INTERNATIONAL STANDARD

IEC 60454-3-11

Second edition
2007-05

Pressure-sensitive adhesive tapes for electrical purposes –

Part 3: Specifications for individual materials – Sheet 11: Polyester film combinations with glass filament, creped cellulosic paper, polyester non-woven, epoxy and pressure-sensitive adhesive



Reference number
IEC 60454-3-11:2007(E)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRESSURE-SENSITIVE ADHESIVE TAPES FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 11: Polyester film combinations with glass filament, creped cellulosic paper, polyester non-woven, epoxy and pressure-sensitive adhesive

FOREWORD

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International Standard IEC 60454-3-11 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

This second edition of IEC 60454-3-11 replaces the first edition, published in 1998, as well as replacing IEC 60454-3-15 (2001), IEC 60454-3-16 (2003) and IEC 60454-3-17 (2001). It constitutes a technical revision.

IEC 60454-3-15 IEC60454-3-16 and IEC 60454-3-17 are to be withdrawn at the time of this publication.

The main changes with regard to the previous edition is the consolidation of Parts 3-11, 3-15, 3-16 and 3-17.

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

FDIS	Report on voting
15/374/FDIS	15/383/RVD

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

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

This International Standard is one of a series which deals with pressure-sensitive adhesive tapes, intended primarily for electrical purposes.

The series consists of three parts:

– Part 1: General requirements (IEC 60454-1);
– Part 2: Methods of test (IEC 60454-2);
– Part 3: Specifications for individual materials (IEC 60454-3).

This standard contains one of the sheets comprising Part 3 as follows:

Sheet 11: Polyester film combinations with glass filament, creped cellulosic paper, polyester non-woven, epoxy and pressure-sensitive adhesive.

SAFETY WARNING

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

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PRESSURE-SENSITIVE ADHESIVE TAPES FOR ELECTRICAL PURPOSES –

Part 3: Specifications for individual materials – Sheet 11: Polyester film combinations with glass filament, creped cellulosic paper, polyester non-woven, epoxy and pressure-sensitive adhesive

1 Scope

This sheet of IEC 60454-3 contains the requirements for pressure-sensitive adhesive tapes, made with combined backings based on polyester film:

- PET film/glass filament combination tapes;
- Creped cellulosic paper/PET film combination tapes;
- PET film/polyester non-woven combination tapes;
- PET film/epoxy combination tapes.

Materials which conform to this specification meet established levels of performance. However, the selection of a 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.

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 60426:1973, *Test methods for determining electrolytic corrosion with insulating materials.*

IEC 60454-1:1992, *Specifications for pressure-sensitive adhesive tapes for electrical purposes – Part 1: General requirements.*

IEC 60454-2, *Specification for pressure-sensitive adhesive tapes for electrical purposes – Part 2: Methods of test*[1]

IEC 60674-3-2:1992, *Specification for plastic films for electrical purposes – Part 3: Specifications for individual materials – Sheet 2: Requirements for balanced biaxially oriented polyethylene terephthalate (PET) films used for electrical insulation*

3 Terms and definitions

For the purposes of this document, refer to the definitions applicable to these materials in IEC 60454-1.

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1 A third edition of IEC 60454-2 is due to be published which will replace the current second edition dated 1998.

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4 Classification and designation

The products supplied according to this standard shall be classified as follows:

4.1 Polyester film/glass filament combinations with pressure-sensitive adhesive

Type 1: Products having properties characteristic of polyester film/glass filament combinations with a temperature index of 130 with a rubber thermosetting adhesive, of nominal tape thickness (0,13 – 0,19) mm and a breaking strength of 280 N/10 mm minimum.

Type 2: Products having properties characteristic of polyester film/glass filament combinations with a temperature index of 130 with a rubber thermosetting adhesive, of nominal tape thickness (0,18 – 0,25) mm and a breaking strength of 450 N/10 mm minimum.

Type 3: Products having properties characteristic of polyester film/glass filament combinations with a temperature index of 130 with an acrylic crosslinked adhesive, of nominal tape thickness (0,13 – 0,19) mm and a breaking strength of 280 N/10 mm minimum.

Type 4: Products having properties characteristic of polyester film/glass filament combinations with a temperature index of 130 with an acrylic crosslinked adhesive, of nominal tape thickness (0,18 – 0,25) mm and a breaking strength of 450 N/10 mm minimum.

Type 5: Products having properties characteristic of polyester film/glass filament combinations with a temperature index of 130 with an acrylic thermoplastic adhesive, of nominal tape thickness (0,13 – 0,19) mm and a breaking strength of 280 N/10 mm minimum.

Type 6: Products having properties characteristic of polyester film/glass filament combinations with a temperature index of 130 with an acrylic thermoplastic adhesive, of nominal tape thickness (0,18 – 0,25) mm and a breaking strength of 450 N/10 mm minimum.

The products shall be designated for ordering purposes as follows:

Type 1: IEC 60454-3-11-1/M/F-PET/G/130/R-Tc

Type 2: IEC 60454-3-11-2/M/F-PET/G/130/R-Tc

Type 3: IEC 60454-3-11-3/M/F-PET/G/130/A-Tx

Type 4: IEC 60454-3-11-4/M/F-PET/G/130/A-Tx

Type 5: IEC 60454-3-11-5/M/F-PET/G/130/A-Tp

Type 6: IEC 60454-3-11-6/M/F-PET/G/130/A-Tp

4.2 Creped cellulosic paper/polyester film combinations with thermosetting adhesive

Type 1: Products having properties characteristic of a cellulosic paper/polyester film combination with a temperature index of 120 with a rubber thermosetting adhesive.

The products shall be designated for ordering purposes as follows:

Type 1: EC 60454-3-11-1/M/P-Cc/F-PET/120/R-Tc.

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4.3 Polyester film/polyester non-woven combinations with rubber thermosetting adhesive

Type 1: Products having properties characteristic of a polyester film/polyester non-woven combination with a temperature index of 130 with a rubber thermosetting adhesive, of nominal tape thickness 0,090 mm to 0,150 mm.

Type 2: Products having properties characteristic of a polyester film/polyester non-woven combination with a temperature index of 130 with a rubber thermosetting adhesive, of nominal tape thickness 0,151 mm to 0,250 mm.

Type 3: Products having properties characteristic of a polyester film/polyester non-woven combination with a temperature index of 130 with a rubber thermosetting adhesive, of nominal tape thickness 0,251 mm to 0,500 mm.

The products shall be designated for ordering purposes as follows:

Type 1: IEC 60454-3-11-1/M/F-PET/P-PET/130/R-Tc

Type 2: IEC 60454-3-11-2/M/F-PET/P-PET/130/R-Tc

Type 3: IEC 60454-3-11-3/M/F-PET/P-PET/130/R-Tc

4.4 Polyester/epoxy combinations with pressure-sensitive adhesive

Type 1: Products having properties characteristic of polyester with an epoxy coating with a temperature index of 130 with a rubber thermosetting adhesive, of nominal tape thickness 0,12 mm to 0,16 mm.

Type 2: Products having properties characteristic of polyester with an epoxy coating with a temperature index of 130 with an acrylic cross-linked adhesive, of nominal tape thickness 0,12 mm to 0,16 mm.

Type 3: Products having properties characteristic of polyester with an epoxy coating with a temperature index of 130 with an acrylic cross-linked adhesive, of nominal tape thickness 0,07 mm to 0,11 mm.

The products shall be designated for ordering purposes as follows:

Type 1: IEC 60454-3-11-1/M/EP/PET/130/R-Tc

Type 2: IEC 60454-3-11-2/M/EP/PET/130/A-Tx

Type 3: IEC 60454-3-11-3/M/EP/PET/130/A-Tx

5 Requirements

5.1 All applicable requirements of IEC 60454-1 shall apply to material furnished under this specification.

The PET film used for the polyester film tapes shall be in accordance with IEC 60674-3-2.

5.2 The electrical and other physical properties of products supplied according to this specification shall be within the limits listed in the relevant tables when tested in accordance with the test methods listed therein.

5.3 Thermal endurance

5.3.1 Polyester film/glass filament combinations with pressure-sensitive adhesive

When required by the purchaser, the manufacturer shall provide evidence that the product has a temperature index of not less than 130 when tested in accordance with Clause 21 of IEC 60454-2. The exposure temperatures shall be 150 °C, 160 °C and 180 °C.

The end-point criterion used shall be as follows: the breakdown voltage shall be 2,2 kV for types 1, 2, 3 and 5; and 3,5 kV for types 4 and 6 (metal foil electrode).

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5.3.2 Creped cellulosic paper/polyester film combinations with thermosetting adhesive

When required by the purchaser, the manufacturer shall provide evidence that the product has a temperature index of not less than 120 when tested in accordance with Clause 21 of IEC 60454-2. The exposure temperatures shall be 130 °C, 140 °C, and 160 °C.

The end-point criterion used shall be as follows: the breakdown voltage shall be 2,0 kV (metal foil electrode) and the loss of mass less than 15 %.

5.3.3 Polyester film/polyester non-woven combinations with rubber thermosetting adhesive

When required by the purchaser, the manufacturer shall provide evidence that the product has a temperature index of not less than 130 when tested in accordance with Clause 21 of IEC 60454-2. The exposure temperatures shall be 150 °C, 160 °C and 180 °C.

The end-point criterion used shall be as follows: the breakdown voltage shall be 2,0 kV (metal-foil electrode).

5.3.4 Polyester/epoxy combinations with pressure-sensitive adhesive

When required by the purchaser, the manufacturer shall provide evidence that the product has a temperature index of not less than 130 when tested in accordance with Clause 21 of IEC 60454-2. The exposure temperatures shall be 150 °C, 160 °C and 180 °C.

The end-point criterion used shall be as follows: the breakdown voltage shall be 2,7 kV for type 1 and 2; and 2,0 kV for type 3 (metal-foil electrode).

6 Test methods

All tests shall be conducted in accordance with the appropriate clauses and subclauses of IEC 60454-2.

7 Marking, labelling and packaging

Unless otherwise specified, all marking, labelling and packaging shall be in accordance with the requirements of IEC 60454-1.

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Table 1 – Requirements for all types and combinations

Properties	Clause or subclause of IEC 60454-2	Units	Requirements
Thickness	4	mm	Nominal value per manufacturer ±0,03 mm or ±15 %, whichever is greater
Width	5	mm	7.2.1 of IEC 60454-1
Length	6	m	7.3 of IEC 60454-1
Thermal endurance	21		See 5.3.1; 5.3.2; 5.3.3; 5.3.4 according to the type concerned

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Table 2 – Polyester film/glass filament combinations; specific requirements for various types

Properties	Clause or subclause of IEC 60454-2	Units	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Electrolytic corrosion: - Insulation resistance after 24 h at (23±2) °C and (93±2) % relative humidity; or - Visual	7.5 7.6	Ω/25 mm width None	1×10^7 min. Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	1×10^7 min. Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	1×10^{11} min. Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	1×10^{11} min. Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	1×10^{11} min. Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	1×10^{11} min. Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)
Tensile strength	8	N/10 mm width	280 min.	450 min.	280 min.	450 min.	280 min.	450 min.
Adhesion to steel	11	N/10 mm width	3,0 min.	3,0 min.	3,0 min.	3,5 min.	1,8 min.	1,8 min.
Bond separation during thermal treatment	14.1 except use (200 ±5) g mass and test at 130 °C		---	---	3 passes	3 passes	---	---
Bond separation after thermal treatment	14.2 Curing conditions are 130 °C for 3 h, if not recommended otherwise by the manufacturer		3 passes	3 passes	---	---	---	---
Flagging	15 Condition per 15.5.1 using 12 mm rod Condition per 15.5.2 Condition per 15.5.2 using 12 mm rod	 mm mm mm	 --- 2 max. ---	 --- 2 max. ---	 --- --- 2 max.	 --- --- 2 max.	 2 max. --- ---	 2 max. --- ---
Breakdown voltage: - at room temperature - after humid conditioning	 17 18	 kV kV	 4,0 min. 4,0 min.	 4,0 min. 4,0 min.	 4,0 min. 4,0 min.	 6,5 min. 6,5 min.	 3,5 min. 3,5 min.	 6,0 min. 6,0 min.

Table 3 – Creped cellulosic paper/polyester film combinations with thermosetting adhesive; specific requirements for various types

Properties	Clause or subclause of IEC 60454-2	Units	Requirements
Electrolytic corrosion:			
– insulation resistance after 24 h at (23 ± 2) °C and (93 ± 2) % relative humidity	7.5	Ω/25 mm width	1×10^6 minimum
or			
– visual method	7.6	None	Grade shall be at least as good as B 4 (See Table I of IEC 60426)
Tensile strength	8	N/10 mm width	200 minimum per millimetre tape thickness
Elongation at break	8	%	15 minimum
Adhesion to steel	11	N/10 mm width	2,5 minimum
Adhesion to backing	11	N/10 mm width	2,0 minimum
Shear adhesion to backing after liquid immersion in 25 % xylene, 75 % heptane	13	N	5,0 minimum
Bond separation after thermal treatment	14.2		3 passes
Flagging test	15 Condition per 15.5.2 – 12 mm rod	mm	2 maximum
Electric strength:			
– at room temperature	17	kV/mm	20 minimum
– after humid conditioning	18	kV/mm	10 minimum

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Table 4 – Polyester film/polyester non-woven combinations with rubber thermosetting adhesive; specific requirements for various types

Properties	Clause or subclause of IEC 60454-2	Units	Type 1	Type 2	Type 3
Electrolytic corrosion – Insulation resistance after 24 h at (23 ± 2) °C and (93 ± 2) % relative humidity	7.5	Ω/25 mm width	1×10^{11} minimum	1×10^{11} minimum	1×10^{11} minimum
or –Visual	7.6	None	Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)
Bond separation after thermal treatment	14.2 Curing conditions are 130 °C for 3 h, if not recommended otherwise by the manufacturer		3 passes	3 passes	3 passes
Breakdown voltage					
– at room temperature	17	kV	4,0 min.	4,0 min.	4,0 min.
– after humid conditioning	18	kV	4,0 min.	4,0 min.	4,0 min.
Tensile strength	8	N/10 mm width	25 min.	40 min.	50 min.
Adhesion to steel	11	N/10 mm width	2,2 min.	3,0 min.	3,5 min.
Flagging	15 Condition according to 15.5.2 using a 12 mm rod	mm	2 max.	2 max.	–

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Table 5 – Polyester/epoxy combinations with pressure-sensitive adhesive; specific requirements for various types

Properties	Clause or subclause of IEC 60454-2	Units	Type 1	Type 2	Type 3
Electrolytic corrosion					
– Insulation resistance after 24 h at (23 ± 2) °C and (93 ± 2) % relative humidity	7.5	Ω/25 mm width	1×10^{11} min	1×10^{11} min	1×10^{11} min
or					
– Visual	7.6	None	Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)	Grade shall not be worse than A 1.4 (see Table 1 of IEC 60426)
Flame test	20	None	Flame retardant (see note)	Flame retardant (see note)	Flame retardant (see note)
NOTE Criteria for flame retardant is described in 20.1 of IEC 60454-2.					
Tensile strength	8	N/10 mm width	60 min	60 min	35 min
Adhesion to steel	11	N/10 mm width	3,0 min	2,5 min	2,5 min
Bond separation during thermal treatment	14.1 except use of (200 ± 5) g mass and test at 130 °C		–	3 passes	3 passes
Bond separation after thermal treatment	14.2		3 passes	–	–
Breakdown voltage					
– at room temperature	17	kV	5,5 min	5,5 min	4,0 min
– after humid conditioning	18	kV	5,5 min	5,5 min	4,0 min

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