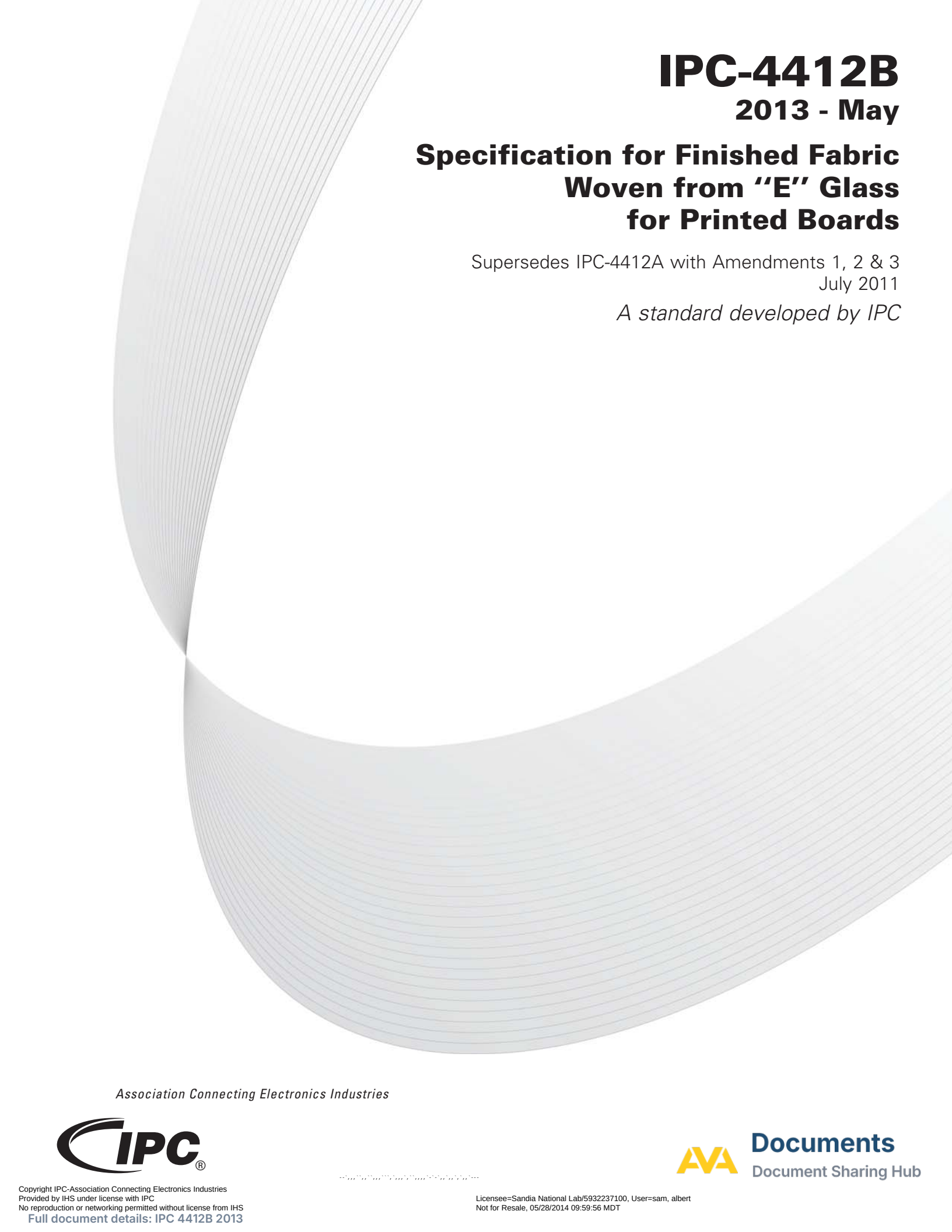




IPC-4412B

2013 - May

Specification for Finished Fabric Woven from "E" Glass for Printed Boards

Supersedes IPC-4412A with Amendments 1, 2 & 3
July 2011

A standard developed by IPC

Association Connecting Electronics Industries



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IPC-4412B

Specification for Finished Fabric Woven from “E” Glass for Printed Boards

Developed by the Woven Glass Reinforcement Task Group (3-12d) of
the Printed Board Base Materials Committee (3-10) of IPC

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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.

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

1.3 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 APPLICABLE DOCUMENTS

2.1 IPC¹

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)²

ASTM D578 Standard Specification for Glass Fiber Strands

ASTM D579 Standard Specification for Greige Woven Glass Fabrics

ASTM D1776 Standard Practice for Conditioning Testing Textiles

2.3 International Standards³

ISO 9001 Quality Management Systems - Requirements

2.4 National Conference of Standards Laboratories (NCSL)⁴

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

3 REQUIREMENTS

3.1 Terms and Definitions The definition of terms shall be in accordance with IPC-T-50 and 3.1.1 through 3.1.21.

3.1.1 AQL (Acceptable Quality Level) Maximum number of defects per hundred units that can be considered satisfactory as a process average.

3.1.2 Bias Filling yarns are off-square to the warp ends.

3.1.3 Bow Filling yarns lie in an arc across the width of the fabric.

3.1.4 Creases A ridge in the fabric caused by a fold or wrinkle being placed under pressure.

3.1.5 Defects A substandard area in a fabric.

1. www.ipc.org

2. www.astm.org

3. www.iso.ch

4. www.ncsl-h9.org

3.1.5.1 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.

3.1.5.2 Minor Defect A defect that is not likely to reduce materially the usability of the unit of product for its intended purpose.

3.1.5.3 Defect per Hundred Units

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

3.1.6 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.

**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.

3.1.6.1 Permittivity (Dielectric Constant) for Bulk Form E Glass The permittivity (dielectric constant) of bulk form E glass to be used for printed board applications, as a *reference only* value, is 7.1 @ 1 GHz, as measured by IPC-TM-650, Method 2.5.5.9.

3.1.7 End Missing A very small portion of the warp in the fabric that may have been broken in the pick-out of waste.

3.1.8 Feather Length Length of distance from last warp end to the end of the pick.

3.1.9 Fabric Finish Treatment of fabric to aid in compatibility with resins.

3.1.10 Fish Eye Small area of fabric which resists resin wetting and can be caused by the resin system, fabric or treatment.

3.1.11 Hollow Filament An individual filament within a glass yarn bundle that contains a longitudinal void.

3.1.12 Leno End Out Missing wrapper warp end from the edge of the fabric.

3.1.13 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.

3.1.14 Mark Heavy or light area in fabric due to excessive or less filling yarns.

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

3.1.14.2 Light Mark A filling defect extending across the width of the fabric containing two picks/inch less than the nominal count.