BS EN 15619:2014

BSI Standards Publication

Rubber or plastic coated fabrics — Safety of temporary structures (tents) — Specification for coated fabrics intended for tents and related structures

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 15619:2014. It supersedes BS EN 15619:2008+A1:2010 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee TCI/69, Footwear, leather and coated fabrics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 77498 0

ICS 59.080.40; 97.200.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2014.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15619

March 2014

ICS 59.080.40; 97.200.30

Supersedes EN 15619:2008+A1:2010

English Version

Rubber or plastic coated fabrics - Safety of temporary structures (tents) - Specification for coated fabrics intended for tents and related structures

Supports textiles revêtus de caoutchouc ou de plastique - Sécurité des structures temporaires (tentes) - Spécification des supports textiles revêtus destinés aux tentes et structures similaires

Mit Kautschuk oder Kunststoff beschichtete Textilien - Sicherheit Fliegender Bauten (Zelte) - Spezifikation für beschichtete Textilien für Zelte und zugehörige Bauten

This European Standard was approved by CEN on 20 December 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 15619:2014) has been prepared by Technical Committee CEN/TC 248 “Textiles and textile products”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2014 and conflicting national standards shall be withdrawn at the latest by September 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15619:2008+A1:2010.

The main changes in comparison with the previous edition include:

— the normative references have been updated;

— use of the expression “coated fabric producer” instead of “manufacturer” throughout the document;

— subclause 5.9 “ Reaction to fire” updated to include an alternative test method related to fire behaviour, used to determine the “Euroclasses”;

— Clause 6 “Requirements” has been updated to include:

  — explanation to determine the product profile;

  — separate tables introduced tables (one table per performance) to avoid confusion when determining the product profile;

  — a specific codification letter is used for each performance;

  — a fourth performance level has been added to Tables 4 and 8 (elongation), Tables 5 and 9 (residual deformation);

— creation of a new Clause 7, Information provided by the coated fabric producer;

— addition of subclause A.8 “Test report”;

— Annex C has been deleted and references to this annex replaced by reference to EN 15977.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The purpose of this European Standard is to specify the characteristics, the requirements and the test methods for coated fabrics intended for temporary structure and tents.

Particular care has been taken not to come in conflict with the items that have already been treated in EN 13782. This European Standard has been drawn up according to past experience and risk analysis. The content of this European Standard collects the different existing national regulations and refers to the different European test standards available for coated fabrics.

This European Standard also introduces a system of levels. It is not possible to divide coated fabric for tents into just a few performance levels, because of the enormous variety of conditions of use. This European Standard proposes different level of performance (level F_1, F_2, F_3, for examples) for each characteristic – or T1, T2, T3, T4 for the fire behaviour. This allows choice of the appropriate level for each characteristic and thus enables the composition of a “product profile”, adapted to each specific type of use. This means, for example, that for small tents exposed to low wind and snow loads but high exposition to sun light, a mechanical resistance level F_3 may be required combined with a colour fastness level C_1.

This European Standard specifies requirements which are useful for design, calculation, manufacture, installation, maintenance, operation, examination and testing of coated fabric. The informative Annex D gives recommendations regarding the assessment of conformity of the production. The informative Annex C gives recommendations regarding the weld resistance.

1 Scope

This European Standard specifies the characteristics, requirements and test methods for coated fabric intended for mobile, temporary installed tents (see 3.3) and related structures.

Plastic film and material other than coated fabrics are not covered by this European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1875-3, *Rubber- or plastics- coated fabrics - Determination of tear strength - Part 3: Trapezoidal method*

EN 14115, *Textiles - Burning behaviour of materials for marquees, large tents and related products - Ease of ignition*

EN 15977:2011, *Rubber or plastic coated fabrics - Mechanical properties - Determination of the elongation under load and the residual deformation*

EN 20105-A02, *Textiles - Tests for colour fastness - Part A02: Grey scale for assessing change in colour (ISO 105-A02)*

EN ISO 846, *Plastics - Evaluation of the action of microorganisms (ISO 846)*

EN ISO 1421, *Rubber- or plastics-coated fabrics - Determination of tensile strength and elongation at break (ISO 1421)*

EN ISO 2286-2, *Rubber- or plastics-coated fabrics - Determination of roll characteristics - Part 2: Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate (ISO 2286-2)*

EN ISO 2411, *Rubber- or plastics-coated fabrics - Determination of coating adhesion (ISO 2411)*

EN ISO 4892-3, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3)*

EN ISO 11925-2, *Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2)*

ISO 1420, *Rubber- or plastics-coated fabrics - Determination of resistance to penetration by water*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
initial approval
design and calculation review, verification, examinations and tests executed before granting a permit for tent operation

3.2
membrane joint
junction of two coated fabric membrane surfaces executed by a sewn, welded, glued or clamped connection

3.3
tent
mobile, temporary installed structure enclosure or open building, excluding camping tents

EXAMPLE Marquee, hangar, tent-hall, booth.

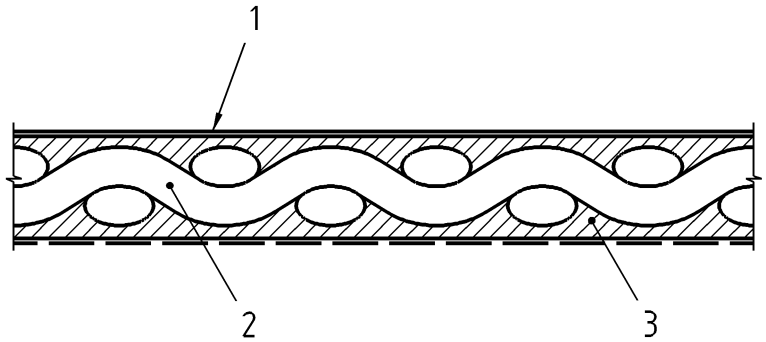
3.4
surface top coating
additional protection of the surface of coated fabric against soiling and discolouration

3.5
product family
total range of products within specific variability limits (defined by the coated fabric producer or a technical specification) of the product parameters and, if appropriate, of the final use parameters for which the specified characteristics do not change (do not deteriorate)

Note 1 to entry: The test results obtained from any one product within the family are valid for all other products within the family.

4 General description of coated fabrics intended for tents

The yarns are in most cases woven into fabrics (some could be based on warp-knitted fabrics[1)] . Coatings on one or both sides guarantee the integrity, contribute to the protection of the fabric against mechanical damage, atmospheric influence, and also against damage caused by animals, plant, and chemical agents. Coatings may be covered by a top coating providing additional protection of the surface against soiling and discoloration.



Key
1 top coating
2 fabric
3 coating

Figure 1 — Schema of a cross section of a woven fabric coated on both sides

1) In the cases of warp-knitted fabrics, the requirements of the Tables 1 to10 remain identical, "warp" meaning the warp direction and "weft" meaning the course direction.

5 Characteristics relating to coated fabrics

5.1 Mass per unit area

The mass per unit area of the coated fabric shall be measured in accordance with EN ISO 2286-2.

5.2 Tensile mechanical behaviour

Tensile strength shall be measured according to method 1 of EN ISO 1421. Tensile properties measured by means of EN ISO 1421 monoaxial tensile test in warp and weft direction are most of the time sufficient for design.

5.3 Tear strength

In order to assess the risk of propagation of a tear due to lack of quality of the coated fabric or to an accident, the tear strength performances of a coated fabric shall be measured according to EN 1875-3.

5.4 Coating adhesion

The adhesion between the base fabric and the coating layer of the membrane material shall be assumed by coating adhesion tests according to Annex B.

5.5 Dimensional stability

During its life, the tent membrane made up of coated fabric is submitted to many environmental loads (wind, snow, rain) and many mounting and dismantling of the structure. In order to limit any dimensional change of the membrane panels during the life of the tent, the fabric shall be dimensionally stable. The dimensional stability of the fabric shall be measured in both directions according to EN 15977.

For tents exposed to elevated temperatures during their use, an optional test is proposed according to EN 15977:2011 including a heat exposure (Clause 7) before mechanical loading.

5.6 Colour fastness to weathering and light

The samples are exposed according to Annex A. Colour fastness is assessed by comparison with the grey scale and the specimens exposed for 2 000 h to artificial ageing and the non-exposed specimens. The ageing procedure detailed in Annex A is based on EN ISO 4892-3 exposure mode 1 (UV, moisture cycle, and elevated temperature) that simulate the outdoor natural ageing.

5.7 Susceptibility to the development of microorganisms

In some climatic and environmental conditions, microorganisms may fix and develop on the surface of the coating. Their presence may damage the coating layer itself (discoloration, degradation of plastic coating) and may also hinder the use of the coated fabric membrane. The coated fabric producer shall ensure that the coated fabric is treated with adapted treatment or sufficiently resistant. This property shall be tested according to EN ISO 846.

5.8 Appearance

Inspection of the appearance of membrane is important not only from an aesthetic point of view, but also from the aspect of examining for the presence of defects causing structural problems and of obstructions during usage. Appearance can be inspected visually or by microscopy.

The possible inspection items are:

a) thickness of protective coating on the surface of yarns;

b) defects on yarns and their arrangement;

c) cracking of the coating and adherence of dirt, stains and foreign matter;

d) other defects which may cause obstruction in usage.

Inspection of those items may be carried out according to sampling plans of a single lot of membrane material. Judgement criteria for the inspection items are determined in accordance with the usage and grade of membrane materials.

Due to subjective approach and lack of standardized method, there is no requirement about this item described in Clause 6.

5.9 Reaction to fire

5.9.1 General

In order to protect peoples against the risk of full development of fire, the coated fabrics used for tent or related structures shall have an appropriate reaction to fire behaviour. For this purpose, the coated fabrics shall be tested according to EN 14115.

The coated fabrics used for tent covering, walls, textile decorations and related applications inside tents shall be classified in accordance with the following classification system.

Materials shall be classified in four categories T1, T2, T3, or T4 (5.9.2 to 5.9.5) or declared “Non classified” (5.9.6).

As an alternative, coated fabrics intended for mobile, temporary installed tents (see 3.3) and related structures can also be tested according to EN ISO 11925-2 and EN 13823, and classified according to EN 13501-1 (B, C, D or E).

WARNING — It should be borne in mind that there is no validated correlation between the “T classification”, according to the present document, and the “Euroclass”, according to EN 13501-1**.**

5.9.2 Level T1

During the test, afterflame times shall not exceed 5 s in any of the specimens tested. Any glowing propagation effect shall not exceed 25 cm from the lower edge of the specimen. If there is any fall of droplets or particles which continue to burn after being in contact with the floor of the apparatus, the material is classified T4. If burning droplets or particles do not burn after being in contact with the floor, they are not taken into account.

Material with a duration of flaming not exceeding 5 s and that opens and does not allow any contact with the pilot flame, shall be subjected and pass the complementary test according to EN ISO 11925-2 with the following testing parameters:

— flame application: on the surface and at the bottom edge;

— time of the flame application: 30 s;

— requirement: the top of the flame shall not reach 150 mm from the application point of the flame before 60 s. In case of failure, the material shall be declared “Non classified”.

5.9.3 Level T2

The material is classified T2 if the following conditions are fulfilled:

— the material is not classified T1;

— the average value of the maximum length of the destroyed area from the lower edge of the test specimen is lower than 350 mm.

If there is any fall of droplets or particles which continue to burn after being in contact with the floor of the apparatus, the material is classified T4. If burning droplets or particles do not burn after being in contact with the floor, they are not taken into account.

5.9.4 Level T3

The material is classified T3 if following conditions are fulfilled:

— the material is classified neither T1 nor T2;

— the average value of the maximum length of the destroyed area from the lower edge of the test specimen is higher than 350 mm and lower than 600 mm;

— the average value of the maximum width of the destroyed area, covering that part of the test specimen between 450 mm and 600 mm from its lower edge, is lower than 90 mm.

If there is any fall of droplets or particles which continue to burn after being in contact with the floor of the apparatus, the material is classified T4. If burning droplets or particles do not burn after being in contact with the floor, they are not taken into account.

5.9.5 Level T4

A material is classified T4 when it meet the requirements of level T1, T2, or T3 but falls of droplets or particles which continue to burn after being in contact with the floor of the apparatus are observed during the test.

5.9.6 Non classified materials

If material does not meet the requirements of T1, T2, T3 or T4 level, this material is declared “Non classified” (N.C.).

6 Requirements

This European Standard proposes different levels of performance (level F_1, F_2, F_3, for example) for each characteristic. This allows choice of the appropriate level for each characteristic and thus enables the composition of a “product profile”, adapted to each specific type of use. This means that low mechanical resistance may be combined with, e.g. high colour fastness.

When relevant, the levels shall be declared independently for both warp and weft (in this order). This means, for example:

— that the tensile strength (F) of a product may be F1/F1 or F1/F3;

— the tear strength (R) of the same product may be R1/R2 or R2/R3.

NOTE A product classified F1 in warp and F2 in weft cannot be declared F1 and is declared F1/F2.

To ensure safe and durable performance, each characteristic of the tent covering membranes made up of coated fabric shall comply with the value and class declared by the coated fabric producer accordance with the requirements of Table 1 to Table 7, as well as with the requirements of 5.9 regarding the fire behaviour and, if required, Table 8 to Table 10.

Table 1 — Tensile strength requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements			Units
			level F_1	level F_2	level F_3	
1	Tensile strength at break Warp - before ageing	EN ISO 1421, method 1	≥ 280	≥ 220	≥ 180	daN / 5cm
	Tensile strength at break Weft - before ageing	EN ISO 1421, method 1	≥ 280	≥ 220	≥ 180	daN / 5cm
	Tensile strength at break (warp/weft) after ageing	Annex A + EN ISO 1421, method 1	> 70 % of the initial declared value in both warp and weft			daN / 5cm

Table 2 — Tear strength requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements			Units
			level R_1	level R_2	level R_3	
2	Tear strength Warp	EN 1875-3	≥ 15	≥ 12	≥ 10	daN
	Tear strength Weft	EN 1875-3	≥ 15	≥ 12	≥ 10	daN

Table 3 — Coating adhesion requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements			Units
			level A_1	level A_2	level A_3	
3	Coating adhesion Warp	EN ISO 2411 or Annex B	≥ 10	≥ 9	≥ 8	daN / 5cm
	Coating adhesion Weft	EN ISO 2411 or Annex B	≥ 10	≥ 9	≥ 8	daN / 5cm

Table 4 — Elongation requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements				Units
			level E_1	level E_2	level E_3	level E_4	
4	Elongation under load Warp	EN 15977	≤ 1	≤ 2	≤ 3	≤ 4	%
	Elongation under load Weft	EN 15977	≤ 1	≤ 2	≤ 3	≤ 4	%

Table 5 —Residual deformation requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements				Units
			level D_1	level D_2	level D_3	level D_4	
5	Residual deformation after loading (Warp)	EN 15977	≤ 0,4	≤ 0,8	≤ 1,2	≤ 1,5	%
	Residual deformation after loading (Weft)	EN 15977	≤ 0,4	≤ 0,8	≤ 1,2	≤ 1,5	%
NOTE The requirements are based on the absolute value of the residual deformation.							

Table 6 — Colour fastness requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements			Units
			level C_1	level C_2	level C_3	
6	Colour fastness to weathering and light	Annex A and scale (EN 20105-A02)	≥ 4	≥ 3	≥ 2	grey scale

Table 7 — Microorganism development requirements for coated fabrics intended for tents and related structures

	Characteristics	Test method	Requirements			Units
			level M_1	level M_2	level M_3	
7	Susceptibility to the development of microorganisms	EN ISO 846	Method A: 1	Method A: 2	Method A: 3	–

Table 8 — Optional properties - Elongation under load after heat exposure

	Characteristics	Test method	Requirements				Units
			level Eh_1	level Eh_2	level Eh_3	level Eh_4	
8	Elongation under load after heat exposure Warp	EN 15977:2011 including Clause 7	≤ 1	≤ 2	≤ 3	≤ 4	%
	Elongation under load after heat exposure Weft	EN 15977:2011 including Clause 7	≤ 1	≤ 2	≤ 3	≤ 4	%

Table 9 — Optional properties - Residual deformation after heat exposure and load

	Characteristics	Test method	Requirements				Units
			level Dh_1	level Dh_2	level Dh_3	level Dh_4	
9	Residual deformation after heat exposure and load (Warp)	EN 15977:2011 including Clause 7	≤ 0,4	≤ 0,8	≤ 1,2	≤ 1,5	%
	Residual deformation after heat exposure and load (Weft)	EN 15977:2011 including Clause 7	≤ 0,4	≤ 0,8	≤ 1,2	≤ 1,5	%
NOTE The requirements are based on the absolute value of the residual deformation.							

Table 10 — Optional properties – Water penetration

	Characteristics	Test method	Requirements			Units
			level W_1	level W_2	level W_3	
10	Water penetration	ISO 1420	≥ 60	≥ 40	≥ 20	kPa

NOTE In the design of the tent membrane, static and dynamic mechanical actions (pre-stressing, snow load and wind load), ageing and environmental influences are taken into account and a safety margin, applied to ensure safe use of the membrane is covered by EN 13782.

All the samples, provided from new production, submitted to tests shall have an area wide enough for tests, and shall be taken from a part 100 cm or more from the end of the fabric roll in the longitudinal direction and 20 cm or more from the selvage.

7 Information provided by the coated fabric producer

If the information, related to the product profile refers to the levels related to T, F, R, A, E, D, C, M, Eh, Dh or W, this information shall include the reference to this European Standard.

Annex A
(normative)

Artificial ageing by long term exposure to the combination of UV irradiation, elevated temperature and water

A.1 General

This annex specifies the method for exposure of factory-made coated fabrics intended for tents to combined effects of long term outdoor exposure. The samples are exposed to the most aggressive components of weathering: ultraviolet radiation, moisture and heat.

A.2 Exposition programme

The samples shall be exposed continuously during (250 ± 6) cycles (representing around 2 000 h) according to “exposition mode 1” of EN ISO 4892-3 corresponding to an exposure cycle having a duration of 8 h (480 min).

A.3 UV cycle

The UV source shall be an array of fluorescent UV lamps of type I (UV-A 340 nm) which are characterized by a maximum emission in the UV range and particularly adapted to simulate sunlight UV radiation between 300 nm and 340 nm as indicated in EN ISO 4892-3.

The mean UV irradiance in the plane of the specimen surfaces shall be (45 ± 5) W/m^2 in the wavelength range $\lambda \geq 300$ nm. For typical spectral irradiance see EN ISO 4892-3. The irradiance at the test specimen surface shall not vary more than 10 % in relation to any two points in the specimen holder plane.

The rate of photochemical reactions is temperature dependent. It is important to match the temperature with the maximum temperature experienced by the material in direct sunlight, i.e. (60 ± 3) °C and to control it.

A.4 Moisture cycle

Outdoors materials are frequently wet up to 12 h each day. Research indicates that the main cause of this outdoor wetness is dew, not rain. The test chamber shall simulate this by a water reservoir in the bottom of the test chamber that is heated during the condensation cycle to produce vapour. The hot vapour maintains the chamber at 100 % relative humidity during the condensation cycle and at an elevated temperature (independent of the UV cycle temperature). As the severity of the attack depends on the temperature, this later shall be controlled at (50 ± 3) °C. The reverse side of the specimens shall be exposed to ambient room air that causes the test surface to drop a few degrees below the vapour temperature. This allows condensation of pure distilled water to occur on the exposed face of the test specimens.

A.5 Preparation of specimens

Test specimens of sufficient size according to the follow-up test to be performed shall be cut from the test sample. The direction (warp or weft) shall be indicated on the specimens.

A.6 Procedure

The test specimen and the black standard thermometer shall be mounted in the specimen holders with their exposed sides facing the lamps. The specimens are inclined at an angle of (15 ± 1)° from the vertical with the upper face exposed to UV. The test specimen rack shall allow the specimens to lie flat in the plane and to be mounted so that the exposed face is in the plane of uniform irradiation. The attachment of the specimen on the stainless steel plates shall leave an area open to free irradiation so that the subsequent tests can be performed on the irradiated part of the specimen. The samples intended to tensile strength test shall be exposed to the UV radiation on the whole width of the specimens (strips).

A.7 Measurements after ageing

The resistance to this exposure is determined by follow up tests described in this document.

The colour fastness shall be tested on all the colours available. Each exposed specimen shall be compared to the unexposed control sample. The visual colour changes shall be observed, compared in the grey scale, according to EN 20105-A02, and conform to the requirements of Table 6.

The mean tensile strength at break is measured on exposed samples in warp and weft direction according to EN ISO 1421 method 1 and compared to the unexposed samples. The product shall meet the requirements of Table 1.

A.8 Test report

The test report shall include the following information:

a) reference to Annex A of this European Standard;

b) colour fastness results;

c) tensile test results:

1) tensile strength at break before and after ageing;

2) percentage of tensile strength after ageing based on the initial declared value in both warp and weft.

Annex B
(normative)

Coating adhesion

B.1 General

This method has been developed to adapt the preparation of test specimens to EN ISO 2411.

The test specimens shall be prepared and welded either by the coated fabric producer or by the manufacturer of the tent.

B.2 Preparation of the test specimens

Cut two strips (strip 1 and strip 2) of at least 400 mm long and 60 mm wide. Both strips shall be oriented in the same direction (warp or weft). Both sides of the specimen shall precisely follow the direction of the yarns. For this purpose, some yarn shall be removed on one side of the sample in order to visualize the yarn direction before to cut the strips.

The two strips are overlapped and welded as indicated in Figure B.1 with the front face of the strip 1 in contact with the back face of strip 2, i.e. different faces shall be in contact. Make sure that the specimens are precisely oriented in the same direction before welding.

B.3 Welding

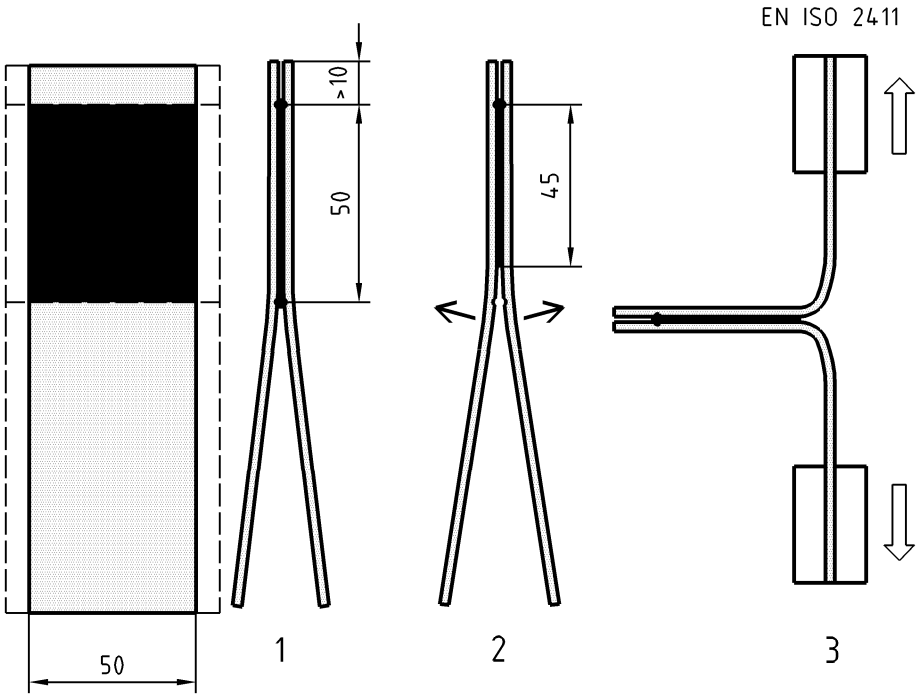
It was found possible to weld by HF (High Frequency) technology. The HF welding regulating parameter shall be adapted to the product. HF welding shall not influence the adhesion force.

The width of welded strips shall be reduced from 60 mm to (50 ± 1) mm. Each side of the strip shall precisely follow the direction of the yarns.

B.4 Testing

The welded zone is manually opened 5 mm long as indicated in Figure B.1 in order to prevent the edge effect due to accumulation of coating at the end of the welding zone.

Dimensions in millimetres



Key:

1 step of the preparation of the welding test specimen

2 step of the manual separation

3 step of the separation in the device

Figure B.1 — Coating adhesion – main steps of the testing preparation

Tensile tests are performed at 100 mm/min according to EN ISO 2411 on 5 specimens welded in the warp direction and 5 specimens welded in the weft direction. The values of coating adhesion declared in both warp and weft directions are the average of the 5 individual values.

B.5 Test report

The test report shall be written according to EN ISO 2411.

The welding condition (type of machine/technology and regulating parameters) shall be indicated in the test report.

Annex C
(informative)

Weld resistance recommendation

C.1 General

This annex describes the resistance of the most practiced assembling mode: welding. However, it is possible to perform the test in the same way on another mode of assembly representative of the end-used tent membrane.

C.2 Weld resistance

The weld resistance should be measured in accordance with EN ISO 1421.

The test specimens should be prepared either by the coated fabric producer or by the manufacturer of the tent.

The welded seam consists of a double-layer membrane strip which is produced by overlap of the edge zones of two coated fabrics. By means of warming up the membrane strip, the coatings of both coated fabrics are connected with each other. Consequently, the load transmission from one coated fabric to the other is as follows: fabric (1) → coating (1) → coating (2) → fabric (2). The controlling factor for a properly welded connection is the adhesion between coating and fabric as well as the quality of the welding itself. The sophisticated welding techniques are undertaken in various forms: high frequency welding, hot gas welding, heating element welding.

Table C.1 — Weld resistance recommendation

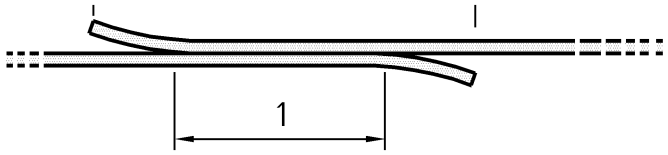
Characteristics	Test method	Recommendation
Weld resistance	EN ISO 1421	At 20 °C: > 70 % of the tensile strength at break At 70 °C: > 40 % of the tensile strength at break

The width of the tested weld should be representative of the end-used membrane. If the weld passes the recommendation of Table C.1, it is assumed that it is also valid for welds of higher width.

C.3 Preparation of test specimens and test procedure

Cut two strips (strip 1 and strip 2) of dimension 200 mm x 55 mm both in the same (warp or weft) direction. Overlap the ends of both strips. The overlapped zone should be at least 70 mm long with the front face of the strip 1 in contact with the back face of strip 2. Both strips should be precisely oriented in the same direction.

The weld is centred in the recovering zone as described in Figure C.1. The width of the welded strips is reduced from 55 mm to (50 ± 1) mm by removing some yarns on both sides.



Key

1 weld width

Figure C.1 — Welding resistance

Tensile tests are performed according to EN ISO 1421 on 5 samples welded in warp direction and 5 samples welded in weft direction. The values of weld resistance declared in both warp and weft are the average of the 5 individual values.

C.4 Test report

The test report should include the following information:

a) a reference to this European Standard;

b) the date of the test;

c) the identification of the product under test;

d) the welding condition (type of machine/technology and regulating parameters);

e) the result of the test;

f) detailed description of the assembling (width of the weld, etc.).

Annex D
(informative)

Assessment of conformity

D.1 General

The conformity of the coated fabric, connections and attachment system to the requirements of this European Standard or to the declared values (including classes) should be demonstrated by:

— initial type tests;

— factory production control carried out by the coated fabric producer, including product verification.

For the tests, the coated fabrics may be grouped by family (see Clause 3) if it is considered that the selected characteristic is common to all the coated fabrics belonging to this family.

If the tests and product verifications have been carried out by the producer of the coated fabric, the producer of tent membrane made up of this coated fabric should not necessarily repeat the tests except for the assessment of the welds and connections resistances.

The coated fabric producer is responsible for the weldability of the coated fabric whereas the manufacturer of the tent membrane made up of assembled coated fabrics is responsible for the quality and resistance of welds and other type of membrane joints.

D.2 Type tests

D.2.1 Initial type tests

The initial type tests should be carried out to demonstrate conformity to this European Standard. Tests carried out beforehand in conformity to the requirements of this standard (same product, same characteristic(s), test method, sampling, attestation of conformity system, etc.) may be taken into account. In addition, the initial type tests should be carried out at the beginning of production of any new product type or at the beginning of a new production method.

D.2.2 Supplementary type tests

If there is a change in the product, raw material or the supplier of one of the components or the manufacturing process, that would significantly modify one or more characteristics, the initial type tests should be repeated for the appropriate characteristic(s).

The results of all the type tests should be recorded and kept by the coated fabric producer for at least 5 years.

D.3 Factory production control

D.3.1 General

Factory production control (FPC) is the permanent internal control of production carried out by the coated fabric producer. FPC should be based on:

— control of the raw materials;

— control of the procedures;

— the calibration plan;

— testing of the finished products;

— traceability.

All the elements, requirements and provisions adopted by the coated fabric producer should be documented systematically in the form of written policies and procedures. This documentation of the production control system should ensure a common understanding of the quality assurance and enable the required characteristics of the product to be obtained and the efficient functioning of the production control system to be verified.

A coated fabric producer applying the relevant part of the EN ISO 9000 series covering the products in question is regarded as meeting the requirements of the FPC.

D.3.2 Control of the raw materials

The coated fabric producer should ensure that the raw materials and constituent elements conform to the specified requirements.

D.3.3 Control of the procedure

In order to manufacture products in conformity to this European Standard, the coated fabric producer should verify the procedure used and carry out an inspection and tests as described in the documentation of the production control system.

D.3.4 Calibration plan

The test equipment should be calibrated as a function of standardized equipment or materials that can be linked to relevant reference standards in conformity to a calibration plan. The appropriate calibrations should be carried out on testing and measuring equipment used for the production control. The minimum calibration intervals should be specified in the coated fabric producer's instruction manual.

D.4 Testing of the finished products

D.4.1 Direct testing

The coated fabric producer should regularly subject the finished products to tests. The tests should be carried out in accordance with the standardized test method specified in this standard or, in the case of indirect testing, as specified below.

The verifications and tests should be carried out on finished products at a frequency that should be indicated in the documentation of the production control system and be suitable for the product and its conditions of manufacture.

If test results are used to assess conformity to the requirements of this European Standard, all these test results (direct and indirect) should be within the limits fixed by the coated fabric producer for each test.

Requirement on mass: ± 5 % tolerance of the declared value.

D.4.2 Indirect evaluation

The tests should normally be carried out according to the test method indicated in this European Standard. However, indirect evaluation is authorized. Indirect evaluation is defined as verification of a specified property X by means of another property Y, if the relationship between these two properties for the product in question is known and may be proven.

For each indirect test procedure applied at a production site, the sampling plan and conformity criteria for the indirect property should be specified, taking into account the relevant relationship between the corresponding properties.

D.5 Inspection and testing

Conformity and non-conformity of the product on the basis of the inspections and tests carried out should be clearly indicated.

All the results of the inspection, calibration and testing should be recorded with:

— a description of the product;

— the date of manufacture;

— the test method;

— the test result;

— the signature of the inspector.

If the products do not conform to the requirements of this European Standard, the necessary corrective actions should be taken. The non-conforming products or lots should be isolated and correctly identified. Once the defect has been corrected, the test or verification in question should be repeated.

The coated fabric producer 's record should be kept for five years.

D.6 Traceability

It is the responsibility of the coated fabric producer or his agent to keep full records of the individual products or product lots, comprising manufacturing details and characteristics, and to keep the records of the people to whom these products or lots have been sold initially.

D.7 Marking

Marking shall include any information identifying the producer and the product.

Bibliography

[1] EN 12280-1, *Rubber- or plastics- coated fabrics - Accelerated ageing tests - Part 1: Heat ageing*

[2] EN 13501-1, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*

[3] EN 13782, *Temporary structures - Tents - Safety*

[4] EN 13823, *Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item*

[5] EN ISO 2231, *Rubber- or plastics-coated fabrics - Standard atmospheres for conditioning and testing (ISO 2231)*

[6] EN ISO 9000, *Quality management systems - Fundamentals and vocabulary (ISO 9000)*

[7] DIN 18204-1:2004, *Components for enclosures made of textile fabrics and plastic films (awnings) for structures and tents - Part 1: PVC coated polyester base fabric*

[8] UNI 10949:2001, *Safety of equipment for fairgrounds and amusement parks - Tents, temporary and/or itinerant fabric structure - Design, construction, installation and maintenance*

[9] *Membranskonstruktionen – Verbindungstechniken*, edition 1997, Published and printed in Germany by Druckerei Wehlmann GmbH, Essen, ISBN 3-9805790-7-7

[10] *Test methods for membrane materials (coated fabrics) – Qualities and performances* – MSAJ/M-03:2003 - Standards of the Membrane Structures, Association of Japan

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™