

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Materials for printed boards and other interconnecting structures –  
Part 2-42: Reinforced base materials clad and unclad – Brominated epoxide  
non-woven/woven E-glass reinforced laminate sheets of defined flammability  
(vertical burning test), copper-clad for lead-free assembly**

<https://standards.iteh.ai/catalog/standards/sist/28d8c07f-ca0f-4b31-a7ad->

**Matériaux pour circuits imprimés et autres structures d'interconnexion –  
Partie 2-42: Matériaux de base renforcés plaqués et non plaqués – Feuilles  
stratifiées renforcées en verre de type E époxyde bromé tissé/non tissé,  
d'inflammabilité définie (essai de combustion verticale), plaquées cuivre pour  
les assemblages sans plomb**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2010 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

[IEC 61249-2-42:2010](mailto:IEC.61249-2-42.2010@iec.ch)

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: [www.iec.ch/webstore/custserv](http://www.iec.ch/webstore/custserv)

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: [csc@iec.ch](mailto:csc@iec.ch)

Tel.: +41 22 919 02 11

Fax: +41 22 919 03 00

### A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: [www.iec.ch/searchpub/cur\\_fut-f.htm](http://www.iec.ch/searchpub/cur_fut-f.htm)

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: [www.iec.ch/webstore/custserv/custserv\\_entry-f.htm](http://www.iec.ch/webstore/custserv/custserv_entry-f.htm)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: [csc@iec.ch](mailto:csc@iec.ch)

Tél.: +41 22 919 02 11

Fax: +41 22 919 03 00



IEC 61249-2-42

Edition 1.0 2010-04

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Materials for printed boards and other interconnecting structures –  
Part 2-42: Reinforced base materials clad and unclad – Brominated epoxide  
non-woven/woven E-glass reinforced laminate sheets of defined flammability  
(vertical burning test), copper-clad for lead-free assembly**

<https://standards.iteh.ai/catalog/standards/sist/28d8c07f-ca0f-4b31-a7ad->

**Matériaux pour circuits imprimés et autres structures d'interconnexion –  
Partie 2-42: Matériaux de base renforcés plaqués et non plaqués – Feuilles  
stratifiées renforcées en verre de type E époxyde bromé tissé/non tissé,  
d'inflammabilité définie (essai de combustion verticale), plaquées cuivre pour  
les assemblages sans plomb**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

S

ICS 31.180

ISBN 978-2-88910-462-8

## CONTENTS

|   |    |
|---|----|
| FOREWORD.....   | 4  |
| 1 Scope.....  | 6  |
| 2 Normative references.....   | 6  |
| 3 Materials and construction .....  | 6  |
| 3.1 Resin system.....   | 6  |
| 3.2 Metal foil .....  | 7  |
| 3.3 Reinforcement.....  | 7  |
| 4 Internal marking.....   | 7  |
| 5 Electrical properties .....   | 7  |
| 6 Non-electrical properties of the copper-clad laminate .....                                   | 7  |
| 6.1 Appearance of the copper-clad sheet.....  | 7  |
| 6.1.1 Indentations (pits and dents).....  | 8  |
| 6.1.2 Wrinkles .....  | 8  |
| 6.1.3 Scratches .....   | 8  |
| 6.1.4 Raised areas .....  | 8  |
| 6.1.5 Surface waviness.....   | 9  |
| 6.2 Appearance of the unclad face.....  | 9  |
| 6.3 Laminate thickness.....   | 9  |
| 6.4 Bow and twist .....   | 9  |
| 6.5 Properties related to the copper foil bond .....  | 10 |
| 6.6 Punching and machining.....   | 10 |
| 6.7 Dimensional stability.....  | 11 |
| 6.8 Sheet sizes.....  | 11 |
| 6.8.1 Typical sheet sizes .....   | 11 |
| 6.8.2 Tolerances for sheet sizes .....  | 11 |
| 6.9 Cut panels .....  | 11 |
| 6.9.1 Cut panel sizes .....   | 11 |
| 6.9.2 Size tolerances for cut panels .....  | 12 |
| 6.9.3 Rectangularity of cut panels .....  | 12 |
| 7 Non-electrical properties of the base material after complete removal of the copper foil..... | 12 |
| 7.1 Appearance of the dielectric base material.....   | 12 |
| 7.2 Flexural strength.....  | 13 |
| 7.3 Flammability .....  | 13 |
| 7.4 Water absorption .....  | 14 |
| 7.5 Measling.....   | 14 |
| 7.6 Glass transition temperature and cure factor.....   | 14 |
| 7.7 Decomposition temperature .....   | 14 |
| 7.8 Time to delamination (TMA).....   | 15 |
| 8 Quality assurance .....   | 15 |
| 8.1 Quality system .....  | 15 |
| 8.2 Responsibility for inspection.....  | 15 |
| 8.3 Qualification inspection.....   | 15 |
| 8.4 Quality conformance inspection .....  | 15 |
| 8.5 Certificate of conformance .....  | 16 |
| 8.6 Safety data sheet.....  | 16 |

|    |   |    |
|----|---|----|
| 9  | Packaging and marking.....  | 16 |
| 10 | Ordering information.....   | 16 |
|    | Annex A (informative) Engineering information.....                                | 17 |
|    | Annex B (informative) Common laminate constructions.....                          | 19 |
|    | Annex C (informative) Guideline for qualification and conformance inspection..... | 20 |
|    | Bibliography.....   | 21 |
|    | Table 1 – Electrical properties.....  | 7  |
|    | Table 2 – Nominal thickness and tolerance of metal-clad laminate.....             | 9  |
|    | Table 3 – Bow and twist requirements.....   | 9  |
|    | Table 4 – Pull-off and peel strength requirements.....                            | 10 |
|    | Table 5 – Dimensional stability.....  | 11 |
|    | Table 6 – Size tolerances for cut panels.....                                     | 12 |
|    | Table 7 – Rectangularity of cut panels.....                                       | 12 |
|    | Table 8 – Flexural strength requirements.....                                     | 13 |
|    | Table 9 – Flammability requirements.....  | 13 |
|    | Table 10 – Water absorption requirements.....                                     | 14 |
|    | Table 11 – Measling requirements.....   | 14 |
|    | Table 12 – Glass transition temperature and cure factor requirements.....         | 14 |
|    | Table 13 – Decomposition temperature requirements.....                            | 14 |
|    | Table 14 – Time to delamination (TMA).....  | 15 |
|    | Table C.1 – Qualification and conformance inspection.....                         | 20 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MATERIALS FOR PRINTED BOARDS  
AND OTHER INTERCONNECTING STRUCTURES –**

**Part 2-42: Reinforced base materials clad and unclad –  
Brominated epoxide non-woven/woven E-glass reinforced  
laminates sheets of defined flammability (vertical burning test),  
copper-clad for lead-free assembly**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61249-2-42 has been prepared by IEC technical committee 91: Electronics assembly technology.

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

|             |                  |
|-------------|------------------|
| FDIS        | Report on voting |
| 91/912/FDIS | 91/923/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.

A list of all parts of the IEC 61249 series, under the general title *Materials for printed boards and other interconnecting structures*, 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.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 61249-2-42:2010](https://standards.iteh.ai/catalog/standards/sist/28d8c07f-ca0f-4b31-a7ad-2076676fee69/iec-61249-2-42-2010)

<https://standards.iteh.ai/catalog/standards/sist/28d8c07f-ca0f-4b31-a7ad-2076676fee69/iec-61249-2-42-2010>

## MATERIALS FOR PRINTED BOARDS AND OTHER INTERCONNECTING STRUCTURES –

### Part 2-42: Reinforced base materials clad and unclad – Brominated epoxide non-woven/woven E-glass reinforced laminates sheets of defined flammability (vertical burning test), copper-clad for lead-free assembly

#### 1 Scope

This part of IEC 61249 gives requirements for properties of brominated epoxide non-woven reinforced core/woven E-glass reinforced surface laminate sheets of defined flammability (vertical burning test), copper-clad for lead-free assembly in thicknesses of 0,60 mm up to 1,70 mm. The flammability rating is achieved through the use of brominated fire retardants reacted as part of the epoxide polymeric structure. The glass transition temperature is defined to be 105 °C minimum.

Some property requirements may have several classes of performance. The class desired should be specified on the purchase order, otherwise the default class of material will be supplied.

**ITeH STANDARD PREVIEW**  
(standards.iteh.ai)

#### 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 61189-2:2006, *Test methods for electrical materials, printed boards and other interconnection structures and assemblies – Part 2: Test methods for materials for interconnection structures*

IEC 61249-5-1, *Materials for interconnection structures – Part 5: Sectional specification set for conductive foils and films with and without coatings – Section 1: Copper foils (for the manufacture of copper-clad base materials)*

ISO 9000, *Quality management systems – Fundamentals and vocabulary*

ISO 11014, *Safety data sheet for chemical products – Content and order of sections*

ISO 14001, *Environmental management systems – Requirements with guidance for use*

#### 3 Materials and construction

The sheet consists of an insulating base with metal-foil bonded to one side or both.

##### 3.1 Resin system

Brominated epoxide, filled or unfilled, resulting in a laminate with a glass transition temperature of 105 °C minimum.



Contrast agents may be added to enhance processing such as automated optical inspection (AOI).

Its flame resistance is defined in terms of the flammability requirements of 7.3.

### 3.2 Metal foil

Copper as specified in IEC 61249-5-1, copper foil (for the manufacture of copper-clad materials). The preferred foils are electrodeposited of defined ductility.

### 3.3 Reinforcement

Woven E-glass as it will be specified in future IEC 61249-6-3, woven E-glass fabric (for the manufacture of prepreg and copper clad material) as the surface sheet on each side of a core reinforcement comprised of non-woven E-glass mat.

## 4 Internal marking

Not specified.

## 5 Electrical properties

The electrical property requirements are shown in Table 1.

**Table 1 – Electrical properties**

| Property  | Test method<br>(IEC 61189-2) | Requirements |
|---|------------------------------|--------------|
| Surface resistance after damp heat while in the humidity chamber      | 2E04                         | ≥5 000 MΩ    |
| Surface resistance after damp heat and recovery (optional)            | 2E03                         | ≥40 000 MΩ   |
| Volume resistivity after damp heat while in the humidity chamber      | 2E04                         | ≥5 000 MΩm   |
| Volume resistivity after damp heat and recovery (optional)            | 2E04                         | ≥10 000 MΩm  |
| Relative permittivity after damp heat and recovery (1 MHz)            | 2E10                         | ≤5,4         |
| Loss tangent after damp heat and recovery (1 MHz)                     | 2E10                         | ≤0,040       |
| Arc resistance  | 2E14                         | ≥60 s        |
| Dielectric breakdown (only for material thickness ≥0,60 mm thickness) | 2E15                         | ≥40 kV       |
| Surface resistance at 125 °C  | 2E04                         | ≥1 000 MΩ    |
| Volume resistivity at 125 °C  | 2E04                         | ≥1 00 MΩm    |

## 6 Non electrical properties of the copper-clad laminate

### 6.1 Appearance of the copper-clad sheet

The copper-clad face shall be substantially free from defects that may have an impact on the material's fitness for use for the intended purpose.

For the following specific defects the requirements given shall apply when inspection is made in accordance with IEC 61189-2, method 2M18.

### 6.1.1 Indentations (pits and dents)

The size of an indentation, usually the length, shall be determined and given a point value to be used as measure of the quality.

| Size mm     | Point value for each indentation |
|-------------|----------------------------------|
| 0,13 – 0,25 | 1                                |
| 0,26 – 0,50 | 2                                |
| 0,51 – 0,75 | 4                                |
| 0,76 – 1,00 | 7                                |
| Over 1,00   | 30                               |

The total point count for any 300 mm × 300 mm area shall be calculated to determine the class of the material.

- Class A 29 maximum
- Class B 17 maximum
- Class C 5 maximum
- Class D 0
- Class X To be agreed upon by user and supplier

Iteh STANDARD PREVIEW  
(standards.iteh.ai)

The required class of material shall be specified in the purchase order. Class A applies unless otherwise specified.

<https://standards.iteh.ai/catalog/standards/sist/28d8c07f-ca0f-4b31-a7ad-2076676fcc69/iec-61249-2-42-2010>

### 6.1.2 Wrinkles

There shall be no wrinkles in the copper surface.

### 6.1.3 Scratches

Scratches deeper than 10 µm or 20 % of the nominal thickness of the foil thickness, whichever is lower, are not permitted.

Scratches with a depth less than 5 % of the nominal thickness of the foil shall not be counted unless this depth is 10 µm or more.

Scratches with a depth between 5 % and 20 % of the nominal thickness of the foil are permitted to a total length of 100 mm for a 300 mm × 300 mm area.

### 6.1.4 Raised areas

Raised areas are usually impressions in the press plates used during manufacture but may also be caused by blisters or inclusions of foreign particles under the foil.

Raised areas caused by blisters or inclusions are not permitted.

Raised areas being impressions of defects in press plates are permitted to the following extent:

- Class A and X material maximum height 15 µm and maximum length 15 mm;
- Class B and C material maximum height 8 µm and maximum length 15 mm;

- Class D material maximum height 5 µm and maximum length 15 mm.

### 6.1.5 Surface waviness

Under consideration.

## 6.2 Appearance of the unclad face

The unclad face of single side clad sheet shall have the natural appearance resulting from the curing process. Small irregularities in colour are permitted. The gloss of the unclad face shall be that given by the press plate, release film, or release foil used. Variations of gloss due to the impact of pressure of gases released during the curing are permitted.

## 6.3 Laminate thickness

If the copper-clad laminate is tested in accordance with test method 2D01 of IEC 61189-2, the thickness shall not depart from the nominal thickness by more than the appropriate value shown in Table 2. The fine tolerances shall apply unless the other tolerances are ordered.

**Table 2 – Nominal thickness and tolerance of metal-clad laminate**

| Property  | Test method<br>(IEC 61189-2) | Nominal thickness<br><i>including metal foil</i><br>mm | Tolerance requirement<br>± mm |      |            |
|-----------|------------------------------|--|-------------------------------|------|------------|
|           |                              |  | Coarse                        | Fine | Extra fine |
| Thickness | 2D01                         | ≥0,60 <0,80  | 0,08                          | 0,06 | 0,05       |
|           |                              | ≥0,80 <1,00  | 0,17                          | 0,10 | 0,08       |
|           |                              | ≥1,00 ≤1,70  | 0,19                          | 0,13 | 0,08       |

IEC 61249-2-42:2010

The thickness and tolerances do not apply to the outer 25 mm of the trimmed master sheet or the outer 13 mm of the cut-to-size panel as manufactured and delivered by the supplier. At no point shall the thickness vary from the nominal by a value greater than 125 % of the specified tolerance.

## 6.4 Bow and twist

When the copper-clad laminate is tested in accordance with test method 2M01 of IEC 61189-2, the bow and twist shall not exceed the values given in Table 3.

**Table 3 – Bow and twist requirements**

| Property      | Test method<br>(IEC 61189-2) | Nominal<br>thickness<br>mm | Panel dimension<br>longest side<br>mm | Requirements<br>%          |                              |
|---------------|------------------------------|----------------------------|---------------------------------------|----------------------------|------------------------------|
|               |                              |                            |                                       | Copper foil on<br>one side | Copper foil on<br>both sides |
| Bow and twist | 2M01                         | ≥0,6 ≤1,3                  | ≤350                                  | ≤2,5                       | ≤2,0                         |
|               |                              |                            | >350 ≤500                             | ≤2,3                       | ≤1,8                         |
|               |                              |                            | >500                                  | ≤2,0                       | ≤1,5                         |
|               |                              | >1,3 <1,7                  | ≤350                                  | ≤2,0                       | ≤1,5                         |
|               |                              |                            | >350 ≤500                             | ≤1,8                       | ≤1,3                         |
|               |                              |                            | >500                                  | ≤1,5                       | ≤1,0                         |

NOTE The requirements for bow and twist apply only to one sided copper-clad laminates with maximum foil thickness of 105 µm (915 g/m<sup>2</sup>) and double sided copper-clad laminates with maximum foil thickness difference of 70 µm (610 g/m<sup>2</sup>).

Requirements for laminates with copper foil configurations beyond these limits should be subject to agreement between purchaser and supplier.

### 6.5 Properties related to the copper foil bond

Pull-off and peel strength requirements are shown in Table 4. These requirements apply to copper foil with a normal profile depth.

**Table 4 – Pull-off and peel strength requirements**

| Property   | Test method (IEC 61189-2) | Requirement   |                                   |                                   |
|--|---------------------------|---|-----------------------------------|-----------------------------------|
| Pull-off strength  | 2M05                      | ≥25 N   |                                   |                                   |
|  |                           | Thickness of the copper foil  |                                   |                                   |
|  |                           | 18 µm<br>(152 g/m <sup>2</sup> )  | ≥35 µm<br>(305 g/m <sup>2</sup> ) | ≥70 µm<br>(610 g/m <sup>2</sup> ) |
| Peel strength after heat shock 288 °C, 20 s  | 2M14 <sup>a</sup>         | ≥1,0 N/mm   | ≥1,4 N/mm                         | ≥1,6 N/mm                         |
|  |                           | No blistering nor delamination  |                                   |                                   |
| Peel strength after dry heat 125 °C  | 2M15                      | Under consideration   | Under consideration               | Under consideration               |
|  |                           | No blistering nor delamination  |                                   |                                   |
| Peel strength after exposure to solvent vapour. Solvents as agreed upon between purchaser and supplier   | 2M06                      | ≥1,0 N/mm<br><a href="https://standards.iteh.ai/catalog/standards/sist/28d18c07f-ca0f-4b31-a7ad-2076676fee69/iec-61249-2-42-2010">IEC 61249-2-42:2010</a> | ≥1,4 N/mm                         | ≥1,6 N/mm                         |
|  |                           | No blistering nor delamination  |                                   |                                   |
| Peel strength after simulated plating  | 2M16                      | Under consideration   | Under consideration               | Under consideration               |
|  |                           | No blistering nor delamination  |                                   |                                   |
| Peel strength at high temperature<br>Temperature 125 °C (optional)   | 2M17                      | ≥0,7 N/mm   | ≥0,9 N/mm                         | ≥1,1 N/mm                         |
| Blistering after 288 °C, 20 s heat shock   | 2C05 <sup>a</sup>         | No blistering nor delamination  |                                   |                                   |
| NOTE In case of difficulty due to breakage of the foil or reading range of the force measuring device, the measurement of peel strength at high temperature may be carried out using conductor widths of more than 3 mm. |                           |   |                                   |                                   |
| <sup>a</sup> The condition of heat shock is 288 °C, 20 s.  |                           |   |                                   |                                   |

### 6.6 Punching and machining

The laminate shall, in accordance with the manufacturer's recommendations, be capable of being punched, sheared or drilled. Delamination at the edges due to the shearing process is permissible, provided that the depth of delamination is not larger than the thickness of the base material. Delamination at the edges of drilled holes due to the drilling process is not permissible. Drilled holes shall be capable of being through-plated with no interference from any exudations into the hole.

A suitable test method for evaluating punching is 2M19 of IEC 61189-2. Requirements for punching force and pull-out force are matters for agreement between user and supplier.

## 6.7 Dimensional stability

When specimens are tested in accordance with IEC 61189-2, 2X02 the observed tolerance shall be as specified in Table 5. The nominal dimensional stability value shall be as agreed upon between user and vendor. The tolerance range around the agreed upon nominal shall be range B unless otherwise specified on the purchase order.

**Table 5 – Dimensional stability**

| Property              | Test method<br>(IEC 61189-2) | Class | Requirement<br>µm/m                      |
|-----------------------|------------------------------|-------|--|
| Dimensional stability | 2X02                         | A     | ±600                                     |
|                       |                              | B     | ±400                                     |
|                       |                              | C     | ±200                                     |
|                       |                              | X     | As agreed upon between user and supplier |

The choice of the glass fabrics and cellulose papers in the construction of the laminate has a significant impact on dimensional stability. Examples of typical constructions used in printed board applications can be found in Annex B. Annex B is not a construction requirement table but is presented for engineering information only.

Class A performance shall be in effect unless otherwise noted on the purchase order.

## 6.8 Sheet sizes

### 6.8.1 Typical sheet sizes

IEC 61249-2-42:2010

<https://standards.iteh.ai/catalog/standards/sist/28d8c07f-ca0f-4b31-a7ad-20766766f691/iec-61249-2-42-2010>

Sheet sizes are matters of agreement between purchaser and supplier. However, the recommended sizes are listed below:

- 915 mm × 1 220 mm;
- 1 020 mm × 1 220 mm;
- 1 070 mm × 1 220 mm;
- 1 065 mm × 1 155 mm;
- 1 065 mm × 1 280 mm;
- 1 000 mm × 1 000 mm;
- 1 000 mm × 1 200 mm.

### 6.8.2 Tolerances for sheet sizes

The size of sheet delivered by the supplier shall not deviate more than  $\begin{matrix} +25 \\ -0 \end{matrix}$  mm from the ordered size.

## 6.9 Cut panels

### 6.9.1 Cut panel sizes

Cut panel sizes shall be, when delivered, in accordance with the purchaser's specification.