



Designation: D578/D578M – 23

Standard Specification for Glass Fiber Strands¹

This standard is issued under the fixed designation D578/D578M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers the requirements for continuous fiber and staple fiber glass strands, including single, plied and multiple wound. It also covers textured glass fiber yarns. This specification is intended to assist ultimate users by designating the general nomenclature for the strand products that are generally manufactured in the glass fiber industry.

1.2 Glass fibers are produced having various compositions. General applications are identified by means of a letter designation. The letter designation represents a family of glasses that have provided acceptable performance to the end-user in the intended application. For example, the composition limits stated for E-Glass in this specification representing the glass fiber family for general and most electrical applications is designated by the letter *E*. Military specifications, such as, MIL-R-60346, recognize the composition limits described in this specification as meeting the respective requirements for E-Glass strands used in reinforced plastic structure applications.

1.3 Glass fiber strands have a variety of general uses under specific conditions, such as high physical or chemical stress, high moisture, high temperature, or electrical environments. Property requirements under specific conditions are agreed upon between the purchaser and the supplier. Electrical property requirements vary with specific end-use applications. For printed circuit board applications, other requirements may be needed such as the use of Institute for Interconnecting and Packaging Electronic Circuits (IPC) Specification EG 4412 A for finished fabric woven from E-Glass for printed circuit boards, or Specification MIL-P-13949 for printed wiring boards applicable to glass fabric base.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each

system shall be used independently of the other. Combining values from the two systems will result in non-conformance with the standard.

1.5 This specification is one of a series to provide a substitute for Military Specifications: MIL-Y-1140 Yarn, Cord, Sleeving, Cloth and Tape-Glass; and MIL-C-9084 Cloth, Glass Finished for Resin Laminates.

1.6 Additional ASTM specifications in this series have been drafted and appear in current editions of the *Annual Book of ASTM Standards*. These include finished glass fabrics, unfinished glass fabrics, glass tapes, glass sleeveings, glass cords, glass sewing threads, and finished laminates made from finished glass fabrics.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- D123 Terminology Relating to Textiles
- D1423/D1423M Test Method for Twist in Yarns by Direct-Counting
- D1907/D1907M Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
- D2256/D2256M Test Method for Tensile Properties of Yarns by the Single-Strand Method
- D2258/D2258M Practice for Sampling Yarn for Testing
- D2904 Practice for Interlaboratory Testing of a Textile Test

¹ This specification is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.18 on Glass Fiber and its Products.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



Method that Produces Normally Distributed Data (Withdrawn 2008)³

D2906 Practice for Statements on Precision and Bias for Textiles (Withdrawn 2008)³

D4963/D4963M Test Method for Ignition Loss of Glass Fiber Strands and Fabrics

D7018/D7018M Terminology Relating to Glass Fiber and Its Products (Withdrawn 2021)³

2.2 ASTM Adjunct:

TEX-PAC⁴

2.3 ANSI Standard:

ANSI/ASQC Z1.4 Sampling Procedures for Inspection by Attributes⁵

2.4 Military Standards and Specifications:

MIL-P-13949 Specification for Plastic Sheet, Laminated, Metal-Clad For Printed Wiring Board⁶

MIL-R-60346 Roving, Glass Fibrous (for Prepreg Tape, Rovings, Filament Winding, and Pultrusion Applications)⁶

MIL-G-55636B Glass Cloth, Resin Preimpregnated (B-STAGE) (For Multilayer Printed Wiring Boards) (Superseded by MIL-P-13949 1981)⁶

MIL-Y-1140 Specification for Yarn, Cord, Sleeveing, Cloth, and Tape-Glass⁶

MIL-C-9084 Specification for Cloth Finished for Resin Laminates (Cancelled 1999)⁶

2.5 Institute for Interconnecting and Packaging Circuits Standard:

IPC EG 4412 A Specification for Finished Fabric Woven from E-Glass for Printed Circuit Boards⁷

3. Terminology

3.1 For all terminology related to D13.18, Glass Fiber and Its Products, see Terminology D7018/D7018M.

3.1.1 The following terms are relevant to this standard: atmosphere for testing textiles, chopped strand, continuous filament yarn, roving, staple glass yarn, strand, textured glass yarn.

3.2 For all other terminology related to textiles, refer to Terminology D123.

4. Classification of Glass Fiber

4.1 “C” Glass—A family of glasses composed primarily of the oxides of sodium, calcium, boron, aluminum, and silicon with a certified chemical composition which conforms to an applicable material specification and which produces good acid resistance (excluding HF).

4.2 “E” Glass—A family of glasses composed primarily of the oxides of calcium, aluminum, and silicon, which has the following certified chemical compositions.

4.2.1 The following certified chemical composition applies to E-glass fiber yarn products for printed circuit boards and aerospace.

Chemical	% by Weight
B ₂ O ₃	5 to 10
CaO	16 to 25
Al ₂ O ₃	12 to 16
SiO ₂	52 to 56
MgO	0 to 5
Na ₂ O and K ₂ O	0 to 2
TiO ₂	0 to 0.8
Fe ₂ O ₃	0.05 to 0.4
Fluoride	0 to 1.0

4.2.2 The following certified chemical composition applies to E-glass fiber products used in general applications.

Chemical	% by Weight
B ₂ O ₃	0 to 10
CaO and MgO	16 to 30
Al ₂ O ₃	12 to 16
SiO ₂	52 to 62
Total alkali metal oxides	0 to 2
TiO ₂	0 to 1.5
Fe ₂ O ₃	0.05 to 0.8
Fluoride	0 to 1.0

4.2.3 Electrical applications include a wide variety of uses. The composition in 4.2.1 is identical to IPC EG 4412 A for printed circuit boards and to MIL-G-55636B. Additionally, such fiber glass products often are specified for aerospace applications. Products covered by the composition range in 4.2.2 are used in general applications, such as power company equipment, high voltage devices, residential electric boxes, third rail covers, high voltage standoff rods, electrical pultrusion products, light poles, electrical tool covers, and electrical tape. Other applications include roofing, flooring, filtration, panel rovings, gun rovings, smc rovings, chopped strand reinforcements, paper yarns, and industrial yarns.

4.2.4 The nomenclature “E-CR-Glass” is used for boron-free modified E-Glass compositions for improved resistance to corrosion by most acids.

4.3 “S” Glass—A family of glasses composed primarily of the oxides of magnesium, aluminum, and silicon with a certified chemical composition which conforms to an applicable material specification and which produces high mechanical strength.

4.4 “R” Glass—A family of boron-free glasses composed primarily of the oxides of silicon, aluminum, calcium and magnesium, such glasses possessing excellent acid and water durability as well as specific strength and specific modulus levels significantly greater than E glass.

DESCRIPTION OF GLASS STRANDS

5. General

5.1 The construction of glass strands is described in a series of two to four segments of alphabetical or numerical characters.

NOTE 1—In glass fiber strand designations, and in the conversion of

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ PC programs on floppy disk for analyzing Committee D13 interlaboratory data are available through ASTM. Request [ADJD2904](http://www.astm.org/ADJD2904).

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁶ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

⁷ Available from Institute for Interconnecting and Packaging Electronic Circuits, 7380 N. Lincoln Ave., Lincolnwood, IL 60646.