2 à l'article: Dans certains pays, tels que le Canada et les Etats-Unis, des classifications de type supplémentaires sont applicables, lorsque des matériaux de moulage préqualifiés sont utilisés. Voir UL 62275/CSA C22.2 nº 62275.

3.2
accessoire de fixation
composant (tel qu'un bloc ou une console) spécialement conçu pour fixer le collier à une surface de montage

3.3
composant métallique
composant constitué uniquement de métal

Note 1 à l'article: Un collier métallique avec un revêtement mince non métallique ou organique ne contribuant pas à la détermination de la tenue à la traction de la boucle est considéré comme un composant métallique. En cas de doute, des essais sur des colliers "en l'état de livraison" avec ou sans revêtement peuvent être effectués.

3.4
composant non métallique
composant constitué uniquement de matériaux non métalliques

3.5
composant composite
composant qui comporte à la fois des matériaux métalliques et des matériaux non métalliques qui contribuent tous deux à la détermination de la tenue à la traction de la boucle

3.6
influence de l'environnement
effet des dangers environnementaux comme les substances corrosives ou le rayonnement solaire, etc.

3.7
tenue à la traction de la boucle
caractéristique mécanique de référence d'un collier avec son mécanisme de fermeture en fonction

3.8
dispositif de fermeture
élément d'un collier destiné à le maintenir en position fermée

3.9
polymère faiblement hygroscopique
polymère présentant la caractéristique de ne pas permettre d'absorption ou de rétention d'eau supérieure à 1,0 % en poids du matériau dans un milieu environnant à 23 °C avec une humidité relative de 50 %

Note 1 à l'article: Le polypropylène, l'acétal, l'éthylène-tétrafluoroéthylène, l'éthylène-chlorotrifluoroéthylène, le nylon 12 et le polyétheréthercétone sont des exemples de polymères faiblement hygroscopiques.

3.10
reprise d'humidité stabilisée
état dans lequel un polymère n'absorbe et ne dégage aucune humidité lorsqu'il est exposé dans un milieu environnant à 23 °C et une humidité relative de 50 %

3.11
collier à embase
composant complet, tel que produit, intégrant un collier et un accessoire de fixation non séparable

3.12
accessoire de fixation adhésif
accessoire de fixation comportant une bande adhésive spécialement conçue pour fixer le collier à une surface de montage

3.13
essai de type
essai de conformité effectué sur une ou plusieurs entités représentatives de la production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.14
faisceau
ensemble de fils ou de câbles rassemblés ou attachés ensemble

4 Exigences générales

Un collier et un accessoire de fixation doivent supporter les contraintes susceptibles de se produire dans le cadre des pratiques d'installation recommandées et assurer leur fonction dans les conditions de classification de l'Article 6 déclarées par le fabricant.

La conformité est vérifiée par la réalisation de tous les essais appropriés spécifiés.

NOTE En vue de se conformer à l'IEC 62275:2022, édition 4 (c'est-à-dire le présent document), l'Annex A donne des détails sur les vérifications de conformité à effectuer pour les colliers et accessoires de fixation actuellement conformes à l'IEC 62275:2018.

5 Notes générales sur les essais

5.1 Les essais prévus selon le présent document sont des essais de type. Sauf spécification contraire, les essais sont effectués sur les colliers et leurs accessoires de fixation, s'ils existent, installés comme en utilisation normale selon les instructions du fabricant.

Sauf spécification contraire, les exigences et essais applicables aux accessoires de fixation s'appliquent également aux accessoires de fixation adhésifs.

NOTE Pour aider à la détermination des types de produits et des lots d'échantillons, des colliers ou des accessoires de fixation d'une famille ayant en commun le matériau, les caractéristiques de construction et les classifications selon l'Article 6 sont considérés comme appartenant au même type de produit. Exemples à prendre en compte: une désignation générique de matériau similaire, les couleurs de matériau ou les longueurs variables d'un collier par ailleurs de fabrication similaire. Les lots d'échantillons choisis pour les essais de chaque type de produit sont représentatifs des valeurs extrêmes de la gamme (exemple: le plus court et le plus long), et le niveau de performance minimal obtenu pour chaque valeur extrême est considéré comme étant représentatif de la totalité de la gamme. Il est tenu compte des variations de construction mineures pouvant être déterminées par examen qui n'ont pas d'effet sur les performances lors de la détermination des types de produits.

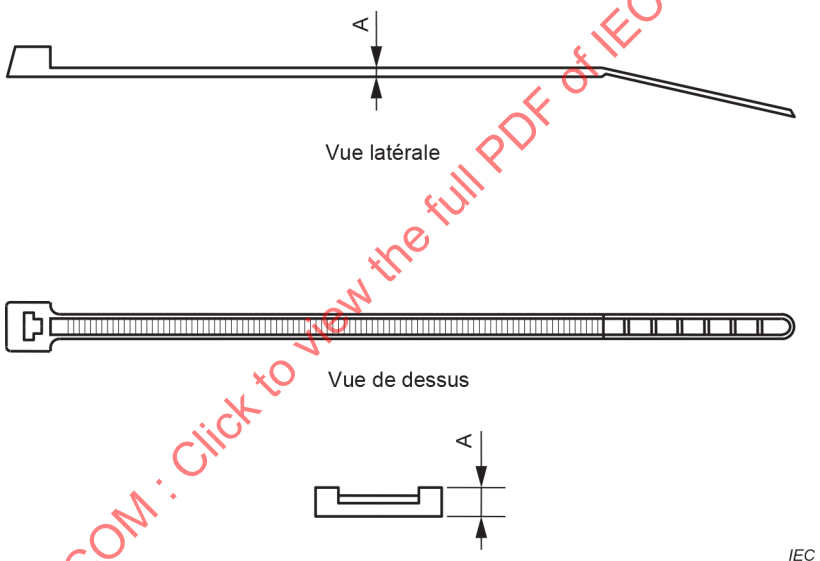
5.2 Sauf spécification contraire, les essais portant sur les composants non métalliques et composites doivent débuter après que les échantillons ont été retirés de leur emballage et conditionnés à la température de (23 ± 5) °C sous une humidité relative de (50 ± 5) %, pendant une période telle qu'indiquée dans le Tableau 1.

NOTE Ce conditionnement a pour but d'atteindre la reprise d'humidité stabilisée pour tous les échantillons avant et après tout conditionnement ultérieur et essai.

Tableau 1 – Durée de conditionnement des échantillons

Épaisseur de référence (RT) de l'échantillon mm	Durée de conditionnement jours
RT ≤ 1,2	7 ± 1
1,2 < RT ≤ 1,4	21^{0}_{-7}
1,4 < RT	35^{0}_{-7}
Toutes les épaisseurs pour les polymères faiblement hygroscopiques	2 ± 1/3

L'épaisseur de référence d'un collier est mesurée au point milieu de la bande. L'épaisseur de référence d'un accessoire de fixation doit être la section la plus faible dans la zone interface avec le collier ou telle que déclarée par le fabricant. Voir Figure 1.



Légende

A Épaisseur de référence du collier

Figure 1 – Épaisseur de référence des colliers

5.3 Sauf spécification contraire, les essais doivent être réalisés à la température ambiante de (23 ± 5) °C sous une humidité relative comprise entre 40 % et 60 %.

5.4 Sauf spécification contraire, trois échantillons neufs sont soumis aux essais et les exigences sont satisfaites si tous les essais sont subis avec succès. Si seulement l'un des échantillons ne satisfait pas à un essai en raison d'un défaut d'assemblage ou de fabrication, cet essai et tous les précédents qui peuvent avoir influencé ces résultats doivent être répétés. Les essais qui suivent doivent être effectués dans l'ordre exigé sur un autre lot complet d'échantillons, qui doivent tous satisfaire aux exigences.

NOTE Le demandeur, lorsqu'il soumet le premier lot d'échantillons, peut aussi soumettre un lot supplémentaire d'échantillons qui peuvent être nécessaires en cas de défaut d'un des échantillons. Le laboratoire soumet alors à l'essai, sans nouvelle demande, le lot supplémentaire d'échantillons, le rejet n'intervenant que dans le cas d'un nouvel échec. Si le lot supplémentaire d'échantillons n'est pas fourni initialement, l'échec d'un échantillon entraîne le rejet.

5.5 Lorsque des procédés toxiques ou dangereux sont utilisés, la sécurité des personnes doit être assurée à l'intérieur de la zone d'essai.

5.6 Sauf spécification contraire, la vitesse de la tête de la machine à traction utilisée pour les essais doit être de (25 ± 2,5) mm/min. Des poids morts peuvent être utilisés pour effectuer les essais de tenue à la traction de la boucle des colliers et des colliers à embase classés selon 6.2.3, à condition qu'il n'y ait pas d'application soudaine de force.

5.7 Si cela est exigé pour le vieillissement à la chaleur, une étuve ventilée telle que celle spécifiée dans l'IEC 60216-4-1:2006 doit être utilisée. Une partie de l'air doit pouvoir recirculer et une quantité importante d'air doit être admise de façon continue pour entretenir une atmosphère normale dans l'environnement des échantillons. L'étuve doit être réglée de façon à réaliser plus de cinq renouvellements complets de l'air par heure.

5.8 Un collier à embase doit être soumis à l'essai en tant qu'échantillon complet. La totalité de l'échantillon doit être soumise aux conditionnements pour le collier avant de réaliser l'essai de tenue mécanique pour l'accessoire de fixation conformément à 9.7.

Un accessoire de fixation, dont la performance dépend de la taille du trou de montage, de l'épaisseur de la feuille de matériau sur laquelle il doit être monté ou de l'orientation de montage déclarée par le fabricant conformément au Tableau 6, doit satisfaire à tous les essais applicables lorsque l'accessoire est assemblé selon l'épaisseur minimale et maximale de chaque surface de montage, avec la taille de trou la plus grande, et selon chaque orientation de montage prévue déclarée par le fabricant. S'il peut être déterminé qu'une orientation particulière de montage représente la condition la plus sévère, les résultats des essais réalisés selon cette orientation peuvent représenter l'ensemble des orientations de montage.

Un accessoire de fixation adhésif, dont la performance dépend de la surface de montage ou de l'orientation de montage, doit satisfaire à tous les essais applicables lorsque l'accessoire est assemblé sur les surfaces auxquelles il est destiné et selon chaque orientation de montage prévue déclarée par le fabricant. S'il peut être déterminé qu'une orientation particulière de montage représente la condition la plus sévère, les résultats des essais réalisés selon cette orientation peuvent représenter l'ensemble des orientations de montage.

5.9 Sauf spécification contraire, lors du déroulement des essais sur les colliers selon l'Article 9, les échantillons doivent être installés selon les instructions du fabricant sur un mandrin en acier ou en aluminium de diamètre A suivant le Tableau 2.

Si le diamètre minimal déclaré du collier est supérieur au diamètre du mandrin d'essai spécifié dans le Tableau 2, un mandrin d'essai du diamètre minimal tel que déclaré par le fabricant doit alors être utilisé.

La largeur B du mandrin doit être supérieure d'au moins 5 mm à la largeur maximale du collier comme représenté à la Figure 2.

Tableau 2 – Diamètre du mandrin d'essai

Diamètre maximal déclaré mm	**Diamètre du mandrin d'essai** (A) mm
≤ 20	9,5 ± 1
> 20 et ≤ 38	20 ± 2
> 38	38 ± 2

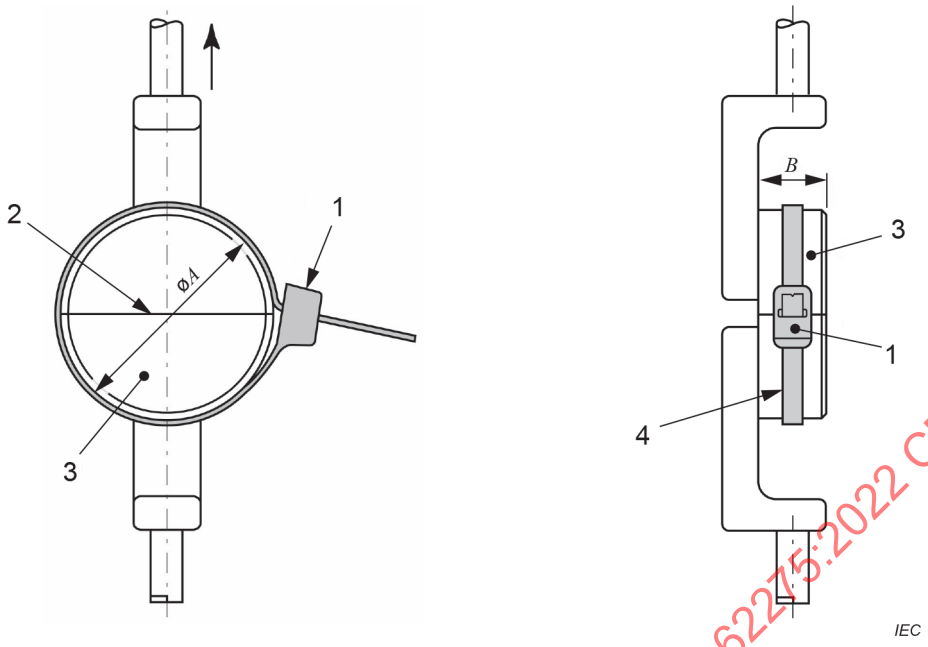
Pour les essais de tenue à la traction de la boucle, le mandrin doit être séparé en deux parties égales.

Un collier métallique ayant une lanière d'entrée parallèle doit être monté sur le mandrin comme représenté à la Figure 2 a). Les colliers non métalliques ou composites ayant une lanière d'entrée parallèle doivent être montés sur le mandrin comme représenté à la Figure 2 b).

Le surplus (lanière) de collier peut être coupé après montage, sauf pour les essais pour lesquels des marques sont exigées à des fins de mesure (voir 9.6).

L'utilisation de mandrins de conditionnement séparés en acier ou aluminium est autorisée. Il n'est pas nécessaire que les mandrins de conditionnement soient en deux parties, toutefois ils doivent avoir un diamètre approximativement équivalent au mandrin d'essai approprié afin de permettre le transfert de l'échantillon sur le mandrin d'essai. Les échantillons conditionnés doivent être soigneusement transférés sur le mandrin d'essai approprié pour effectuer l'essai de tenue à la traction de la boucle. S'il est établi que le transfert des échantillons du mandrin de conditionnement à un mandrin d'essai a influencé les résultats d'essai, un lot d'échantillons supplémentaire doit être conditionné et soumis à l'essai.

Pour les colliers à embase, lorsqu'il s'avère peu pratique de conditionner les échantillons montés sur un support rigide, les échantillons doivent être conditionnés séparément. Lorsqu'ils sont conditionnés séparément, ils doivent être installés sur un mandrin monobloc de taille similaire à celle du montage d'essai et l'ensemble des échantillons peut être installé sur le même mandrin. Après conditionnement, chaque échantillon doit être monté sur le montage d'essai à support rigide avant d'être soumis à la force de traction appropriée. S'il est établi que le transfert des échantillons du mandrin de conditionnement à un mandrin d'essai a influencé les résultats d'essai, un lot d'échantillons supplémentaire doit être conditionné et soumis à l'essai.



Légende

1 Dispositif de fermeture (tête)

2 Ligne de séparation

3 Mandrin

4 Collier

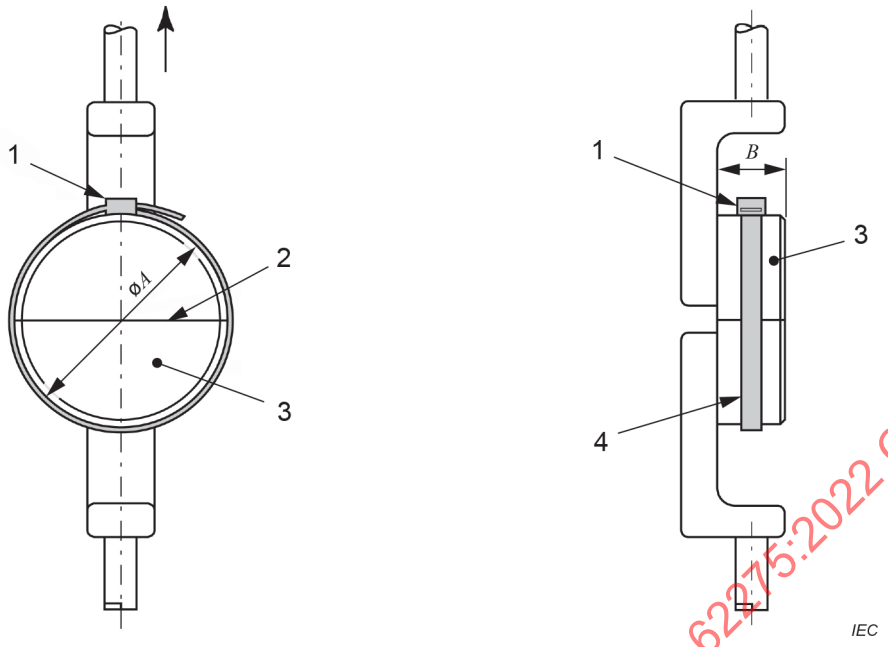
A Diamètre du mandrin d'essai

B Largeur du mandrin d'essai

Les mandrins doivent être fabriqués en acier ou en aluminium et doivent être lisses et exempts d'arêtes vives.

Il convient de veiller à ce que l'écartement des deux demi-mandrins reste parallèle à la ligne de séparation.

Figure 2 a) Configuration type pour l'orientation du collier non métallique et composite à entrée à angle droit et d'un collier métallique à entrée parallèle sur le mandrin en deux parties pour l'essai de traction



Légende

1 Dispositif de fermeture (tête)

2 Ligne de séparation

3 Mandrin

4 Collier

A Diamètre du mandrin d'essai

B Largeur du mandrin d'essai

Les mandrins doivent être fabriqués en acier ou en aluminium et doivent être lisses et exempts d'arêtes vives.

Il convient de veiller à ce que l'écartement des deux demi-mandrins reste parallèle à la ligne de séparation.

Figure 2 b) Configuration type pour l'orientation du collier non métallique et composite sur le mandrin en deux parties pour l'essai de traction – Lanière d'entrée parallèle

Figure 2 – Configurations types pour l'orientation du collier sur le mandrin en deux parties pour l'essai de traction

5.10 Essais pour accessoires de fixation et colliers à embase adhésifs en caoutchouc sur un panneau nu en acier inoxydable ou en aluminium couvrent l'installation sur les surfaces suivantes:

– toute surface métallique nue;
– surface métallique revêtue de peinture émaillée;
– surface métallique revêtue de peinture époxy;
– surface métallique revêtue de peinture polyester.

L'installation sur d'autres surfaces et d'autres surfaces peintes doit être soumise à essai.

5.11 Les essais pour accessoires de fixation adhésifs et colliers à embase adhésifs en acrylique sur un panneau nu en acier inoxydable ou en aluminium couvrent l'installation sur toute surface métallique nue. L'installation sur d'autres surfaces doit être soumise à essai.

5.12 Tout autre type générique d'adhésif utilisé sur un accessoire de fixation ou un collier à embase doit être soumis à des essais sur chaque surface.

5.13 Sauf spécification contraire de la part du fabricant, les échantillons sont à maintenir sur le panneau pendant une durée de 5^{+1}_{0} s avec une force de (50 ± 5) N avant de démarrer la période de préconditionnement spécifiée ou autres expositions. Avant d'appliquer toute force, la période de préconditionnement recommandée par le fabricant doit être respectée.

NOTE Au Canada et aux Etats-Unis, un adhésif préalablement évalué selon les exigences appropriées pour les systèmes adhésifs polymères conformément à l'UL 746C ou à la CAN/CSA-C22.2 nº 0.17 exige uniquement l'évaluation selon 9.7 sur un seul substrat.

6 Classification

6.1 Selon le matériau

6.1.1 Composant métallique

6.1.2 Composant non métallique

6.1.3 Composant composite

6.2 Selon la tenue à la traction de la boucle des colliers et la tenue mécanique des accessoires de fixation

6.2.1 Tenue à la traction de la boucle pour les colliers

Comme indiqué dans le Tableau 3.

Tableau 3 – Tenue à la traction de la boucle

Tenue à la traction de la boucle N	
50	530
80	800
130	890
180	1 150
220	1 300
360	2 200
450	

D'autres valeurs peuvent être déclarées à la discrétion du fabricant.

NOTE La tenue à la traction de la boucle ne constitue pas une indication de l'aptitude des colliers à supporter une charge statique à long terme.

6.2.2 Type 1 – Après les essais de vieillissement, il conserve au moins 50 % de la tenue à la traction de la boucle déclarée pour les colliers et de la tenue mécanique pour les accessoires de fixation

NOTE Dans certains pays tels que le Canada et les États-Unis, des classifications de type supplémentaires sont applicables lorsque des matériaux de moulage préqualifiés sont utilisés. Voir UL 62275/CSA C22.2 nº 62275.

6.2.3 Type 2 – Après les essais de vieillissement, il conserve au moins 100 % de la tenue à la traction de la boucle déclarée pour les colliers et de la tenue mécanique pour les accessoires de fixation

Les colliers et accessoires de fixation métalliques doivent être classés conformément à 6.2.3.

NOTE Dans certains pays tels que le Canada et les États-Unis, des classifications de type supplémentaires sont applicables lorsque des matériaux de moulage préqualifiés sont utilisés. Voir UL 62275/CSA C22.2 nº 62275.

6.2.4 Selon la tenue à la traction de la boucle et la tenue mécanique des colliers à embase

Un collier à embase doit avoir une seule classification de type selon 6.2.2 et 6.2.3.

6.3 Selon la température

6.3.1 Selon la température maximale d'utilisation indiquée dans le Tableau 4

Tableau 4 – Température maximale d'utilisation de l'application

Température °C
50
60
75
85
105
115
125
150

Des valeurs assignées supplémentaires au-dessus de 150 °C peuvent être déclarées par pas de 10 °C.

6.3.2 Selon la température minimale d'utilisation indiquée dans le Tableau 5

Tableau 5 – Température minimale d'utilisation de l'application

Température °C
0
-5
-15
-25
-40
-60

6.3.3 Selon la température minimale lors de l'installation telle que déclarée par le fabricant

6.4 Selon la contribution au feu pour les colliers et les colliers à embase non métalliques et composites uniquement

6.4.1 Propagateur de la flamme

NOTE En raison de la faible quantité de matériau, les colliers classés propagateurs de la flamme sont considérés comme ne constituant qu'une contribution potentielle mineure en cas de feu.

6.4.2 Non propagateur de la flamme

Les colliers métalliques et les colliers à embase métalliques sans revêtement non métallique sont considérés comme non propagateurs de la flamme.

6.5 Selon les influences de l'environnement

6.5.1 Selon la tenue au rayonnement ultraviolet pour les composants non métalliques et les composants composites

6.5.1.1 Non déclaré

6.5.1.2 Résistant au rayonnement ultraviolet

6.5.2 Selon la résistance à la corrosion pour les composants métalliques et composites

6.5.2.1 Non déclaré

6.5.2.2 Tenue à la corrosion

7 Marquage et documentation

7.1 Chaque collier et accessoire de fixation doit être marqué:

– du nom du fabricant ou du fournisseur responsable ou de la marque déposée; et

– d'un symbole d'identification tel que défini par le fabricant.

La conformité est vérifiée par examen.

S'il est impossible de marquer le symbole d'identification sur un collier ou un accessoire de fixation (par exemple en raison de leur petite taille), ce symbole peut alors être marqué sur l'emballage.

NOTE 1 Le symbole d'identification peut être un nombre, une lettre de référence, etc.

NOTE 2 Le marquage peut être réalisé, par exemple, par moulage, estampage, gravure, impression, étiquettes adhésives, etc.

7.2 Le marquage apposé sur les colliers, les accessoires de fixation ou les colliers à embase doit être lisible, durable et indélébile.

Le marquage au laser effectué directement sur le produit et le marquage effectué par moulage, estampage ou gravure ne sont pas soumis à l'essai décrit dans l'alinéa ci-dessous.

La conformité est vérifiée par examen, en utilisant une vision normale ou corrigée, sans grossissement supplémentaire.

L'essai est effectué en frottant le marquage pendant 15 s avec une pièce de tissu de coton imbibée d'eau puis, à nouveau pendant 15 s, avec une pièce de tissu de coton imbibée de n-hexane à 95 % (nº d'enregistrement CAS (Chemical Abstracts Service) 110-54-3).

NOTE Le n-hexane 95 % est disponible auprès de différents fournisseurs de produits chimiques comme solvant de chromatographie liquide haute pression (CLHP).

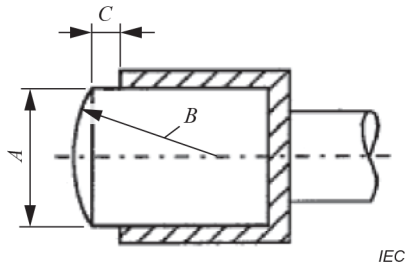
Lors de l'utilisation du liquide spécifié pour l'essai, des précautions comme indiqué sur la fiche de sécurité correspondante fournie par le fournisseur de produits chimiques, doivent être prises pour protéger les techniciens de laboratoire.

Après l'essai à l'eau, la surface de marquage à soumettre à essai doit être séchée.

Le frottement doit commencer juste après avoir imbibé d'eau le tissu de coton, en appliquant une force d'appui de (5 ± 1) N à une vitesse d'environ un cycle par seconde (un cycle comprenant un mouvement de va-et-vient sur la longueur du marquage). Pour les marquages de plus de 20 mm de longueur, le frottement peut être limité à une partie du marquage, sur une distance d'au moins 20 mm de longueur.

La force d'appui est appliquée au moyen d'un piston d'essai qui est enveloppé d'une couche de coton constituée d'ouate recouverte d'un morceau de gaze médicale en coton. Le piston d'essai est représenté à la Figure 3.

Les dimensions du piston d'essai doivent être celles indiquées à la Figure 3. Le piston d'essai doit être en matériau élastique qui est inerte au contact des liquides d'essai et a une dureté Shore-A de 47 ± 5 (par exemple caoutchouc synthétique). Lorsqu'il n'est pas possible d'effectuer l'essai sur les échantillons en raison de la forme/taille du produit, une éprouvette convenable, c'est-à-dire présentant les mêmes caractéristiques que le produit, peut être soumise à l'essai.



Dimensions mm		
A	*B*	*C*
20	20	2

Figure 3 – Piston d'essai pour l'essai de durabilité du marquage

7.3 Le fabricant ou le fournisseur responsable doit fournir dans sa documentation de référence les informations selon le Tableau 6.

Tableau 6 – Informations à fournir

Information	Colliers	Accessoires de fixation	Colliers à embase
Classification suivant le matériau selon 6.1	X	X	X
Tenue à la traction de la boucle selon 6.2.1	X		X [a]
Tenue mécanique déclarée par le fabricant		X	X [a]
Désignation de type selon 6.2.2 ou 6.2.3	X	X	X
Température maximale d'utilisation selon 6.3.1	X	X	X
Température minimale d'utilisation pour les composants non métalliques et les composants composites selon 6.3.2	X	X	X
Température minimale pendant l'installation pour les composants non métalliques et les composants composites selon 6.3.3	X		X
Contribution au feu pour les composants non métalliques et les composants composites selon 6.4	X		X
Tenue au rayonnement ultraviolet pour les composants non métalliques et composites selon 6.5.1	X	X	X
Résistance à la corrosion pour les composants métalliques et les composants composites selon 6.5.2	X	X	X
Diamètres maximal et minimal de faisceau en mm	X		X
Méthode recommandée d'installation, incluant l'outil à utiliser s'il y a lieu, et la charge à appliquer	X	X	X
Recommandations relatives au transport et au stockage	X	X	X
Conditions de montage ou d'assemblage spécifiques telles que les tailles des trous de montage, les épaisseurs de matériau, les orientations de montage, etc. selon 5.8.		X	X
Matériau des surfaces auxquelles l'accessoire de fixation adhésif est destiné à être fixé selon 5.10 et 5.12		X	X
Recommandations du fabricant relatives à la préparation des surfaces, à la plage de températures d'application des adhésifs et au temps de prise avant application de la charge pour les accessoires de fixation et les colliers à embase adhésifs.		X	X

[a] Tenue mécanique de l'accessoire de fixation et tenue à la traction de la boucle du collier, telles que déclarées par le fabricant.

Si les deux valeurs assignées sont identiques, une seule valeur assignée combinée peut être déclarée. Par exemple, tenue mécanique et tenue à la traction de la boucle de 80 N.

Si les deux valeurs assignées sont différentes, les deux doivent être déclarées. Par exemple, tenue mécanique de 40 N, tenue à la traction de la boucle de 80 N.

La tenue mécanique déclarée de l'accessoire de fixation intégré au collier ne doit pas dépasser la valeur déclarée pour la tenue à la traction de la boucle du collier.

NOTE Dans les pays suivants, il est exigé d'inscrire sur l'emballage accompagnant le produit certaines informations de marquage spécifiées dans le Tableau 6: CA, US, MX et RU (Canada, Etats-Unis, Mexique et Russie).

La conformité est vérifiée par examen.

8 Construction

La surface du collier ou de l'accessoire de fixation doit être exempte de bavures et autres défauts similaires, et les bords doivent être lisses de façon à ne pas endommager les câbles ou infliger des blessures à l'installateur ou à l'utilisateur.

La conformité est vérifiée par examen.

9 Propriétés mécaniques

9.1 Exigences

Les colliers, les accessoires de fixation et les colliers à embase doivent résister aux contraintes susceptibles de se produire lors de l'installation et de l'utilisation.

Un collier à embase doit satisfaire aux exigences relatives à la fois à l'accessoire de fixation et au collier.

Le collier doit:

– être capable d'enserrer les diamètres maximal et minimal de faisceau déclarés par le fabricant;

La conformité est vérifiée par l'essai de 9.2.

– pouvoir être installé à la température minimale déclarée par le fabricant;

La conformité est vérifiée par l'essai de 9.3, pour les colliers classés selon 6.1.2 et 6.1.3 seulement.

– être résistant aux effets des forces d'impact à la température minimale d'utilisation déclarée par le fabricant;

La conformité est vérifiée par l'essai de 9.4, pour les colliers classés selon 6.1.2 et 6.1.3 seulement.

– conserver sa fonction de fixation aux températures minimale et maximale de l'application déclarées par le fabricant. Les colliers métalliques doivent conserver leur fonction de fixation en cas d'exposition à des vibrations.

NOTE 1 Les colliers non métalliques et les colliers composites sont considérés comme étant résistants aux effets des vibrations.

La conformité est vérifiée par les essais appropriés. Pour les colliers classés selon 6.2.2, par les essais de 9.5. Pour les colliers classés selon 6.2.3, par les essais de 9.6.

L'accessoire de fixation doit conserver sa fonction de fixation aux températures minimale et maximale de l'application déclarées par le fabricant.

La conformité est vérifiée par les essais de 9.7.

NOTE 2 L'essai de tenue à la traction de la boucle est utilisé pour évaluer la résistance au rayonnement ultraviolet de 11.1 et la résistance à la corrosion de 11.2.

L'essai de tenue à la traction de la boucle des colliers et l'essai de tenue mécanique des accessoires de fixation sont toujours effectués à température ambiante. La température minimale d'application et la température maximale d'application sont vérifiées par d'autres essais tels que l'essai de choc, l'essai de vieillissement et le cycle de température.

9.2 Essai d'installation

L'échantillon doit être installé sur un mandrin représentant le diamètre ou la taille spécifié maximal et le diamètre ou la taille spécifié minimal afin de déterminer son aptitude à être installé de la façon prévue, comme spécifié par le fabricant.

Le conditionnement de stabilisation en humidité selon 5.2 n'est pas applicable pour cet essai.