



Designation: E1434 – 00(Reapproved 2013)

Standard Guide for Recording Mechanical Test Data of Fiber-Reinforced Composite Materials in Databases¹

This standard is issued under the fixed designation E1434; 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.

1. Scope

1.1 This guide provides a common format for mechanical test data for composite materials for two purposes: (1) to establish data reporting requirements for test methods and (2) to provide information for the design of material property databases. This guide should be used in combination with Guide E1309 which provides similar information to identify the composite material tested.

1.2 These guidelines are specific to mechanical tests of high-modulus fiber-reinforced composite materials. Types of tests considered in this guide include tension, compression, shear, flexure, open/filled hole,² bearing, fracture toughness, and fatigue. The ASTM standards for which this guide was developed are listed in 2.1. The guidelines may also be useful for additional tests or materials.

1.3 This guide is the second part of a modular approach for which the first part is Guide E1309. Guide E1309 serves to identify the material, and this guide serves to describe mechanical testing procedures and variables and to record results. The interaction of this guide with Guide E1309 is emphasized by the common numbering of data elements. Data Elements A1 through G13 are included in Guide E1309 and numbering data elements in this guide begins with H1.

1.4 This guide with Guide E1309 may be referenced by the data-reporting section of a test method to provide common data-reporting requirements for the types of tests listed in 1.2.

1.5 From this information and Guide E1309, the database designer should be able to construct the data dictionary preparatory to developing a database schema.

1.6 Data elements in this guide are relevant to test data, data as obtained in the test laboratory and historically recorded in lab notebooks. Property data, data which have been analyzed

and reviewed, require a different level of data elements. Data elements for property data are provided in Annex A1.

2. Referenced Documents

2.1 *ASTM Standards*:³

- D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D3039/D3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials
- D3410/D3410M Test Method for Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading
- D3518/D3518M Test Method for In-Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a $\pm 45^\circ$ Laminate
- D3552 Test Method for Tensile Properties of Fiber Reinforced Metal Matrix Composites
- D3878 Terminology for Composite Materials
- D5229/D5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials
- D5379/D5379M Test Method for Shear Properties of Composite Materials by the V-Notched Beam Method
- D5449/D5449M Test Method for Transverse Compressive Properties of Hoop Wound Polymer Matrix Composite Cylinders
- D5528 Test Method for Mode I Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites
- D5961/D5961M Test Method for Bearing Response of Polymer Matrix Composite Laminates
- D6115 Test Method for Mode I Fatigue Delamination Growth Onset of Unidirectional Fiber-Reinforced Polymer Matrix Composites
- E6 Terminology Relating to Methods of Mechanical Testing
- E111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus

¹ This guide is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.01 on Editorial and Resource Standards.

Current edition approved May 1, 2013. Published May 2013. Originally approved in 1991. Last previous edition approved in 2006 as E1434 – 00 (2006). DOI: 10.1520/E1434-00R13.

² Documentation requirements for filled-hole tests were based on open-hole tests with the addition of fastener identification and application information.

³ 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.

E1309 Guide for Identification of Fiber-Reinforced Polymer-Matrix Composite Materials in Databases

E1013 Terminology Relating to Computerized Systems (Withdrawn 2000)⁴

E1443 Terminology Relating to Building and Accessing Material and Chemical Databases (Withdrawn 2000)⁴

E1484 Guide for Formatting and Use of Material and Chemical Property Data and Database Quality Indicators (Withdrawn 2000)⁴

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System

2.2 Other Standards:

ANSI X3.172–1996 Information Technology—American National Standard Dictionary of Information Technology (ANSDIT)

CODATA A Glossary of Terms Relating to Data, Data Capture, Data Manipulation, and Databases, *CODATA Bulletin*, Vol 23, Nos. 1–2, Jan.–June 1991⁵

ISO 8601 Data Elements and Interchange Formats—Information Interchange—Representation of Dates and Times⁵

Recommended Method SRM 11R-94 SACMA Recommended Method for Environmental Conditioning of Composite Test Laminates⁶

Recommended Method SRM 1–88 SACMA Recommended Method for Compressive Properties of Oriented Fiber-Resin Composites⁶

3. Terminology

3.1 *Definitions*—Terminology in accordance with Terminologies **D3878** and **E1443** shall be used where applicable.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *composite material*—a substance consisting of two or more materials, insoluble in one another, which are combined to form a useful engineering material possessing certain properties not possessed by the constituents.

3.2.1.1 *Discussion*—A composite material is inherently inhomogeneous on a microscopic scale but can often be assumed to be homogeneous on a macroscopic scale for certain engineering applications. The constituents of a composite retain their identities; they do not dissolve or otherwise merge completely into each other, although they act in concert.

3.2.2 *data dictionary*—a collection of the names of all data items used in a software system together with relevant properties of those items; for example, length of data item, mode of representation, and so forth. **(CODATA)**

3.2.3 *data element*—one individual piece of information used in describing a material or to record test results, for example, a variable name, test parameter, and so forth.

3.2.4 *database schema*—in a conceptual schema language, the definition of the representation forms and structure of a

⁴ The last approved version of this historical standard is referenced on www.astm.org.

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

⁶ Suppliers of Advanced Composite Materials, 1600 Wilson Blvd., Suite 901, Arlington, VA 22209.

database for the possible collection of all sentences that are in the conceptual schema and in the information base, including manipulation aspects of these forms. **(ANSI X3.172)**

3.2.5 *essential data element*—a data element in a record that must be completed to make the record meaningful in accordance with the pertinent guidelines or standard. **(E1443)**

3.2.5.1 *Discussion*—Data elements are considered essential if they are required to make a comparison of property data from different sources meaningful. A comparison of data from different sources may still be possible if essential information is omitted, but the value of the comparison may be greatly reduced.

3.2.6 *value set*—an open listing of representative acceptable strings that could be included in a particular field of a record. **(E1443)**

3.2.6.1 *Discussion*—A closed listing of such strings is called a domain or category set.

3.3 Other relevant terminology can be found in Terminologies **E6** and **E1013**.

4. Significance and Use

4.1 This guide provides recommended standard formats for the computerization of mechanical test data for a range of test methods for high-modulus fiber-reinforced composite materials. The types of mechanical tests considered are tension, compression, shear, flexure, open/filled hole, bearing, fracture toughness, and fatigue. The ASTM standards for which this guide was developed are listed in **2.1**. The recommended formats are not limited in use to these test methods. There are other test methods for which these recommended formats may be useful.

4.2 Comparison of data from various sources will be most meaningful if all of the elements are available.

4.3 The intent is to provide sufficient detail that values are known for the testing variables that may influence the results. The motivation for this guide is the steadily increasing use of computerized databases. However, this guide is equally appropriate for data stored in a hard-copy form.

4.4 This format is for mechanical test data for high-modulus fiber-reinforced composites only. It does not include the recommended material description or the presentation of other specific types of test data (such as fracture toughness test results). These items are covered by separate formats to be referenced in material specifications or other test standards.

5. Data Reporting

5.1 This guide is intended to provide common data-reporting requirements for the documents listed in **1.2**. Each document will reference this guide and identify any usage specific to that document in the data-reporting section. For example, Test Method **D3410/D3410M** requires that the transition strain be reported as the progressive damage parameter. These requirements do not mean that the information must be reported separately for each specimen. Any data elements that are the same for a series of specimens may be reported once for the entire series, as long as it is clearly indicated that they apply to all specimens.

TABLE 1 Data Elements for Mechanical Test Data of Fiber-Reinforced Composite Materials

NOTE 1—ET = Essential for Test validation,
 EM = Essential for Material traceability,
 RT = Recommended for Test validity,
 RM = Recommended for Material traceability, and
 O = Optional.

No.	Data Element Name of Description	Data Type or Standard Data Element Set	Tension	Compression	Shear	Flexure	Open/Filled Hole	Bearing	Fracture Toughness	Fatigue	Value Sets or Units
H. Test Method Block											
H1	Test property class	STRING					— O —				Table 2
H2	Test method	[Test_Method]					— ET —				
H3	Test personnel	[Person]					— ET —				
H4	Test facility	[Organization]					— ET —				
H5	Test facility address	[Address]					— ET —				
H6	Type of test	STRING					— RT —				Table 3
H7	Property form type	STRING					— O —				Table 4
I. Specimen Preparation Block											
Specimen Preparation Subblock											
I1	Specimen orientation	REAL	ET	ET	ET	ET	ET	ET	ET	ET	degrees
I2	Specimen labeling scheme	STRING	ET	ET	ET	ET	ET	ET	ET	ET	
I3	Specimen extraction technique	STRING	ET	ET	ET	ET	ET	ET	ET	ET	Table 5
I4	Coupon layout cutting plan reference	STRING	RM	RM	RM	RM	RM	RM	RM	RM	
I5	Specimen labeling method	STRING	RM	RM	RM	RM	RM	RM	RM	RM	
I6	Material sampling method	STRING	EM	EM	EM	EM	EM	EM	EM	EM	Table 6
I7	Ply count	INTEGER	RM	RM	RM	RM	RM	RM	RM	RM	
I8	Specimen geometry	STRING	RT	RT	RT	RT	RT	RT	RT	RT	Table 7
I9	Nominal specimen thickness	REAL	RT	RT	RT	RT	RT	RT	RT	RT	mm (in.)
I10	Nominal specimen width	REAL	RT	RT	RT	RT	RT	RT	RT	RT	mm (in.)
I11	Nominal specimen overall length	REAL	RT	RT	RT	RT	RT	RT	RT	RT	mm (in.)
I12	Nominal specimen gage length	REAL	RT	RT	RT	RT	-	-	-	RT	mm (in.)
I13	Nominal specimen outer diameter	REAL	ET	ET	ET	.	.	.	.	.	mm (in.)
I14	Nominal specimen inner diameter	REAL	ET	ET	ET	.	.	.	.	.	mm (in.)
I15	Nominal wall thickness	REAL	ET	ET	ET	.	.	.	.	.	mm (in.)
I16	Nominal specimen cross-sectional area	REAL	RT	RT	RT	RT	.	.	.	.	mm ² (in. ²)
I17	Nominal specimen notch radius (V-notch shear)	REAL	-	-	ET	-	-	-	-	-	mm (in.)
I18	Nominal specimen notch angle (V-notch shear)	REAL	-	-	ET	-	-	-	-	-	degrees
I19	Nominal specimen gage section width (V-notch shear)	REAL	-	-	ET	-	-	-	-	-	mm (in.)
I20	Nominal hole diameter	REAL	-	-	-	-	ET	ET	-	-	mm (in.)
I21	Nominal width to diameter ratio	REAL	-	-	-	-	ET	-	-	-	
I22	Nominal thickness to diameter ratio	REAL	-	-	-	-	ET	ET	-	-	
I23	Nominal edge distance ratio	REAL	-	-	-	-	-	ET	-	-	
I24	Nominal pitch distance ratio	REAL	-	-	-	-	-	ET	-	-	
I25	Nominal bypass ratio	REAL	-	-	-	-	-	ET	-	-	
I26	Sandwich core common name	STRING	-	ET	-	-	-	-	-	-	Table 8
I27	Sandwich core type	STRING	-	ET	-	-	-	-	-	-	
I28	Sandwich core material	STRING	-	ET	-	-	-	-	-	-	
I29	Sandwich core manufacturer	STRING	-	ET	-	-	-	-	-	-	
I30	Sandwich core lot number	STRING	-	RT	-	-	-	-	-	-	
I31	Sandwich core cell size	REAL	-	ET	-	-	-	-	-	-	mm (in.)
I32	Sandwich core nominal density	REAL	-	ET	-	-	-	-	-	-	g/cm ³
I33	Sandwich core ribbon thickness	REAL	-	RT	-	-	-	-	-	-	mm (in.)
I34	Adhesive common name	STRING	-	ET	-	-	-	-	-	-	
I35	Adhesive chemical family	STRING	-	ET	-	-	-	-	-	-	
I36	Adhesive manufacturer	STRING	-	ET	-	-	-	-	-	-	
I37	Adhesive lot number	STRING	-	RT	-	-	-	-	-	-	
I38	Adhesive date of manufacture	STRING	-	RT	-	-	-	-	-	-	
I39	Adhesive scrim common name	STRING	-	RT	-	-	-	-	-	-	
I40	Adhesive scrim fabric style	STRING	-	RT	-	-	-	-	-	-	
I41	Adhesive scrim sizing	STRING	-	RT	-	-	-	-	-	-	
I42	Adhesive surface preparation	STRING	-	RT	-	-	-	-	-	-	
NDE Subblock											
I43	NDE technique	STRING					— RM —				Table 9
I44	NDE material form	STRING					— RM —				Table 10
I45	NDE results	STRING					— RM —				Table 11
I46	NDE criteria reference	STRING					— RM —				
I47	NDE report	STRING					— RM —				
Tab/Hinge/Loading-Block Subblock											
I48	Tab/hinge/loading-block material	STRING	ET	ET	ET	-	RT	ET	ET	ET	
I49	Tab/hinge/loading-block adhesive	STRING	ET	ET	ET	-	RT	ET	ET	ET	
I50	Nominal tab orientation	REAL	ET	ET	ET	-	RT	ET	-	ET	degrees
I51	Nominal tab thickness	REAL	ET	ET	ET	-	RT	ET	-	ET	mm (in.)