

Combined flexible materials for electrical insulation —

Part 3: Specifications for individual materials

The European Standard EN 60626-3:1996 with the incorporation of amendment A1:1999 has the status of a British Standard

ICS 29.035.01

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- Adhesive Tape Manufacturers Association
- British Capacitor Manufacturers Association (BEAMA Ltd.)
- British Industrial Ceramic Manufacturers Association
- British Plastics Federation
- ERA Technology Ltd.
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Federation of the Electronics Industry
- Transmission and Distribution Association (BEAMA Ltd.)

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National foreword

This part of BS EN 60626 has been prepared by Subcommittee GEL/15/3, and is the English language version of EN 60626-3:1996, *Combined flexible materials for electrical insulation Part 3: Specifications for individual materials*, including amendment A1:1999, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 60626-3:1996, including corrigendum March 1999 and amendment 1:1999, published by the International Electrotechnical Commission (IEC).

Amendment 1: 1999 to IEC 60626:1996 added the following new data sheets: 340, 350, 351, 360, 400, 401, 402, 403, 410, 411, 420, 421. Corrections made by IEC corrigendum March 1999 are indicated by a sideline.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index” or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 36, an inside back cover and a back cover.

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English version

Combined flexible materials for electrical insulation — Part 3: Specifications for individual materials

(includes amendment A1:1999)
(IEC 60626-3:1996 + A1:1999)

Matériaux combinés souples destinés
à l'isolement électrique —
Partie 3: Spécifications pour matériaux
particuliers
(inclut l'amendement A1:1999)
(CEI 60626-3:1996 + A1:1999)

Flexible Mehrschichtisolierstoffe
zur elektrischen Isolation —
Teil 3: Bestimmung für einzelne
Materialien
(enthält Änderung A1:1999)
(IEC 60626-3:1996 + A1:1999)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 15C/609/FDIS, future edition 2 of IEC 626-3, prepared by SC 15C, Specifications, of IEC TC 15, Insulating materials, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60626-3 on 1996-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-08-01

Annexes designated “normative” are part of the body of the standard. In this standard, annex ZA is normative.

Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document 15C/1037/FDIS, future amendment 1 to IEC 60626-3, prepared by SC 15C, Specifications, of IEC TC 15, Insulating materials, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60626-3:1996 on 1999-08-01.

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2002-08-01

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Introduction

This International Standard is one of a series which deals with combined flexible materials. The series consists of three parts:

- *part 1: Definitions and general requirements (IEC 626-1);*
- *part 2: Methods of test (IEC 626-2);*
- *part 3: Specifications for individual materials (IEC 626-3).*

This standard contains 31 of the sheets comprising part 3, as follows:

Sheets: 100, 101, 102, 110, 111, 112, 113, 114, 115, 302, 303, 312, 313, 315, 320, 330, 340, 350, 351, 360, 400, 401, 402, 403, 410, 411, 420, 421, 502, 503, 505.

1 Scope

This part of IEC 626 specifies dimensional and performance requirements for individual combined flexible materials. This part is in the form of groups of sheets. Sheets are numbered in accordance with Table 1, which provides a complete list of all the specification sheets belonging to this standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 626. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 626 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards. In the event of dispute, the referenced editions shall be used.

IEC 554-1:1977, *Specification for cellulosic papers for electrical purposes — Part 1: Definitions and general requirements.*

IEC 554-3, *Specification for cellulosic papers for electrical purposes — Part 3: Specifications for individual materials.*

IEC 626-1:1995, *Combined flexible materials for electrical insulation — Part 1: Definitions and general requirements.*

IEC 626-2:1995, *Combined flexible materials for electrical insulation — Part 2: Methods of test.*

IEC 641-1:1979, *Specification for pressboard and presspaper for electrical purposes — Part 1: Definitions and general requirements.*

IEC 641-3, *Specification for pressboard and presspaper for electrical purposes — Part 3: Specifications for individual materials.*

IEC 674-1:1980, *Specification for plastic films for electrical purposes — Part 1: Definitions and general requirements.*

IEC 674-3, *Specification for plastic films for electrical purposes — Part 3: Specifications for individual materials.*

IEC 819-1:1995, *Non-cellulosic papers for electrical purposes — Part 1: Definitions and general requirements.*

IEC 819-3, *Specification for non-cellulosic papers for electrical purposes — Part 3: Specifications for individual materials.*

3 Requirements

In addition to complying with the general requirements of IEC 626-1, each flexible combined laminate shall conform to the requirements set forth in the appropriate sheet corresponding to its type, as shown in the sheets of this standard.

4 Designation

Table 1 lists material designations and constructions appropriate to each sheet. Material conforming to this specification shall be identified by a designation containing the IEC standard number, the material designation from IEC 626-1 and the nominal thickness. For example:

IEC 626-3, Sheet 112, P-C/F-PET/P-C, 0,15 mm

5 Thermal classification

Performance experience provides information about the thermal capability of combined flexible materials in electrical insulation systems. This information is given in each individual sheet. Thermal classification information on these sheets is not to be considered as a requirement.

6 Specification sheets

Table 1 — Master listing for IEC 626-3 sheet identification

Sheet No.	Flexible laminate composition
100 to 149	Paper or presspaper containing sulphate woodpulp fibres
100 to 109	Duplex with PET film
110 to 119	Triplex with PET film
120 to 149	Others
150 to 199	Paper or presspaper containing cotton fibres
150 to 159	Duplex with PET film
160 to 169	Triplex with PET film
170 to 199	Others
200 to 249	Paper or presspaper containing both cotton and woodpulp fibres
200 to 209	Duplex with PET film
210 to 219	Triplex with PET film
220 to 249	Others
250 to 299	Paper or presspaper containing other cellulosic fibres or mixtures of cellulosic and non-cellulosic fibres
300 to 399	Wet-laid paper containing organic non-cellulosic fibres
300 to 309	Duplex calendered aramid with PET film
310 to 319	Triplex calendered aramid with PET film
320 to 329	Triplex uncalendered aramid with PET film
330 to 339	Triplex calendered aramid with PI film
340 to 349	Duplex hybrid organic-inorganic with PET film
350 to 359	Triplex hybrid organic-inorganic with PET film
360 to 369	Triplex hybrid organic-inorganic with filled glass paper
370 to 399	Others
400 to 499	Wet-laid paper containing inorganic fibres
400 to 459	Glass
460 to 499	Others
500 to 599	Dry-laid non-woven containing organic fibres
500 to 519	100 % PET-based fibres
520 to 539	100 % aramid-based fibres
540 to 599	Others
600 to 999	Other constructions
NOTE Not all the specification sheets listed in this table are yet available.	

The specification sheets available are given below.

Sheet 100

Requirements for combined flexible duplex materials of two layers — F-PET/P-C (23 µm PET film with presspaper or paper)

1 Description

This sheet gives the requirements for duplex materials consisting of paper or presspaper containing sulphate woodpulp fibres (P-C) laminated on a polyethylene terephthalate film (F-PET) having a nominal thickness of 23 µm.

2 Thermal classification

Experience has shown that the combined flexible materials listed in this sheet may be suitable for use in electrical apparatus with ratings up to and including the range of 120 °C to 130 °C.

3 Single-layer requirements

Use paper which meets the requirements for classes 1.1, 1.2, 1.3 or 1.4 of IEC 554-1 and IEC 554-3. Alternatively, use presspaper which meets the requirements for P2 or P4 of IEC 641-1 and IEC 641-3. Each of these presspapers or papers can have a different density, which will affect the nominal grammage of the laminate.

Use a PET film which has a nominal thickness of 23 µm and meets the requirements of IEC 674-1 and IEC 674-3.

4 Breakdown voltage requirements

For all laminates listed in clause 5, the minimum electric breakdown voltage using 6 mm diameter electrodes is:

- for unfolded specimens: 6 kV;
- for folded specimens: 5 kV.

However, in accordance with IEC 626-2, a minimum electric breakdown voltage on folded specimens is not required for laminates of nominal thickness greater than 0,5 mm.

5 Additional requirements

Additional requirements are given in the table below:

Property	Clause in IEC 626-2	Units Tolerance	
Laminate nominal thickness	2	mm	0,10 0,13 0,15 0,18 0,20 0,30 0,35 0,40 0,45 0,50 0,60
Laminate thickness tolerance	2	± %	15 15 15 15 15 15 10 10 10 10 10
Laminate nominal grammage	3	g/m ² ± 12 %	115 155 190 215 250 300 370 430 490 610 730
Unfolded tensile strength	4	N/10 mm min. MD CMD	90 100 135 150 180 220 270 300 360 450 540 60 70 90 100 120 140 180 200 240 300 360
Folded tensile strength, film inside	4	N/10 mm min. MD CMD	70 80 100 110 140 170 210 240 280 350 420 40 50 60 70 80 100 120 140 160 200 240
Elongation, unfolded	4	% min. MD CMD	3 3 3 3 5 5 5 5 5 5 5 10 10 10 10 13 13 13 13 13 13 13
NOTES MD = machine direction CMD = cross machine direction min. = minimum			

Sheet 101

Requirements for combined flexible duplex materials of two layers — F-PET/P-C (36 µm PET film with presspaper or paper)

1 Description

This sheet gives the requirements for duplex materials consisting of paper or presspaper containing sulphate woodpulp fibres (P-C) laminated on a polyethylene terephthalate film (F-PET) having a nominal thickness of 36 µm.

2 Thermal classification

Experience has shown that the combined flexible materials listed in this sheet may be suitable for use in electrical apparatus with ratings up to and including the range of 120 °C to 130 °C.

3 Single-layer requirements

Use paper which meets the requirements for classes 1.1, 1.2, 1.3, or 1.4 of IEC 554-1 and IEC 554-3. Alternatively, use presspaper which meets the requirements for P2 or P4 of IEC 641-1 and IEC 641-3. Each of these presspapers or papers can have a different density, which will affect the nominal grammage of the laminate.

Use a PET film which has a nominal thickness of 36 µm and meets the requirements of IEC 674-1 and IEC 674-3.

4 Breakdown voltage requirements

For all laminates listed in clause 5, the minimum electric breakdown voltage using 6 mm diameter electrodes is:

- for unfolded specimens: 7 kV;
- for folded specimens: 6 kV.

However, in accordance with IEC 626-2, a minimum electric breakdown voltage on folded specimens is not required for laminates of nominal thickness greater than 0,5 mm.

5 Additional requirements

Additional requirements are given in the table below.

Property	Clause in IEC 626-2	Units Tolerance												
Laminate nominal thickness	2	mm	0,10	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,60		
Laminate thickness tolerance	2	± %	15	15	15	15	10	10	10	10	10	10		
Laminate nominal grammage	3	g/m ² ± 12 %	120	190	250	280	370	395	490	510	610	730		
Unfolded tensile strength	4	N/10 mm min. MD CMD	90 60	135 90	180 120	190 130	270 180	280 190	360 240	380 250	450 300	540 360		
Folded tensile strength, film inside	4	N/10 mm min. MD CMD	70 40	100 60	130 80	150 90	200 120	230 130	270 160	300 170	340 200	410 240		
Elongation, unfolded	4	% min. MD CMD	3 10	3 10	5 13	5 13	5 13	5 13	5 13	5 13	5 13	5 13		
NOTES MD = machine direction CMD = cross machine direction min. = minimum														

Sheet 102

Requirements for combined flexible duplex materials of two layers — F-PET/P-C (50 µm PET film with presspaper or paper)

1 Description

This sheet gives the requirements for duplex materials consisting of paper or presspaper containing sulphate woodpulp fibres (P-C) laminated on a polyethylene terephthalate film (F-PET) having a nominal thickness of 50 µm.

2 Thermal classification

Experience has shown that the combined flexible materials listed in this sheet may be suitable for use in electrical apparatus with ratings up to and including the range of 120 °C to 130 °C.

3 Single-layer requirements

Use paper which meets the requirements for classes 1.1, 1.2, 1.3, or 1.4 of IEC 554-1 and IEC 554-3. Alternatively, use presspaper which meets the requirements for P2 or P4 of IEC 641-1 and IEC 641-3. Each of these presspapers or papers can have a different density, which will affect the nominal grammage of the laminate.

Use a PET film which has a nominal thickness of 50 µm and meets the requirements of IEC 674-1 and IEC 674-3.

4 Breakdown voltage requirements

For all laminates listed in clause 5, the minimum electric breakdown voltage using 6 mm diameter electrodes is:

- for unfolded specimens: 8 kV;
- for folded specimens: 6 kV.

However, in accordance with IEC 626-2, a minimum electric breakdown voltage on folded specimens is not required for laminates of nominal thickness greater than 0,5 mm.

5 Additional requirements

Additional requirements are given in the table below.

Property	Clause in IEC 626-2	Units Tolerance										
Laminate nominal thickness	2	mm	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,60	
Laminate thickness tolerance	2	± %	15	15	15	15	10	10	10	10	10	
Laminate nominal grammage	3	g/m ² ± 12 %	190	245	305	360	420	480	535	590	700	
Unfolded tensile strength	4	N/10 mm min. MD CMD	100 80	120 90	150 95	190 105	240 120	300 150	360 180	380 190	400 200	
Folded tensile strength, film inside	4	N/10 mm min. MD CMD	70 40	80 50	95 60	130 90	180 115	230 145	275 175	300 180	320 190	
Elongation, unfolded	4	% min. MD CMD	3 10	3 10	3 10	3 10	5 13	5 13	5 13	5 13	5 13	
NOTES MD = machine direction CMD = cross machine direction min. = minimum												

Sheet 110

Requirements for combined flexible triplex materials of three layers — P-C/F-PET/P-C (23 µm PET film with presspaper or paper)

1 Description

This sheet gives the requirements for triplex materials consisting of paper or presspaper containing sulphate woodpulp fibres (P-C) laminated on both sides of a polyethylene terephthalate film (F-PET) having a nominal thickness of 23 µm.

2 Thermal classification

Experience has shown that the combined flexible materials listed in this sheet may be suitable for use in electrical apparatus with ratings up to and including the range of 120 °C to 130 °C.

3 Single-layer requirements

Use paper which meets the requirements for classes 1.1, 1.2, 1.3, or 1.4 of IEC 554-1 and IEC 554-3. Alternatively, use presspaper which meets the requirements for P2 or P4 of IEC 641-1 and IEC 641-3. Each of these presspapers or papers can have a different density, which will affect the nominal grammage of the laminate.

Use a PET film which has a nominal thickness of 23 µm and meets the requirements of IEC 674-1 and IEC 674-3.

4 Breakdown voltage requirements

For all laminates listed in clause 5, the minimum electric breakdown voltage using 6 mm diameter electrodes is:

- for unfolded specimens: 6 kV;
- for folded specimens: 5 kV.

However, in accordance with IEC 626-2, a minimum electric breakdown voltage on folded specimens is not required for laminates of nominal thickness greater than 0,5 mm.

5 Additional requirements

Additional requirements are given in the table below.

Property	Clause in IEC 626-2	Units Tolerance											
Laminate nominal thickness	2	mm	0,12	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,60	
Laminate thickness tolerance	2	± %	15	15	10	10	10	10	10	10	10	10	
Laminate nominal grammage	3	g/m ² ± 12 %	140	170	230	270	370	430	490	550	610	730	
Unfolded tensile strength	4	N/10 mm min. MD CMD	100 70	135 90	160 120	190 130	270 160	300 200	360 240	400 270	450 300	540 360	
Folded tensile strength	4	N/10 mm min. MD CMD	60 40	105 60	140 80	150 90	210 120	240 135	260 160	310 175	350 200	420 240	
Elongation, unfolded	4	% min. MD CMD	3 10	3 10	5 10	5 10	5 10	5 10	5 10	5 10	5 10	5 10	
NOTES MD = machine direction CMD = cross machine direction min. = minimum													

Sheet 111

Requirements for combined flexible triplex materials of three layers — P-C/F-PET/P-C (36 µm PET film with presspaper or paper)

1 Description

This sheet gives the requirements for triplex materials consisting of paper or presspaper containing sulphate woodpulp fibres (P-C) laminated on both sides of a polyethylene terephthalate film (F-PET) having a nominal thickness of 36 µm.

2 Thermal classification

Experience has shown that the combined flexible materials listed in this sheet may be suitable for use in electrical apparatus with ratings up to and including the range of 120 °C to 130 °C.

3 Single-layer requirements

Use paper which meets the requirements for classes 1.1, 1.2, 1.3, or 1.4 of IEC 554-1 and IEC 554-3. Alternatively, use presspaper which meets the requirements for P2 or P4 of IEC 641-1 and IEC 641-3. Each of these presspapers or papers can have a different density, which will affect the nominal grammage of the laminate.

Use a PET film which has a nominal thickness of 36 µm and meets the requirements of IEC 674-1 and IEC 674-3.

4 Breakdown voltage requirements

For all laminates listed in clause 5, the minimum electric breakdown voltage using 6 mm diameter electrodes is:

- for unfolded specimens: 7 kV;
- for folded specimens: 6 kV.

However, in accordance with IEC 626-2, a minimum electric breakdown voltage on folded specimens is not required for laminates of nominal thickness greater than 0,5 mm.

5 Additional requirements

Additional requirements are given in the table below.

Property	Clause in IEC 626-2	Units Tolerance												
Laminate nominal thickness	2	mm	0,12	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50	0,60		
Laminate thickness tolerance	2	± %	15	15	15	10	10	10	10	10	10	10		
Laminate nominal grammage	3	g/m ² ± 12 %	150	180	240	300	370	430	490	550	610	730		
Unfolded tensile strength	4	N/10 mm min. MD CMD	100 75	135 100	180 120	200 130	270 180	300 200	360 240	400 255	450 300	540 360		
Folded tensile strength	4	N/10 mm min. MD CMD	85 50	100 60	140 80	160 90	210 120	230 130	280 160	300 175	350 200	420 240		
Elongation, unfolded	4	% min. MD CMD	5 10	5 10	5 10	5 10	5 10	5 10	5 10	5 10	5 10	5 10		
NOTES MD = machine direction CMD = cross machine direction min. = minimum														