



IEC/PAS 61249-6-3

Edition 1.0 2011-09

PUBLICLY AVAILABLE SPECIFICATION

Specification for finished fabric woven from "E" glass for printed boards
(standards.iteh.ai)

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**SPECIFICATION FOR FINISHED FABRIC
WOVEN FROM “E”GLASS FOR PRINTED BOARDS**

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IEC-PAS 61249-6-3 has been processed by IEC technical committee 91: Electronics assembly technology.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
91/956/PAS	91/961/RVD

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SPECIFICATION FOR FINISHED FABRIC WOVEN FROM “E” GLASS FOR PRINTED BOARDS

1 Scope

This specification covers finished fabrics woven from “E” glass electrical grade glass fiber 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.

1.1 Purpose

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

1.2 Designation

Appendix II of this standard 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. Fabrics listed in Appendix II also categorize fabrics by their current availability status.

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.

2.1 IPC

IPC-T-50, *Terms and Definitions for Interconnecting and Packaging Electronic Circuits*

IPC-9191, *General Guidelines for Implementation of Statistical Process Control (SPC)*

2.2 American Society for Testing and Materials (ASTM)

ASTM-D578, *Standard Specification for Glass Fiber Strands*

ASTM-D1776, *Standard Practice for Conditioning Testing Textiles*

2.3 International Standards

ISO 9001, *Quality Management Systems – Requirements*

2.4 National Conference of Standards Laboratories (NCSL)

NCSL Z 540-1, *General Requirements for Calibration Laboratories and Measuring and Test Equipment*

3 Terms and definitions

The definition of terms shall be in accordance with IPC-T-50 and the following:

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**

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

3.5**defects**

a substandard area in a fabric

3.6**major defect**

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

3.7**minor defect**

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

3.8**defect per hundred units**

$$\frac{\text{Number of Defects}}{\text{Number of Units Inspected}} \times 100$$

3.9**E glass (electrical grade glass fiber)**

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

B ₂ O ₃	5 %–10 %
CaO	16 %–25 %
Al ₂ O ₃	12 %–16 %
SiO ₂	52 %–56 %
MgO	0 %–5 %
Na ₂ O and K ₂ O	0 %–2 %
TiO ₂	0 %–0.8 %
Fe ₂ O ₃	0.05 %–0.4 %
F ₂	0 %–1.0 %

Composition is to be certified by yarn supplier as requested.

3.10

end missing

a very small portion of the warp in the fabric that may have been broken in the pick-out of waste

3.11

feather length

length of distance from last warp end to the end of the pick

3.12

fabric finish

treatment of fabric to aid in compatibility with resins

3.13

fish eye

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

3.14

leno end out

missing wrapper warp end from the edge of the fabric

3.15

lot or batch size

a 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

3.16

mark

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

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3.17

heavy mark

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

3.18

light mark

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

3.19

pick

filling yarn running crosswise the entire width of a fabric

3.20

broken pick

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

3.21

mis-picks

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

3.22

plain weave

a 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

3.23**splits**

an opening in the fabric resulting from either the pick or end breaking in two. This is usually caused by the fabric folding over and creasing

3.24**tears**

a large rip in the fabric usually caused by excessive tension being applied during processing. Could be caused by weak fabric

3.25**TEX system**

a system for expressing linear density of yarn or other textile strand. The unit is equivalent to grams/kilometer.

3.26**waste**

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

3.27**waviness**

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

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4 Requirements**4.1 Yarn nomenclature**

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There are two systems of identifying fiber glass yarns: the US system and system international (SI)/metric. Consider the following example: ECD 450 1/2 in US system or EC5 11 1x2 in SI.

4.1.1 US system

For the “ECD” in “ECD 450 1/2,” the first letter represents the grade of glass; the second indicates whether the yarn is continuous (“C”) or staple (“S” – fibers of a cut length), and the third represents the filament diameter (see 3.4.8). “ECD” is then read as an “E” glass electrical grade fiber of “C” (continuous) length and with the filament diameter of “D.” The “450” in ECD 450 1/2 represents the linear density of the yarn in units of yards per pound divided by 100. The 450 in ECD 450 ½ indicates that the nominal single yarn measurement in yards per pound is $450 \times 100 = 45,000$ yards per pound.

The “1/2” indicates the number of single yarns twisted together into a strand/the number of twisted strands plied together. Thus, the “1/2” in ECD 450 1/2 indicates that one single yarn is twisted (becomes the strand) and two twisted strands are plied together. By convention, a “1/0” means that the yarn is a single yarn (no or “zero” plying required).

Since this specification is for E grade glass where all yarns are continuous, the ECD 450 1/2 nomenclature can be shortened to the D 450 1/2 nomenclature.

4.1.2 SI/metric

For the “EC5” in EC5 11 1x2, the first letter represents the grade of glass; the second indicates whether the yarn is continuous (“C”) or staple (“S” – fibers of a cut length). The number represents the filament diameter (see 3.4.8). “EC5” is then read as an “E” glass electrical grade fiber of “C” (continuous) length and with the nominal filament diameter of 5 µm (rounded to the nearest µm). The “11” in EC5 11 1x2 represents the TEX number of

linear density. The 11 in EC5 11 1x2 indicates that the nominal single yarn measurement is 11 g/km or 90,716 m/kg.

The “1x2” indicates the number of single yarns twisted together into a strand x the number of twisted strands plied together. Thus, the “1x2” in EC5 11 1x2 indicates that one single yarn is twisted (becomes the strand) and two twisted strands are plied together. By convention, a “1x0” means that the yarn is a singles yarn (no or “zero” plying required).

Since this specification is for E grade glass where all yarns are continuous, the EC5 11 1x2 nomenclature can be shortened to the 5 11 1x2 nomenclature.

4.1.3 Conversion from US system to SI

To convert from the US system to SI, the changes are:

- 1) The alphabetical filament diameter designation in US System to be changed to a numerical designation (filament diameter in micrometers) in SI, e.g., “D” to be changed to “5” {see 3.4.8}.
- 2) The linear density indicator to be changed from a number with an unit of hundred yards per pound in US System to a TEX number of grams per kilometer equivalent, e.g., “450” to be changed to “11” (see 3.4.9).
- 3) The “/” sign in the US System to be changed to a “x” sign in SI for the number of single yarns twisted together into a strand and the number of twisted strands plied together. e.g., “1/2” to be changed to “1x2.”

4.2 Visual requirements

When specified by purchase contract, fabric is examined in accordance with 4.4.1. Visual defects shall be identified and classified per Table 1 and meet the AQL defined in 4.3.2 or 4.3.3 as specified.

4.3 Physical requirements

4.3.1 Fabric count

Fabric count shall be evaluated in accordance with 4.4.2. The nominal fabric count for each style shall be as specified in Appendix II. 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 ± 2 /inch of the nominal count.

4.3.2 Weave type

Weave type shall be determined in accordance with 4.4.3. This specification only addresses plain weave.

4.3.3 Fabric thickness

Fabric thickness shall be determined in accordance with 4.4.4. The nominal fabric thickness for each style shall be as specified in Appendix II.

4.3.4 Fabric weight

Fabric weight shall be determined in accordance with 4.4.5. The nominal fabric weight for each style shall be as specified in Appendix II and shall meet the tolerance listed.

4.3.5 Fabric length

Fabric length shall be determined in accordance with 4.4.6 and shall be as specified on the purchase order. The length of the fabric shall be within ± 1 % of the value specified.