IEC 60819-3-3

Edition 3.0 2011-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Non-cellulosic papers for electrical purposes – Part 3: Specifications for individual materials – Sheet 3: Unfilled aramid (aromatic polyamide) papers

Papiers non cellulosiques pour usages électriques – Partie 3: Spécifications pour matériaux particuliers – Feuille 3: Papiers en aramide non chargé (polyamide aromatique)

IEC 60819-3-3:2011

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NON-CELLULOSIC PAPERS FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 3: Unfilled aramid (aromatic polyamide) papers

FOREWORD

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International Standard IEC 60819-3-3 has been prepared by IEC technical committee15: Solid electrical Insulating materials.

This third edition cancels and replaces the second edition published in 2006. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

– normative references change: all the requirements are now determined according the clauses of test methods from IEC 60819-2 specific for non cellulosic papers, instead of IEC 60554-2:2001 generally valid for cellulosic papers;
– some new, very thin thicknesses, of type 4, calendered paper with lower density for laminating, were added.

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

CDV	Report on voting
15/619/CDV	15/645/RVC

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

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

A list of all the parts in the IEC 60819 series, under the general title *Non-cellulosic papers for electrical purposes*, can be found on the IEC website.

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

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- withdrawn,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

INTRODUCTION

This International Standard is one of a series which deals with non-cellulosic papers for electrical purposes.

The series consists of three parts:

– Part 1: Definitions and general requirements (IEC 60819-1).
– Part 2: Methods of test (IEC 60819-2).
– Part 3: Specifications for individual materials (IEC 60819-3).

This standard is one of the sheets comprising Part 3:

Sheet 3: Unfilled aramid (aromatic polyamide) papers

NON-CELLULOSIC PAPERS FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 3: Unfilled aramid (aromatic polyamide) papers

1 Scope

This sheet of IEC 60819-3 specifies requirements for four types of unfilled aramid papers:

Type 1: calendered paper;

Type 2: calendered paper, with improved tearing resistance and conformability;

Type 3: uncalendered paper;

Type 4: calendered paper, with lower density for laminating.

Materials which conform to this specification meet established levels of performance. However, the selection of material by a user for a specific application should be based on the actual requirements necessary for adequate performance in that application and not based on this specification alone.

SAFETY WARNING: It is the responsibility of the user of the methods contained or referred to in this document to ensure that they are used in a safe manner.

2 Normative references

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

IEC 60819-1, *Non-cellulosic papers for electrical purposes – Part 1: Definitions and general requirements*

IEC 60819-2: 2001, *Non-cellulosic papers for electrical purposes – Part 2: Methods of test*

IS0 186:2002, *Paper and board – Sampling to determine average quality*

3 Requirements

Papers shall satisfy the general requirements in IEC 60819-1, and shall in addition comply with the requirements specified in Table 1 of this part. In assessing conformity with the requirements in Table 1, the sampling procedures used shall be in accordance with ISO 186. In all cases, the values given in Table 1 are the central values, with the number of test pieces to be in accordance with the reference test methods.

Table 1 – Requirements

Properties	Method (see IEC 60819-2 clause/ subclause)	Units	Requirements							
Thickness	4	µm	Nominal thickness	Permissible deviation of central value from nominal value						
				Type 1		Type 2		Type 3		Type 4	
			≤ 50 >50	± 20 % ± 15 %		± 15 %		± 25 % ± 25 %		± 20% ± 15 %	
Grammage	5	g/m^2	Nominal thickness µm	Type 1		Type 2		Type 3		Type 4	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
			38	–	–	–	–	–	–	21	30
			50	35	46	–	–	–	–	30	44
			65	–	–	–	–	–	–	41	59
			80	45	75	–	–	–	–	52	74
			100	–	–	–	–	–	–	60	90
			130	100	130	–	–	34	47	100	130
			180	150	200	150	200	54	71	–	–
			250	220	280	220	280	71	88	–	–
			300	270	340	270	340	–	–	–	–
			380	350	430	350	430	120	140	–	–
			510	490	600	–	–	–	–	–	–
			580	–	–	–	–	180	220	–	–
			610	630	750	–	–	–	–	–	–
			760	750	880	–	–	–	–	–	–
Apparent density	4 and 5	g/cm^3	Nominal thickness µm	Type 1		Type 2		Type 3		Type 4	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
			38	–	–	–	–	–	–	0,50	0,80
			50	0,64	0,88	–	–	–	–	0,55	0,85
			65	–	–	–	–	–	–	0,56	0,87
			80	0,71	0,97	–	–	–	–	0,66	0,96
			100	–	–	–	–	–	–	0,66	0,96
			130	0,79	1,02	–	–	0,28	0,38	0,74	0,99
			180	0,87	1,09	0,85	1,07	0,28	0,38	–	–
			250	0,88	1,08	0,85	1,09	0,28	0,38	–	–
			300	0,92	1,10	0,85	1,09	–	–	–	–
			380	0,93	1,13	0,85	1,09	0,28	0,38	–	–
			510	0,97	1,17	–	–	–	–	–	–
			580			–	–	0,28	0,38	–	–
			610	1,04	1,26	–	–	–	–	–	–
			760	1,00	1,25	–	–	–	–	–	–
Minimum tensile strength	7	Width N/mm	Nominal thickness µm	Type 1		Type 2		Type 3		Type 4	
				MD	CD	MD	CD	MD	CD	MD	CD
			38	–	–	–	–	–	–	2,0	1,0
			50	2,8	1,4	–	–	–	–	2,4	1,2
			65	–	–	–	–	–	–	3,0	1,5
			80	4,7	2,2	–	–	–	–	4,6	2,2
			100	–	–	–	–	–	–	6,0	3,2
			130	9,5	5,2	–	–	1,2	0,5	9,0	4,6
			180	16,0	8,5	11,0	5,5	1,8	0,9	–	–
			250	22,0	12,0	19,0	8,5	2,0	1,0	–	–
			300	30,0	17,0	24,0	11,0	–	–	–	–
			380	36,0	22,0	27,0	14,0	3,5	1,8	–	–
			510	52,0	30,0	–	–	–	–	–	–
			580	–	–	–	–	5,3	3,0	–	–
			610	63,0	36,0	–	–	–	–	–	–
			760	79,0	47,0	–	–	–	–	–	–

Table 1 *(continued)*

	Properties	Units	Requirements								
			Nominal thickness µm	Type 1		Type 2		Type 3		Type 4	
				MD	CD	MD	CD	MD	CD	MD	CD
Minimum elongation at break	7	%	38	–	–	–	–	–	–	5	3
			50	6	5	–	–	–	–	5	3
			65	–	–	–	–	–	–	5	3
			80	7	6	–	–	–	–	6	4
			100	–	–	–	–	–	–	7	4
			130	11	9	–	–	2,5	2,5	10	6
			180	13	11	7	7	2,5	2,5	–	–
			250	13	11	11	11	2,5	2,5	–	–
			300	13	12	11	11	–	–	–	–
			380	13	12	11	11	2,5	2,5	–	–
			510	13	12	–	–	–	–	–	–
			580	–	–	–	–	2,5	2,5	–	–
			610	13	12	–	–	–	–	–	–
			760	13	10	–	–	–	–	–	–
Minimum edge tearing resistance	8 [a]	N	Nominal thickness µm	Type 1		Type 2		Type 3		Type 4	
				MD	CD	MD	CD	MD	CD	MD	CD
			38	–	–	–	–	–	–	21	8
			50	48	24	–	–	–	–	34	14
			65	–	–	–	–	–	–	37	14
			80	100	44	–	–	–	–	70	30
			100	–	–	–	–	–	–	120	40
			130	200	80	–	–	20	11	180	50
			180	300	130	320	160	36	20	–	–
			250	400	160	520	280	50	27	–	–
			300	460	180	600	300	–	–	–	–
			380	480	180	800	440	90	50	–	–
			510	520	200	–	–	–	–	–	–
			580	–	–	–	–	150	90	–	–
			610	520	240	–	–	–	–	–	–
			760	640	240	–	–	–	–	–	–
Minimum electric strength	10	kV/mm	Nominal thickness µm	Type 1		Type 2		Type 3		Type 4	
			38	–		–		–		10	
			50	15		–		–		10	
			65	–		–		–		12	
			80	18		–		–		15	
			100	–		–		–		15	
			130	21		–		9		17	
			180	27		25		9		–	
			250	27		25		9		–	
			300	27		25		–		–	
			380	25		23		9		–	
			510	25		–		–		–	
			580	–		–		9		–	
			610	23		–		–		–	
			760	21		–		–		–	

Table 1 *(continued)*

Properties	Method (see IEC 60819-2 clause/ subclause)	Units	Requirements						
Maximum shrinkage on heating	9 b	%	Nominal thickness µm	Type 1		Type 2		Type 3	Type 4	
				MD	CD	MD	CD		MD	CD
			38	–	–	–	–	No requirement	4,0	2,0
			50	4,0	2,0	–	–		4,0	2,0
			65	–	–	–	–		4,0	2,0
			80	3,0	2,0	–	–		3,0	2,0
			100	–	–	–	–		3,0	2,0
			130	3,0	2,0	–	–		2,0	2,0
			180	2,0	2,0	3,0	3,0		–	–
			250	2,0	2,0	3,0	3,0		–	–
			300	2,0	2,0	3,0	3,0		–	–
			380	2,0	2,0	3,0	3,0		–	–
			510	1,5	1,5	–	–		–	–
			580	–	–	–	–		–	–
			610	1,5	1,5	–	–		–	–
			760	1,5	1,5	–	–		–	–

MD = Machine direction

CD = Cross machine direction

a The thickness of the plate, rate of loading, and the width and thickness of the test piece shall be reported.

b Three test pieces 250 mm × 250 mm to be heated in an oven at 300 °C ± 5 K for 40 min to 45 min. Pieces to be suspended vertically, with damps or light weights on bottom edge to prevent curling during heating. Condition in accordance with Clause 3 of IEC 60819-2, before and after heating, and make measurements on conditioned pieces. Calculate the percentage shrinkage in each direction and report the central values.