

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Materials for printed boards and other interconnecting structures –
Part 6-3: Sectional specification set for reinforcement materials – Specification
for finished fabric woven from "E" glass for printed boards**

**Matériaux pour circuits imprimés et autres structures d'interconnexion –
Partie 6-3: Ensemble de spécifications intermédiaires pour matériaux de renfort
– Spécification des tissus finis en verre "E" pour circuits imprimés**



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CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Visual requirements.....	9
5 Physical requirements	10
5.1 Fabric count.....	10
5.2 Weave type.....	10
5.3 Fabric thickness.....	10
5.4 Fabric weight	10
5.5 Fabric length.....	10
5.6 Fabric width	10
5.7 Feather length	10
5.8 Filament diameter.....	10
5.9 Bare glass nominal measurement	11
6 Chemical requirements.....	11
7 Electrical requirements.....	11
7.1 Dielectric constant	11
7.2 Dissipation factor	11
8 Workmanship requirements	12
8.1 Splices.....	12
8.2 Laser machinability performance.....	12
8.3 Alternate fabric styles and weaves.....	12
9 Quality assurance.....	12
9.1 Statistical process control (SPC).....	12
9.2 Responsibility for inspection	13
9.3 Test equipment and inspection facilities	13
9.4 Preparation of samples	13
9.5 Standard laboratory conditions.....	13
9.6 Inspection requirements and acceptability.....	13
9.6.1 General	13
9.6.2 Sample size.....	13
9.6.3 Sampling plans	14
9.6.4 Acceptable quality level (AQL).....	14
9.7 Test methods	14
9.7.1 Fabric appearance.....	14
9.7.2 Fabric count	15
9.7.3 Weave type	15
9.7.4 Fabric thickness	15
9.7.5 Weight per unit area	15
9.7.6 Fabric length	16
9.7.7 Fabric width.....	16
9.7.8 Finish level (organic content).....	16
9.7.9 Bias or bowed filling	17
10 Preparation for delivery	17
10.1 Preservation and packaging.....	17

10.2 Packing..... 17

10.3 Marking..... 17

11 Additional Information..... 17

11.1 Ordering data..... 17

11.2 New styles 17

Annex A (normative) Finished fabric glass styles in SI units..... 18

Bibliography..... 21

Table 1 – Classification of defects 9

Table 2 – Filament Thdiameter designations 10

Table 3 – Bare glass nominal measurements 11

Table 4 – Sample size per number of rolls shipped 13

Table 5 – Sample size per length of individual roll shipped and
the acceptable quality level..... 14

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 6-3: Sectional specification set for reinforcement materials –
Specification for finished fabric woven from "E" glass for printed boards**

FOREWORD

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IEC 61249-6-3 has been prepared by IEC technical committee 91: Electronics assembly technology. It is an International Standard.

This first edition cancels and replaces the IEC/PAS 61249-6-3 published in 2011. This edition constitutes a technical revision.

The text of this International Standard is based on the following documents:

Draft	Report on voting
91/1680/CDV	91/1828A/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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MATERIALS FOR PRINTED BOARDS AND OTHER INTERCONNECTING STRUCTURES –

Part 6-3: Sectional specification set for reinforcement materials – Specification for finished fabric woven from "E" glass for printed boards

1 Scope

This part of IEC 61249 covers finished fabrics woven from "E" glass electrical grade glass fibre yarns that are intended as a reinforcing material in laminated plastics for electrical and electronic use. All fabrics covered by this specification are plain weave.

This specification determines the nomenclature, definitions, general and chemical requirements for the glass, and physical requirements for finished woven glass fibre fabrics.

Annex A of this document provides a style designator for each finished fabric glass style, with specifications on yarn, fabric count, thickness and weight in both SI and US system.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

AQL

Acceptable Quality Level

maximum number of defects per hundred units that can be considered satisfactory as a process average

3.2

bias

filling yarns are off-square to the warp ends

3.3

bow

filling yarns lie in an arc across the width of the fabric

**3.4
creases**

ridge in the fabric caused by a fold or wrinkle being placed under pressure

**3.5
defect**

substandard area in a fabric

**3.5.1
major defect**

defect that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose

**3.5.2
minor defect**

defect that is not likely to reduce materially the usability of the unit of product for its intended purpose

**3.6
E-glass**

Electrical Glass which is to be used for printed board applications, is a continuous filament glass yarn with a chemical composition by weight that is within the following limits:

B2O3	5 % to 10 %
CaO	16 % to 25 %
Al2O3	12 % to 16 %
SiO2	52 % to 56 %
MgO	0 % to 5 %
Na2O / K2O	0 % to 2 %
TiO2	0 % to 0,8 %
Fe2O3	0,05 % to 0,4 %
F2	0 % to 10 %

Note 1 to entry: For convenience, the composition of borosilicate glass is often expressed in terms of oxides (B2O3, SiO2, Al2O3, Na2O, CaO, etc.). This does not imply anything about the nature and structure of glass. Borates are network formers and are part of the structure of borosilicate glass. All raw materials are completely consumed during manufacturing, and no raw materials are present in the final product.

**3.7
permittivity for bulk form E glass**

reference dielectric constant to be used for printed board applications

**3.8
feather length**

distance from last warp end to the end of the pick

**3.9
fabric finish**

treatment of fabric to aid in compatibility with resins

**3.10
fish eye**

small area of fabric which resists resin wetting and can be caused by the resin system, fabric or treatment

3.11**hollow filament**

individual filament within a glass yarn bundle that contains a longitudinal void

3.12**Leno end out**

missing wrapper warp end from the edge of the fabric

3.13**lot**

collection of units produced in one continuous, uninterrupted finish run from which a sample is drawn and inspected or tested to determine conformance with the acceptability criteria.

3.14**mark**

heavy or light area in fabric due to excessive or less filling yarns

3.14.1**heavy mark**

filling defect extending across the width of the fabric containing two picks/inch in excess of the nominal count

3.14.2**light mark**

filling defect extending across the width of the fabric containing two picks/inch less than the nominal count

3.15**pick**

filling yarn running crosswise the entire width of a fabric

3.16**broken pick**

filling yarn missing from a portion of the width of the fabric

3.17**mis-picks**

break in the pattern of cloth from selvage to selvage caused by a missing filling yarn

3.18**plain weave**

fabric configuration where each warp end should go over one pick and under the next, and each pick should go over one warp end and under the next

3.19**split**

opening in the fabric resulting from either the pick or end breaking in two

3.20**spread glass fabric**

woven glass fabric, the warp and/or fill yarns of which, through mechanical action, are flattened (spread out) such that the radial cross sectional aspect ratio (ratio of length of major and minor axes) is increased and the percentage of open space between yarns per unit area is decreased, as compared to a non-spread fabric of the same style

3.21**TEX system**

system for expressing linear density of yarn or other textile strand expressed as grams/kilometer

3.22**waste**

lump or collection of yarn or filament woven into the fabric where accumulated contamination off the loom has found its way into the fabric

3.23**waviness**

cloth is woven under varying tensions preventing even placement of picks resulting in alternating thick and thin places

4 Visual requirements

When specified by purchase contract, the fabric is examined in accordance with 9.7.1. Visual defects shall be identified and classified per Table 1 and meet the AQL defined in 9.6.3 and 9.6.4 as specified.

Table 1 – Classification of defects

Visual Defect	Description	Classification
Bias or bowed filling ^a	Pick line distortion from horizontal by more than 2,5 % for entire width	Major
Baggy or wavy cloth	Clearly noticeable per 9.7.1	Major
Cut or tear	> 6,5 mm in any direction (body only)	Major
Spots, streaks, stains, foreign inclusions	Clearly noticeable	Major
Broken or missing ends or picks	2 or more continuous, regardless of length	Major
Light marks	> 6,5 mm in width	Major
	2 picks/2,54 cm less than nominal	Minor
Heavy marks	Puckering clearly noticeable	Major
	2 picks/2,54 cm more than nominal	Minor
Crease	Hard embedded and folded over on self	Major
Waste	Clearly noticeable > 6,5 mm	Major
	Clearly noticeable ≤ 6,5 mm	Minor
Weave separation	Clearly noticeable >3,175 mm	Major
Leno ends out	>5 m	Major
	≤5 m	Minor
Feather length	>5 mm running >4,5 m	Major
	>5 mm running ≤4,5 m	Minor
^a It is important that as a target for the future, the non-homogeneous bow (i.e., a bow not stretching across the width of material) should be reduced.		

5 Physical requirements

5.1 Fabric count

Fabric count shall be evaluated in accordance with 9.7.2. The nominal fabric count for each style shall be as specified in Annex A. For fabrics not listed, the nominal fabric count shall be as agreed upon between user and supplier. The actual average count of warp ends or filling picks shall be within $\pm 2/2,54$ cm of the nominal count.

5.2 Weave type

Weave type shall be determined in accordance with 9.7.3. This specification only addresses plain weave.

5.3 Fabric thickness

Fabric thickness shall be determined in accordance with 9.7.4. The nominal fabric thickness for each style shall be as specified in Annex A.

5.4 Fabric weight

Fabric weight shall be determined in accordance with 9.7.5. The nominal fabric weight for each style shall be as specified in Annex A and shall meet the tolerance listed.

5.5 Fabric length

Fabric length shall be determined in accordance with 9.7.6 and shall be as specified on the purchase order. The length of the fabric shall be within ± 1 % of the value specified.

5.6 Fabric width

Fabric width shall be determined in accordance with 9.7.7 and shall be as specified on the purchase order. The width of the fabric shall be within (-0/+13) mm of the value specified. If the fabric has coated and cut (C&C) edges, the width shall be within (-0/+5) mm of the value specified.

5.7 Feather length

The feather length shall not exceed 5,0 mm.

5.8 Filament diameter

The nominal filament diameter and the range of averages for products used in electrical laminates are as given in Table 2. The filament diameters are to be certified by the yarn supplier when requested.

Table 2 – Filament diameter designations

Designation (SI)	Nominal diameter (μm)	Range of averages (μm)
4	4	3,50 to 4,70
4,5	4,5	3,56 to 5,08
5	5	4,80 to 5,87
6	6	5,84 to 7,16
7	7	6,40 to 7,82
9	9	8,46 to 10,34

5.9 Bare glass nominal measurement

Bare glass nominal measurement (meters) shall be as defined in Table 3.

Table 3 – Bare glass nominal measurements

Yarn	Nominal length per unit weight
SI Nomenclature	SI (m/kg)
4 1,65 1x0	604,773
4 2,20 1x0	453,571
4 3,31 1x0	302,385
4,5 2,76 1x0	362,864
4,5 4,13 1x0	241,905
5 2,75 1x0 ^a	362,864
5 5,5 1x0	181,432
6 8,27 1x0	120,955
5 11 1x0	90,716
6 16,5 1x0	60,477
5 22 1x0	45,358
7 22 1x0	45,358
9 33 1x0	30,239
6 33 1x0	30,239
7 41 1x0	25,199
7 45 1x0	22,175
6 49 1x0	20,159
9 68 1x0	14,716
9 74 1x0	13,507
9 99 1x0	10,080
9 134 1x0	7,459
^a 1/0 or 1x0 = Single yarn which has not been combined.	

6 Chemical requirements

The finish level of the fabric shall be determined in accordance with 9.7.8. The organic content of the finish fabric shall be no less than 0,05 % and no more than 0,30 %, unless otherwise agreed upon between user and supplier.

7 Electrical requirements

7.1 Dielectric constant

The dielectric constant of bulk form E-glass when measured at 1 GHz shall be 7,1 +/-0,3 units when tested using parallel plate analysis or equivalent.

7.2 Dissipation factor

The dissipation factor when measured at 1 GHz shall be as agreed upon between user and supplier.