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Standard Guide for Recording Mechanical Test Data of Fiber-Reinforced Composite Materials in Databases[1]

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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 E 1309 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 E 1309. Guide E 1309 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 E 1309 is emphasized by the common numbering of data elements. Data Elements A1 through G13 are included in Guide E 1309 and numbering data elements in this guide begins with H1.

1.4 This guide with Guide E 1309 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 E 1309, 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:*

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials[3]

D 2344 Test Method for Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short-Beam Method[4]

D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials[4]

D 3410/D 3410M Test Method for Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading[4]

D 3479/D 3479M Test Method for Tension-Tension Fatigue of Polymer Matrix Composite Materials[4]

D 3518/D 3518M Practice for In-Plane Shear Stress-Strain Response of Unidirectional Polymer Matrix Composite Materials by Tensile Test of a ±45° Laminate[4]

D 3552/D 3552M Test Method for Tensile Properties of Fiber-Reinforced Metal Matrix Composites[4]

D 3878 Terminology of Composite Materials[4]

D 4255/D 4255M Guide for Testing In-Plane Shear Properties of Composite Laminates[4]

D 5229/D 5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials[4]

D 5379/D 5379M Test Method for Shear Properties of Composite Materials by the V-Notched Beam Method[4]

D 5448/D 5448M Test Method for In-Plane Shear Properties of Hoop Wound Polymer Matrix Composite Cylinders[4]

D 5449/D 5449M Test Method for Transverse Compressive Properties of Hoop Wound Polymer Matrix Composite Cylinders[4]

D 5450/D 5450M Test Method for Transverse Tensile Properties of Hoop Wound Polymer Matrix Composite Cylinders[4]

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

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 15.03.

D 5467 Test Method for Compressive Properties of Unidirectional Polymer Matrix Composites Using a Sandwich Beam[4]

D 5528 Test Method for Mode I Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites[4]

D 5766/D 5766M Test Method for Open Hole Tensile Strength of Polymer Matrix Composite Laminates[4]

D 5961/D 5961M Test Method for Bearing Response of Polymer Matrix Composite Laminates[4]

D 6115 Test Method for Mode I Fatigue Delamination Growth Onset of Unidirectional Fiber-Reinforced Polymer Matrix Composites[4]

E 6 Terminology Relating to Methods of Mechanical Testing[5]

E 111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus[5]

E 1309 Guide for the Identification of Fiber-Reinforced Polymer-Matrix Composite Materials in Databases[4]

E 1471 Guide for the Identification of Fibers, Fillers, and Core Materials in Computerized Material Property Databases[4]

E 1013 Terminology Relating to Computerized Systems[6]

E 1443 Terminology Relating to Building and Accessing Material and Chemical Databases[6]

E 1484 Guide for Formatting and Use of Material and Chemical Property Data and Database Quality Indicators[6]

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System[7]

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 1991[8]

ISO 8601 Data Elements and Interchange Formats—Information Interchange—Representation of Dates and Times[8]

Recommended Method SRM 11R-94 SACMA Recommended Method for Environmental Conditioning of Composite Test Laminates[9]

Recommended Method SRM 1–88 SACMA Recommended Method for Compressive Properties of Oriented Fiber-Resin Composites[9]

3. Terminology

3.1 *Definitions*—Terminology in accordance with Terminologies D 3878 and E 1443 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 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. **(E 1443)**

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. **(E 1443)**

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 E 6 and E 1013.

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

[5] *Annual Book of ASTM Standards*, Vol 03.01.
[6] *Annual Book of ASTM Standards*, Vol 14.01.
[7] *Annual Book of ASTM Standards*, Vol 14.04.
[8] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.
[9] Suppliers of Advanced Composite Materials, 1600 Wilson Blvd., Suite 901, Arlington, VA 22209.

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 D 3410 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.

5.2 The levels of requirement defined in Section 8 and identified in Table 1 apply to the data reporting for the appropriate test type: tension, compression, shear, flexure, open/filled hole, bearing, fracture toughness, and fatigue. The cost of acquiring and storing the data documentation is recognized. Less extensive data reporting requirements may be established for a given program or purpose upon agreement of the parties involved.

5.3 In some cases, a data element may be considered essential or required depending on the value in another data element. For example, if Data Element H13, the method of calculating modulus, is "Tangent," then Data Element H15, the initial strain for the modulus calculation is required (ET). In this case, Data element H16, the final strain for the modulus calculation, is not required. This dependence is shown in Table 2 by placing the number of the triggering data element, in parentheses, in the requirement level column of the dependent element. The dependent data elements are required for database design.

5.4 In addition, for data reporting, some data elements are essential only if measured. For example, strain-to-failure in a tension test can be reported only if an extensometer or strain gage was used. If strain-to-failure was measured, it should be reported.

5.5 The information that is considered essential may not always be available. For example, strain-to-failure cannot be obtained if the strain instrumentation is removed before failure. Footnote data elements, Data Elements H34 and K64, are provided to document this type of situation. Not all of the data elements included in the recommended format are appropriate for all tests, For example, there is a wide range of information applicable to the shear test methods, cited in 2.1.1, which is not appropriate for tension or compression tests.

5.6 While some test methods require the reporting of mean, standard deviation, and coefficient of variation, often the results for individual specimens are needed. This format provides for both types of data reports. Data Element Blocks F through J can be used to describe the test results for an individual specimen. Data Element Block K can be used to describe the results for an ensemble of specimens.

6. Database Design

6.1 This guide defines the principal elements of information that are considered worth recording and storing permanently in computerized data storage systems from which machine-readable databases will be developed. These are not intended to be requirements of any specific database, but if available, are likely to be valuable to engineers or material specialists building databases for various applications.

6.2 It is recognized that many databases are prepared for specific applications, and individual database builders may elect to omit certain pieces of information considered to be of no value for that specific application. However, there are a certain minimum number of data elements considered essential to any database, without which the user will not have sufficient information to interpret the data reasonably. In the recommended standard format, these data elements are indicated by levels of requirement of ET or EM as defined in Section 8. Data elements that are considered essential depending on the value of another data element are generally considered essential for database design.

6.3 The presentation of this format does not represent a requirement that all of the elements of information included in the recommendation must be included in every database. Rather it is a guide as to those elements of information recommended for inclusion in all databases; that fact should not discourage database builders and users from proceeding so long as the minimum basic information is included (based on the level or requirement). Compared to the formats for recording test data for metals, there are many more data elements, and more data elements are identified as essential. This relatively large number of data elements is due to the complexity of the materials and the test methods. These data elements represent information that may influence the results of the test or identify potential problem areas when considering a material for a specific application. These requirements do not mean that separate records for individual specimens must include all data elements. A database specific to a project or to common practice within an organization may be structured so that values for data elements that are the same for a group of specimens need only be entered once, as long as it is clearly indicated that they apply to all specimens in the group.

6.4 It is not uncommon for one or more elements of essential information to be unavailable, as noted in 5.3. It may be appropriate for databases to differentiate between zero values and null entries in data elements that are not used for a given test. Also, it is recognized that in some individual cases, additional elements of information of value to users of a database may be available. In those cases, database builders are encouraged to include them as well as the elements in the recommended format.

6.5 Depending on the database application, a database designer may wish to include individual specimen results or the statistical parameters summarizing a group of results, or both. Individual specimen results are described using the data elements in Data Blocks Q, S, T, U. The statistical parameters are described using the data elements in Data Block V. Both approaches used the data elements in Data Blocks K-P and R. This format is intended to be flexible enough that the database designer has the latitude to define the approach for a database for a specific purpose.

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						

TABLE 1 *Continued*

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
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.)
I52	Nominal tab bevel angle	REAL	ET	ET	ET	-	RT	ET	-	ET	degrees
I53	Nominal tab length	REAL	RT	RT	RT	-	RT	RT	-	RT	mm (in.)
I54	Tab adhesive curing temperature	REAL	RT	RT	RT	-	RT	RT	-	RT	C (F)
I55	Tab adhesive curing time	REAL	RT	RT	RT	-	RT	RT	-	RT	min
	J. Specimen Conditioning Block										
J1	Specimen conditioning method	[Test_Method]					— ET —				
J2	(Number of conditioning steps)	INTEGER					— ET —				
J3	Conditioning temperature	REAL					— ET —				C (F)
J4	Conditioning parameter	STRING					— ET —				
J5	Conditioning parameter value	REAL					— ET —				
J6	Conditioning time	REAL					— ET —				h
J7	Conditioning environment	STRING					— ET —				Table 12
J8	Traveler geometry	STRING					— ET —				
J9	Equilibrium condition	STRING					— ET —				Table 13
	K. Test Equipment Block Test Machine Subblock										
K1	Type of fixture (grips)	STRING	ET	ET	ET	ET	ET	ET	ET	ET	Table 14
K2	Test machine identification	[Test_Equipment]	RT	RT	RT	RT	RT	RT	RT	RT	
K3	Actuator type	STRING	RT	RT	RT	RT	RT	RT	RT	RT	Table 15
K4	Fixture identification	STRING	RT	RT	RT	RT	RT	RT	RT	RT	
K5	Grip length	REAL	RT	RT	RT	-	RT	RT	RT	RT	mm (in.)
K6	Wedge angle	REAL	RT	RT	RT	-	RT	RT	RT	RT	degrees
K7	Gripping surface	STRING	RT	RT	RT	-	RT	RT	RT	RT	Table 16
K8	Potting material identification	STRING	ET	ET	ET	-	-	-	-	-	
K9	Radius of potting material bead	REAL	ET	ET	ET	-	-	-	-	-	mm (in.)
K10	Potting material cure temperature	REAL	ET	ET	ET	-	-	-	-	-	C (F)
K11	Span-to-depth ratio	REAL	-	-	ET	ET	-	-	-	-	
K12	Load-span to support-span ratio, nominal	STRING	-	-	-	ET	-	-	-	-	
K13	Radius of supports	REAL	-	-	-	ET	-	-	-	-	mm (in.)
K14	Radius of loading noses	REAL	-	-	-	ET	-	-	-	-	mm (in.)
K15	Equipment description	STRING	RT	RT	RT	RT	RT	RT	RT	RT	
K16	Test machine calibration	[Calibration]	RT	RT	RT	RT	RT	RT	RT	RT	
K17	Fastener or pin type	STRING	-	-	-	-	ET	ET	-	-	
K18	Fastener or pin material	STRING	-	-	-	-	ET	ET	-	-	
K19	Fastener or pin diameter	REAL	-	-	-	-	ET	ET	-	-	mm (in.)
K20	Pin hardness	STRING	-	-	-	-	-	RT	-	-	
K21	Pin surface roughness	REAL	-	-	-	-	-	RT	-	-	
K22	Hole clearance	REAL	-	-	-	-	ET	ET	-	-	mm (in.)
K23	Countersink angle	REAL	-	-	-	-	ET	ET	-	-	degrees
K24	Countersink depth	REAL	-	-	-	-	ET	ET	-	-	mm (in.)
K25	Grommet	STRING	-	-	-	-	-	ET	-	-	
K26	Mating material identification	STRING	-	-	-	-	-	ET	-	-	
K27	Mating material width	REAL	-	-	-	-	-	ET	-	-	mm (in.)
K28	Mating material thickness	REAL	-	-	-	-	-	ET	-	-	mm (in.)
K29	Mating material lay-up	STRING	-	-	-	-	-	ET	-	-	
K30	Number of fasteners	INTEGER	-	-	-	-	-	ET	-	-	
K31	Fastener or pin and coupon cleaning method	STRING	-	-	-	-	-	ET	-	-	
	L. Transducer Block										
L1	Transducer type	STRING	ET	ET	ET	-	-	ET	-	ET	Table 17
L2	Transducer location on specimen	STRING	ET	ET	ET	-	-	ET	-	ET	Table 18
L3	Extensometer class	STRING	ET	ET	ET	-	-	RT	-	ET	
L4	Transducer manufacturer	STRING	RT	RT	RT	-	-	RT	-	RT	
L5	Transducer model number	STRING	RT	RT	RT	-	-	RT	-	RT	
L6	Timing of transducer application	STRING	O	O	O	-	-	RT	-	0	
L7	Transducer cure temperature	REAL	RT	RT	RT	-	-	RT	-	RT	C (F)
L8	Transducer cure time	REAL	RT	RT	RT	-	-	RT	-	RT	min
L9	Transducer calibration	[Calibration]	RT	RT	RT	-	-	RT	-	RT	
L10	Transducer lead-wire resistance correction	REAL	RT	RT	RT	-	-	RT	-	RT	
L11	Measured extensometer gage length	REAL	RT	RT	RT	-	-	RT	-	RT	mm (in.)
	M. Specimen Geometry Block										
M1	Number of specimens	INTEGER	ET	ET	ET	ET	ET	ET	ET	ET	
M2	Specimen label	STRING	ET	ET	ET	ET	ET	ET	ET	ET	
M3	Coupons meets test method requirements?	LOGICAL	ET	ET	ET	ET	ET	ET	ET	ET	

TABLE 1 *Continued*

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
M4	Measured specimen thickness	REAL	ET	ET	ET	ET	ET	ET	ET	ET	mm (in.)
M5	Maximum thickness variation	REAL	-	-	-	-	-	-	ET	ET	mm (in.)
M6	Measured specimen width	REAL	ET	ET	ET	ET	ET	ET	ET	ET	mm (in.)
M7	Measured specimen reinforcement volume	REAL	O	O	-	-	O	-	-	-	vol%
M8	Measured specimen overall length	REAL	RT	RT	RT	RT	RT	ET	-	RT	mm (in.)
M9	Measured specimen gage (span) length	REAL	ET	RT	RT	RT	-	-	-	ET	mm (in.)
M10	Measured specimen outer diameter	REAL	ET	ET	ET	-	-	-	-	-	mm (in.)
M11	Measured specimen inner diameter	REAL	ET	ET	ET	-	-	-	-	-	mm (in.)
M12	Measured wall thickness	REAL	ET	ET	ET	-	-	-	-	-	mm (in.)
M13	Specimen minimum cross-sectional area	REAL	-	RT	RT	RT	-	-	-	RT	mm^2 ($in.^2$)
M14	Method of finding minimum cross-sectional area	STRING	-	RT	RT	RT	-	-	-	RT	Table 19
M15	Specimen notch radius (V-notch shear)	REAL	-	-	O	-	-	-	-	-	mm (in.)
M16	Specimen notch angle (V-notch shear)	REAL	-	-	O	-	-	-	-	-	degrees
M17	Specimen gage section width (V-notch shear)	REAL	-	-	O	-	-	-	-	-	mm (in.)
M18	Measured sandwich thickness	REAL	-	ET	-	-	-	-	-	-	mm (in.)
M19	Measured core thickness	REAL	-	ET	-	-	-	-	-	-	mm (in.)
M20	Measured opposite facesheet thickness	REAL	-	ET	-	-	-	-	-	-	mm (in.)
M21	Specimen hole diameter	REAL	-	-	-	-	ET	ET	-	-	mm (in.)
M22	Specimen width to diameter ratio	REAL	-	-	-	-	ET	-	-	-	
M23	Specimen thickness to diameter ratio	REAL	-	-	-	-	ET	ET	-	-	
M24	Specimen edge distance ratio	REAL	-	-	-	-	-	ET	-	-	
M25	Specimen pitch distance ratio	REAL	-	-	-	-	-	ET	-	-	
M26	Measured fastener or pin diameter	REAL	-	-	-	-	-	ET	-	-	mm (in.)
M27	Insert type	STRING	-	-	-	-	-	-	ET	ET	
M28	Insert thickness	REAL	-	-	-	-	-	-	ET	ET	mm (in.)
M29	Initial delamination length	REAL	-	-	-	-	-	-	-	ET	mm (in.)
	N. Test Environment Block										
N1	Date of test	DATE					— ET —				
N2	Test environment	STRING					— ET —				Table 20
N3	Test temperature	REAL					— ET —				C (F)
N4	Test humidity	REAL					— ET —				%
N5	Temperature of testing laboratory	REAL					— RT—				C (F)
N6	Relative humidity of testing laboratory	REAL					— RT—				%
N7	Soak time at test conditions	REAL					— RT —				min
N8	Moisture content before test	REAL					— RT —				%
N9	Moisture content after test	REAL					— RT —				%
N10	Nominal moisture state	STRING					— O —				Table 21
	O. Loading Block										
O1	Procedure for displacement/strain application	REAL	ET	ET	ET	ET	ET	ET	ET	ET	Table 22
O2	Rate of displacement/strain application	REAL	ET	ET	ET	ET	ET	ET	ET	-	
O3	Fixture torque-up	REAL	-	ET	-	-	-	-	-	-	(in.-lb)
O4	Jaw pressure	REAL	RT	RT	RT	-	RT	RT	RT	RT	N (lb)
O5	Preload	REAL	RT	RT	RT	RT	RT	RT	-	-	N (lb)
O6	Data acquisition method	STRING	RT	RT	RT	RT	RT	RT	RT	RT	Table 23
O7	Data acquisition sampling rate	REAL	RT	RT	RT	RT	RT	RT	RT	RT	
O8	Fastener torque	REAL	-	-	-	-	ET	ET	-	-	(in.-lb)
O9	Fatigue test control parameter	STRING	-	-	-	-	-	-	-	ET	Table 24
O10	Fatigue frequency	REAL	-	-	-	-	-	-	-	ET	
O11	Fatigue waveform	STRING	-	-	-	-	-	-	-	ET	Table 25
O12	Loading parameter ratio	REAL	-	-	-	-	-	-	-	ET	
O13	Mean load	REAL	-	-	-	-	-	-	-	ET	N (lb)
O14	Mean stress	REAL	-	-	-	-	-	-	-	ET	MPa (ksi)
O15	Mean strain	REAL	-	-	-	-	-	-	-	ET	με
O16	Average number of fatigue transition loading	REAL	-	-	-	-	-	-	-	ET	
O17	Loading procedure	STRING	-	-	-	-	-	-	-	ET	
O18	Strength of control specimens—average	REAL	-	-	-	-	-	-	-	ET	MPa (ksi)
O19	Strength of control specimens—standard deviation	REAL	-	-	-	-	-	-	-	ET	MPa (ksi)
O20	Strength of control specimens—coefficient of variation	REAL	-	-	-	-	-	-	-	ET	%
O21	Strain-to-failure of control specimens—average	REAL	-	-	-	-	-	-	-	ET	με
O22	Strain-to-failure of control specimens—standard deviation	REAL	-	-	-	-	-	-	-	ET	με
O23	Strain-to-failure of control specimens—coefficient of variation	REAL	-	-	-	-	-	-	-	ET	%
O24	Maximum cyclic displacement	REAL	-	-	-	-	-	-	-	ET	mm (in.)

TABLE 1 *Continued*

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
				P. Raw Data Block Failure Subblock							
P1	Strength	REAL	ET	ET	ET	ET	ET	ET	-	-	MPa (ksi)
P2	Strain offset	REAL	-	-	ET	ET	-	ET	-	-	%
P3	Offset strength	REAL	-	-	ET	ET	-	ET	-	-	MPa (ksi)
P4	Method of linear fit for offset strength	STRING	-	-	-	-	-	ET	-	-	
P5	Initial strain for offset fit	REAL	-	-	-	-	-	ET	-	-	με
P6	Final strain for offset fit	REAL	-	-	-	-	-	ET	-	-	με
P7	Initial stress for offset fit	REAL	-	-	-	-	-	ET	-	-	MPa (ksi)
P8	Final stress for offset fit	REAL	-	-	-	-	-	ET	-	-	MPa (ksi)
P9	Initial peak strength	REAL	-	-	-	-	-	ET	-	-	MPa (ksi)
P10	Test truncated at 5 % shear strain	LOGICAL	-	-	ET	-	-	-	-	-	
P11	Maximum load	REAL	RT	RT	ET	RT	-	ET	RT	ET	N (lb)
P12	Maximum deflection	REAL	ET	-	-	-	-	-	-	-	mm (in.)
P13	Strain at failure	REAL	ET	ET	ET	ET	-	ET	-	ET	με
P14	Failure location	STRING	ET	ET	ET	ET	ET	ET	-	ET	Table 26
P15	Failure mode	STRING	ET	ET	ET	ET	ET	ET	-	ET	Table 27
				Modulus Subblock							
P16	Modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	GPa (Msi)
P17	Method of calculating modulus/stiffness	STRING	ET	ET	ET	ET	-	ET	-	-	Table 28
P18	Fitting procedure for modulus/stiffness calculation	STRING	ET	ET	ET	ET	-	ET	-	-	Table 29
P19	Initial strain for modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	με
P20	Final strain for modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	με
				Poisson's Ratio Subblock							
P21	Poisson's ratio value	REAL	ET	ET	-	-	-	-	-	-	
P22	Method of calculating Poisson's ratio	STRING	ET	ET	-	-	-	-	-	-	Table 27
P23	Fitting procedure for Poisson's ratio	STRING	ET	ET	-	-	-	-	-	-	Table 28
P24	Initial strain for Poisson's ratio	REAL	ET	ET	-	-	-	-	-	-	με
P25	Final strain for Poisson's ratio	REAL	ET	ET	-	-	-	-	-	-	με
				Bending Subblock (Table 29)							
P26	Was bending strain measured?	LOGICAL	ET	ET	ET	-	-	-	-	ET	
P27	Initial strain for bending	REAL	ET	ET	ET	-	-	-	-	ET	με
P28	Final strain for bending	REAL	ET	ET	ET	-	-	-	-	ET	με
P29	Percent bending strain	REAL	ET	ET	ET	-	-	-	-	ET	%
P30	Satisfies bending strain requirement?	LOGICAL	ET	ET	ET	-	-	-	-	ET	
P31	Percent twist	REAL	-	-	ET	-	-	-	-	-	%
				Fracture Toughness Subblock							
P32	Intercept	REAL	-	-	-	-	-	-	ET	-	mm (in.)
P33	Exponent	REAL	-	-	-	-	-	-	ET	-	
P34	Slope	REAL	-	-	-	-	-	-	ET	-	
P35	Fracture toughness—deviation from linearity	REAL	-	-	-	-	-	-	ET	-	kJ/m^2
P36	Fracture toughness—visual observation	REAL	-	-	-	-	-	-	ET	-	kJ/m^2
P37	Fracture toughness—5 % offset/maximum load	REAL	-	-	-	-	-	-	ET	-	kJ/m^2
P38	Method of calculating fracture toughness	STRING	-	-	-	-	-	-	ET	-	Table 30
P39	Fracture toughness	REAL	-	-	-	-	-	-	ET	-	kJ/m^2
				Fatigue Subblock							
P40	Number of cycles to 1 % compliance increase	INTEGER	-	-	-	-	-	-	-	ET	
P41	Number of cycles to 5 % compliance increase	INTEGER	-	-	-	-	-	-	-	ET	
P42	Number of cycles to failure	INTEGER	-	-	-	-	-	-	-	ET	
P43	Peak test control parameter	REAL	-	-	-	-	-	-	-	ET	
P44	Valley test control parameter	REAL	-	-	-	-	-	-	-	ET	
P45	Load/strain ratio	REAL	-	-	-	-	-	-	-	ET	
P46	Condition leading to failure	STRING	-	-	-	-	-	-	-	ET	Table 31
P47	Failure criterion	STRING	-	-	-	-	-	-	-	ET	Table 32
				Tabulated/Graphical Data Subblock (see Table 33)							
P48	Tabulated data reference	STRING	ET	ET	ET	ET	-	ET	-	ET	
P49	Tabulated data independent variable	STRING	ET	ET	ET	ET	-	ET	-	ET	Table 34
P50	Tabulated data dependent variable	STRING	ET	ET	ET	ET	-	ET	-	ET	Table 34
P51	Graphical data reference	STRING	ET	ET	ET	ET	-	ET	ET	ET	
P52	Graphical data independent variable	STRING	ET	ET	ET	ET	-	ET	ET	ET	Table 34

TABLE 1 *Continued*

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
P53	Graphical data dependent variable	STRING	ET	ET	ET	ET	-	ET	ET	ET	Table 34
P54	Curve-fitting method	STRING	RT	RT	RT	RT	-	RT	RT	-	
P55	Curve-fitting equation	STRING	RT	RT	RT	RT	-	RT	RT	-	
P56	Curve-fitting parameter	STRING	RT	RT	RT	RT	-	RT	RT	-	
P57	Curve-fitting parameter value	REAL	RT	RT	RT	RT	-	RT	RT	-	
P58	Progressive damage parameter	STRING	RT	-	RT	RT	-	-	-	-	Table 35
P59	Progressive damage parameter value	REAL	S	-	S	S	-	-	-	-	
P60	Progressive damage parameter method of fit	STRING	RT	-	RT	-	-	-	-	-	
P61	Progressive damage parameter initial strain	REAL	RT	-	RT	-	-	-	-	-	με
P62	Progressive damage parameter final strain	REAL	RT	-	RT	-	-	-	-	-	με
P63	Footnotes	STRING	ET	ET	ET	ET	ET	ET	ET	ET	
	Q. Normalized Data Block										
Q1	Data normalization method	STRING	ET	ET	-	-	ET	-	-	-	Table 36
Q2	Baseline cured ply thickness	REAL	ET	ET	-	-	ET	-	-	-	mm (in.)
Q3	Baseline fiber areal weight	REAL	O	O	-	-	O	-	-	-	g/m^2
Q4	Baseline fiber volume	REAL	ET	ET	-	-	ET	-	-	-	vol%
Q5	Normalized strength	REAL	S	S	-	-	S	-	-	-	MPa (ksi)
Q6	Normalized modulus value	REAL	S	S	-	-	S	-	-	-	GPa (Msi)
	R. Statistical Analysis Block Specimen Statistical Parameters Subblock										
R1	Specimen width—average	REAL	ET	ET	ET	ET	ET	-	ET		mm (in.)
R2	Specimen width—coefficient of variation	REAL	RT	RT	RT	RT	RT	-	RT		mm (in.)
R3	Specimen thickness—average	REAL	ET	ET	ET	ET	ET	-	ET	O	mm (in.)
R4	Specimen thickness—coefficient of variation	REAL	RT	RT	RT	RT	RT	-	RT	O	mm (in.)
R5	Specimen length—average	REAL	ET	ET	ET	RT	ET	-	-	O	mm (in.)
R6	Specimen length—coefficient of variation	REAL	RT	RT	RT	RT	RT	-	-	O	mm (in.)
R7	Specimen gage length—average	REAL	ET	ET	ET	ET	-	-	-	O	mm (in.)
R8	Specimen gage length—coefficient of variation	REAL	RT	RT	RT	RT	-	-	-	O	mm (in.)
R9	Specimen cross-sectional area—average	REAL	RT	RT	RT	RT	RT	-	-	O	mm^2 ($in.^2$)
R10	Specimen fiber volume—average	REAL	RM	RM	RM	RM	RM	-	-	-	vol%
R11	Specimen notch radius—average (V-notch)	REAL	-	-	O	-	-	-	-	-	mm (in.)
R12	Specimen notch angle—average (V-notch)	REAL	-	-	O	-	-	-	-	-	degrees
R13	Specimen gage section width—average (V-notch)	REAL	-	-	O	-	-	-	-	-	mm (in.)
	Testing Summary Subblock										
R14	Date of test completion—ensemble	DATE	ET								
R15	Test temperature—ensemble	REAL	ET								C (F)
R16	Test humidity—ensemble	REAL	ET								%
R17	Moisture content before testing—average	REAL	ET								%
R18	Moisture content after testing—average	REAL	RT								%
	Strength Statistical Parameter Subblock										
R19	Strength—number of valid measurements	INTEGER	ET	ET	ET	ET	ET	ET	-	-	
R20	Strength—average	REAL	ET	ET	ET	ET	ET	ET	-	-	MPa (ksi)
R21	Strength—standard deviation	REAL	O	O	O	O	O	O	-	-	MPa (ksi)
R22	Strength—coefficient of variation	REAL	ET	ET	ET	ET	ET	ET	-	-	%
R23	Offset strength—number of valid measurements	INTEGER	-	-	ET	ET	-	ET	-	-	
R24	Offset strength—average	REAL	-	-	ET	ET	-	ET	-	-	MPa (ksi)
R25	Offset strength—standard deviation	REAL	-	-	O	O	-	O	-	-	MPa (ksi)
R26	Offset strength—coefficient of variation	REAL	-	-	ET	ET	-	ET	-	-	%
R27	Maximum cyclic strain energy release rate	REAL	-	-	-	-	-	-	ET	-	
	Strain Statistical Parameter Subblock										
R28	Strain at failure—number of valid measurements	INTEGER	ET	ET	ET	ET	-	ET	-	-	
R29	Strain at failure—average	REAL	ET	ET	ET	ET	-	ET	-	-	με
R30	Strain at failure—standard deviation	REAL	O	O	O	O	-	O	-	-	με
R31	Strain at failure-coefficient of variation	REAL	ET	ET	ET	ET	-	ET	-	-	%
R32	Was bending strain measured?	LOGICAL	ET	ET	ET	-	-	-	-	-	
R33	Percent bending strain—average	REAL	ET	ET	ET	-	-	-	-	-	%
	Modulus Statistical Parameter Subblock										
R34	Modulus/stiffness—number of valid measurements	INTEGER	ET	ET	ET	ET	-	ET	-	-	

TABLE 1 *Continued*

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
R35	Modulus/stiffness—average	REAL	ET	ET	ET	ET	-	ET	-	-	GPa (Msi)
R36	Modulus/stiffness—standard deviation	REAL	O	O	O	O	-	O	-	-	GPa (Msi)
R37	Modulus/stiffness—coefficient of variation	REAL	ET	ET	ET	ET	-	ET	-	-	%
R38	Method of calculating modulus/stiffness	STRING	ET	ET	ET	ET	-	ET	-	-	Table 29
R39	Fitting procedure for modulus/stiffness calculation	STRING	ET	ET	ET	ET	-	ET	-	-	Table 30
R40	Initial strain for modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	με
R41	Final strain for modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	με
	Poisson's Ratio Statistical Parameter Subblock										
R42	Poisson's ratio—number of valid measurements	INTEGER	ET	ET	-	-	-	-	-	-	
R43	Poisson's ratio—average	REAL	ET	ET	-	-	-	-	-	-	
R44	Poisson's ratio—standard deviation	REAL	O	O	-	-	-	-	-	-	
R45	Poisson's ratio—coefficient of variation	REAL	ET	ET	-	-	-	-	-	-	%
R46	Method of calculating Poisson's ratio	STRING	ET	ET	-	-	-	-	-	-	Table 29
R47	Fitting procedure for Poisson's ratio calculation	STRING	ET	ET	-	-	-	-	-	-	Table 30
R48	Initial strain for Poisson's ratio	REAL	ET	ET	-	-	-	-	-	-	με
R49	Final strain for Poisson's ratio	REAL	ET	ET	-	-	-	-	-	-	με
	Tabulated/Graphical Data Ensemble Subblock										
R50	Tabulated data reference	STRING	ET	ET	ET	ET	-	ET	-	ET	
R51	Tabulated data independent variable	STRING	ET	ET	ET	ET	-	ET	-	ET	Table 34
R52	Tabulated data dependent variable	STRING	ET	ET	ET	ET	-	ET	-	ET	Table 34
R53	Graphical data reference	STRING	ET	ET	ET	ET	-	ET	ET	ET	
R54	Graphical data independent variable	STRING	ET	ET	ET	ET	-	ET	ET	ET	Table 34
R55	Graphical data dependent variable	STRING	ET	ET	ET	ET	-	ET	ET	ET	Table 34
R56	Curve fitting method	STRING	ET	ET	ET	ET	-	ET	-	ET	
R57	Curve fitting equation	STRING	ET	ET	ET	ET	-	ET	-	ET	
R58	Curve fitting parameter	STRING	ET	ET	ET	ET	-	ET	-	ET	
R59	Curve fitting parameter value	REAL	ET	ET	ET	ET	-	ET	-	ET	
R60	Progressive damage parameter—ensemble	STRING	RT	-	RT	-	-	RT	-	-	Table 35
R61	Progressive damage parameter value—average	REAL	RT	-	RT	-	-	RT	-	-	
R62	Progressive damage parameter value—coefficient of variation	REAL	RT	-	RT	-	-	RT	-	-	
	Summary - Ensemble Subblock										
R63	Failure location—ensemble	STRING	ET	ET	ET	ET	ET	ET	-	ET	Table 27
R64	Failure mode—ensemble	STRING	ET	ET	ET	ET	ET	ET	-	ET	Table 28
R65	Data quality indicator—ensemble	STRING	ET	ET	ET	ET	ET	ET	ET	ET	
R66	Footnotes—ensemble	STRING	ET	ET	ET	ET	ET	ET	ET	ET	

TABLE 2 Value Set for Test Property Class

Mechanical	Fracture toughness	Fatigue

TABLE 3 Value Set for Type of Test

Tension	Filled hole Tension
Compression	Filled hole compression
Shear	Bearing
Flexure	Toughness
Open hole tension	Fatigue
Open hole compression	

TABLE 4 Value Set for Property Form Type

Lamina	Laminate

TABLE 5 Value Set for Specimen Extraction Technique

Machined	As fabricated
Machined and ground	Wet diamond saw

6.6 The method of including information identifying the units for each data element are left to the database designer. Frequently used units, in both SI and inch-pound units, are listed in the tables to clarify the format and examples. This should not be interpreted as a requirement that any example shown with units represents a requirement that a data element be stored in a database as a character string.

6.7 While data elements indicating the accuracy of each measurement are beyond the scope of this guide, entries in all data elements should be given to the correct number of significant digits.

TABLE 6 Value Set for Material Sampling Method

End of roll	Beginning of roll
Beginning and end of roll	

TABLE 7 Value Set for Specimen Geometry

Cylinder	Rectangular, arc segment
Rectangular, flat	Ring
Sandwich beam	

TABLE 8 Value Set for Sandwich Core Type

Honeycomb
Close-cell foam
Open-cell foam

TABLE 9 Value Set for NDE Technique

Acoustic emission
Shearography
Thermography
Ultrasonic
Visual
X-ray

TABLE 10 Value Set for NDE Material Form

Component	Panel	Specimen
Subpanel	Tube	

TABLE 11 Value Set for NDE Results

Passed	Extensive microcracks	Excessive voids
Passed, unrestricted	Passed, restricted	Failed

TABLE 12 Value Set for Conditioning Environment

(Laboratory air, [fill-in-blank gas]) in still oven	(Laboratory air, [fill-in-blank gas]) in convection oven
Laboratory air	Humidity chamber
[Fluid]	

TABLE 13 Value Set for Equilibrium Condition

Values in Value Sets	Description
Nonequilibrium fixed-time conditioning	
D 5229/D 5229M equilibrium	<0.01 % mass change over a specimen/material dependent reference time period
SACMA RM 11R-94 equilibrium	<0.01 % mass change over a 24-h period
MIL-HDBK-17D[A] equilibrium	≥0.01 % mass change over three consecutive readings

[A]MIL-HDBK-17–1E, *Polymer Matrix Composites*, Vol 1, Section 2.4.3, 23 Jan. 1997, available from DODSSP, Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Ave., Philadelphia, PA 19111–5094. Additional information on handbook availability at http://mil-17.udel.edu.

TABLE 14 Value Set for Fixture or Grips

Compression:	Tension:	Shear:	Flexure:
Celanese-type	Wedge	Three-point bend	Three-point bend
IITRI-type	Hydraulic	Wedge tensile	Four-point bend
Four-point bend	Pneumatic	Hydraulic tensile	
SACMA SRM 1-88		Two-rail	
		Three-rail	
		V-notch	

TABLE 15 Value Set for Actuator Type

Servohydraulic	Screw-driven

TABLE 16 Value Set for Gripping Surface

Smooth
Flame/plasma-sprayed abrasive grit
File-cut serrations, (fine or coarse)
Cross-hatched serrations, (fine or coarse)

TABLE 17 Value Set for Transducer Type

Strain gage	Strain gage extensometer
LVDT	DCDT

TABLE 18 Value Set for Transducer Location

Mid-gage, face-mounted, dual transducers
Mid-gage, edge-mounted, dual transducers
Mid-gage/mid-span, face-mounted, single transducer
Mid-gage/mid-span, edge-mounted, single transducer

TABLE 19 Value Set for Method of Finding Minimum Cross-Sectional Area

Minimum thickness × minimum width	Minimum area
Average thickness × average width	Nominal area
Average area	

7. Data Element Sets

7.1 Sets of data elements that are used repetitively or are common to many documents have been identified. The following standard sets of data elements are used in the format for mechanical properties of high-modulus fiber-reinforced composite materials: Address, Date, Organization, Calibration, Person, Test equipment, and Test method.

7.1.1 The format of the data elements sets is:
data_element_name : data type - definition.

7.1.2 The data type of an data element may be: STRING, NUMBER (REAL or INTEGER), LOGICAL or DATE.
For database development, the closest available data type should be used. If a DATE type is not available, STRING should be used. The format for DATE is YYYY-MM-DD, where:

YYYY is a four-character string for the year,
MM is a two-character string for the month as defined in ISO 8601 (5.2.1),
Note: January is 01, February is 02, and so forth, and,
DD is a two-character string for the specified day of the month.

The hyphens in the date format shall be used for compatibility with ISO 8601. Dates are presented in accordance with the Gregorian calendar.

7.2 *Use of Standard Data Element Sets*—The name of a standard data element set, indicated in this guide in brackets, represents all of the data elements in that set. The following example illustrates identical data elements, using a standard data element set. The descriptive name of the data element in the standard set is attached to the referring data element to help clarify the usage.

TABLE 20 Value Set for Test Environment

Laboratory air	Oven air

TABLE 21 Value Set for Nominal Moisture State

A	Ambient/as-fabricated (loosely controlled, generally considered near-dry)
D	Dry (dried)
F	Fluid exposure (exposed to fluid other than water)
W	Wet (exposed to high humidity air or water)

TABLE 22 Value Set for Displacement/Strain Application Procedure

Strain rate	Load rate
Crosshead displacement rate	Transducer displacement rate

TABLE 23 Value Set for Data Acquisition Method

Digital	Analog

TABLE 24 Value Set for Fatigue Test Control Parameter

Load	Strain

TABLE 25 Value Set for Fatigue Waveform

Sine	Square	Triangle	Trapezoid

TABLE 26 Value Set for Failure Location

Center half of gage section	End quarter of gage section
Outside gage section	Indeterminate

Example: Table 1, Data Element A1, Test Method, indicates the standard data element set for Test_method in square brackets in the third column. This is the equivalent of listing the five data elements in the Test Method standard data element set as individual data elements. Thus,

Data Element A1 Test method [Test_method]

is the equivalent of

Data Element A1a test_method_organization_name : string — name of organization responsible for test method
Data Element A1b test_method_id : string — identification of test method
Data Element A1c test_method_date : date — date of approval of most recent technical revision or initial release
Data Element A1d test_method_version : string — identification of a specific version of a test method
Data Element A1e test_method_designation : string — identification of a specific procedure or method when the test method document contains more than one

These two representations of the same data elements are apparent when Table 1 and Tables 22-24 are compared. In Table 1, the standard data element set is identified. In the example tables, each element of the standard set is listed so that example data can be presented. Each use of the standard data element sets is identified in the following sections where the standard sets are defined.

TABLE 27 Value Set for Failure Mode

Compression:	Tension:	Shear:	Bearing:
Brooming	Regular fracture surface	Interlaminar	Bearing
Fiber microbuckling	Fiber pullout	Regular fracture surface	Cleavage
Fiber crushing	Irregular fracture surface	Irregular fracture surface	Fastener or pin
Delamination			Lateral
Irregular fracture surface			Multimode
			Shearout
			Tearout

TABLE 28 Value Set and Dependent Elements for Method of Calculating Elastic Constants from Stress-Strain Curves

Value Set	Dependent Elements Required	
Chord	Initial strain	Final strain
Initial tangent		
Secant		Final strain
Tangent	Initial strain	

TABLE 29 Value Set for Fitting Procedure for Calculating Elastic Constants from Stress-Strain Curves

Graphical fit of linear region	Linear regression curve fit	Nonlinear curve fit

TABLE 30 Value Set for Method of Calculating Fracture Toughness

Modified Beam Theory (MBT)	Compliance Calibration (CC)	Modified Compliance Calibration (MCC)

TABLE 31 Value Set for Condition Leading to Failure

Edge delamination	Interlaminar cracking
Intralaminar cracking	

TABLE 32 Value Set for Failure Criterion

Loss in stiffness	Loss in residual strength
Excessive creep	Matrix crazing delamination
Complete delamination	Complete transverse split
Compliance exceeds 105 % original value	Maximum number of cycles

7.3 *Address*:

7.3.1 *Data Element Set Definition*—An address is the place where people and organizations are located.

7.3.2 *Data Elements*:

TABLE 33 Tabulated and Graphical Data Required for Standards Listed in 2.1

	Level	Standard
Tabulated Data		
Tension		
Stress versus strain	ET	D 3039/D 3039M
Shear		
Stress versus strain	ET	D 5379/D 5379M
Bearing		
Bearing stress versus bearing strain	ET	D 5961/D 5961M
Fatigue		
Compliance versus elapsed cycles	ET	D 6115
Graphical Data		
Tension:		
Stress versus strain	ET	D 3039/D 3039M, D 3552/D 3552M
Shear:		
Stress versus strain	ET	D 5379/D 5379M, D 5449/D 5449M
Load versus displacement	ET	D 5379/D 5379M
Load versus strain	ET	D 5449/D 5449M
Bearing:		
Bearing stress versus bearing strain	ET	
Fracture toughness:		
Load-displacement	ET	D 5528
Cube-root compliance versus delamination length	ET	D 5528
Log (load point deflection/load) versus log (delamination length)	ET	D 5528
Delamination length/specimen thickness versus cube-root compliance	ET	D 5528
Delamination resistance curve	ET	D 5528
Fatigue:		
Compliance versus elapsed cycles	ET	D 6115
Strain energy release rate versus cycles (ensemble)	ET	D 6115

TABLE 34 Value Set for Data Variable

Load	Displacement
Stress	Longitudinal strain
Transverse strain	Shear strain
Bending strain in outer fibers	

TABLE 35 Value Set for Progressive Damage Parameter

Proportional limit load	Proportional limit strength
Transition strain	Load to edge delamination

TABLE 36 Value Set for Data Normalization Method[A]

By fiber volume as measured on the test specimen
By specimen cured ply thickness and batch average fiber areal weight
By specimen cured ply thickness and batch average fiber volume

[A] MIL-HDBK-17–1E, *Polymer Matrix Composites*, Vol 1, Section 2.4.3, 23 Jan. 1997, available from DODSSP, Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Ave., Philadelphia, PA 19111–5094. Additional information on handbook availability at http://mil-17.udel.edu.

mail_stop : string — an organization-defined address for internal mail delivery
street_number : string— the number of a building in a street
street : string — the name of a street
postal_box : string — the number of a postal box
town : string — the name of a town
region : string — the name of a region

NOTE 1—The counties of Great Britain and the states of the United States are regions.

country : string — the name of a country
postal_code : string — the numeric or alphanumeric designation used by a country to identify an address
facsimile_number : string— the number at which facsimiles may be received
telephone_number : string— the number at which telephone calls may be received
electronic_mail_address : string — the electronic address at which electronic mail may be received
telex_number : string— the number at which telex messages may be received

7.3.3 *Usage*—The standard data element set Address is used in Table 1 in A4 Test facility address.

7.4 *Organization*:

7.4.1 *Data Element Set Definition*—An organization is an administrative structure.

7.4.2 *Data Elements*:

id : string — the means by which the organization's individuality may be deduced
name : string — the word, or group of words, by which an organization is referred to
description : string — text that relates the nature of an organization
organization_role_name : string — the word, or group of words, which indicate the function being performed

7.4.3 *Usage*—The standard data element set Organization is used in Table 1 in A3 Test facility.

7.5 *Calibration*:

7.5.1 *Data Element Set Definition*—Calibration is a record of information for a calibration procedure on test equipment.

7.5.2 *Data Elements*:

calibration_date : date — the date when the calibration was performed
calibration_method : string— method of calibration
calibration_parameter : string — independent variable controlled during calibration
calibration_parameter value : real — controlled value of independent variable

7.5.3 *Usage*—The standard data element set Calibration is used in Table 1 in D16 Test machine calibration and E6 Transducer calibration.

7.6 *Person*:

7.6.1 *Data Element Set Definition*—A person is an individual human being.

7.6.2 *Data Elements*:

id : string — a means by which a person may be identified
last_name : string — the person's surname
first_name : string — the first element of the person's list of forenames
middle_names : string— the person's other forenames, if any
prefix_titles : string— the word, or group of words, which specify the person's social and professional standing and appear before the person's name
suffix_titles : string— the word, or group of words, which specify the person's social and professional standing and appear after the person's name
person_role_name : string— the word, or group of words, which indicate a function performed by a person

7.6.3 *Usage*—The standard data element set Person is used in Table 1 in A2 Test personnel.

7.7 *Test_Equipment*:

7.7.1 *Data Element Set Definition*—Test_Equipment is a machine or instrument used for testing purposes.

7.7.2 *Data Elements*:

manufacturer : string — the organization that manufactured the test equipment
model_number : string— the identification of type of test equipment
serial_number : string— the identification of a specific piece of test equipment
manufacture_date : date— the date of production

7.7.3 *Usage*—The standard data element set Test Equipment is used in Table 1 in D2 Test machine identification.

7.8 *Test_Method*:

7.8.1 *Data Element Set Definition*—Identification of documented method used in performing test

7.8.2 *Data Elements*:

organization_name : string — name of organization responsible for test method, for example, ASTM
id : string — identification of test method, for example, D 3410/D 3410M
date : date — date of approval of most recent technical revision or initial release
version : string — identification of a specific version of a test method. For example, ASTM uses lowercase letters to distinguish between revisions, to a document, in the same calendar year.
designation : string — identification of a specific procedure or method when the test method document contains more than one. For example, Test Method II, Procedure A in Test Methods D 790

7.8.3 *Usage*—The standard data element set Test Method is used in Table 1 in A1 Test method (primary test being reported), C1 Specimen conditioning method, and J3 Reinforcement volume fraction test method.

8. Levels of Requirement

8.1 It is recognized that these test methods are used by two different communities: testing laboratories, which do not necessarily have access to full material identification, and material suppliers and users, for whom material traceability is often important. To address the needs of both of these groups, data-reporting requirements in this guide have been separated into data elements for test validity and for material traceability.

8.2 The five levels of requirement are:

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

9. Recording of Test Data

9.1 Table 1 is a recommended standard format for the computerization of mechanical test data for high-modulus fiber-reinforced composite materials. There are eleven columns of information:

9.1.1 *Data Element Number*—A reference number for ease of dealing with the individual data elements within this format guideline. It has no permanent value and does not become part of the database itself. The numbering starts with H1 to highlight the interaction with Guide E 1309, which contains material identification data elements, numbered A1 through G13.

9.1.2 *Data Element Name and Description*—The complete name of the data element, descriptive of the element of information that would be included in this data element of the database.

9.1.3 *Data Type or Standard Data Element Set*—A data type is indicated for each individual data element. These are the same data types discussed in 7.1.2. Data types are presented in capital letters. Data element sets are indicated by the name of the standard data element set in brackets. This indicates that each element of the set is included, as demonstrated in 7.2.

9.1.4 *Level of Requirement*—The fourth through eleventh columns indicate the level of requirement for different types of tests as indicated at the top of the table.

9.1.5 *Value Sets or Units*—A listing of the types of information that would be included in the data element or, in the case of properties or other numeric data elements, the units in which the numbers are expressed. Value sets are representative sets, listing sample (but not necessarily all acceptable) inputs to the data element. The units listed are SI, in accordance with Standard IEEE/ASTM SI 10, followed by inch-pound units in parentheses.

9.2 The information for reporting test results is divided into nine segments: test method, specimen preparation, specimen conditioning, test equipment, transducer, specimen geometry, test environment, raw data, normalized data, and statistical analysis. As noted in 5.6, the data elements for individual specimens, or the data elements for an ensemble or group of specimens, or both, may be used at the discretion of the database designer. Data from a given test method which references this guide should be reported as individual specimens or an ensemble, or both, depending on the requirements of the test method.

9.3 *Dates*—Several data elements require a date, for example, date of test. If the process or procedure took more than one day, then the date of completion is reported.

9.4 *References*—Several data elements, such as the Coupon layout cutting plan, NDE criteria, the tabulated data, and the graphical data, provide for a reference. This may be a human-interpretable reference to a hard copy document, or a machine-interpretable reference or key to a computer file. At the present stage of development, either possibility should be available.

9.5 *Specimen Geometry*—Data elements are provided for nominal specimen dimensions, measured specimen dimensions, and statistical parameters (average and coefficient of variation) based on measured specimen dimensions. Specimen orientation is the orientation of the specimen loading axis

relative to the reference axis assumed in defining the lay-up, for example, 90 degrees.

9.6 *Specimen Conditioning*—If a multistage method is used, the number of stages should be identified and the data elements that define each stage should be repeated as necessary. The compression example table shows the use of repeated data elements to include two-stage conditioning procedures. The method of including this information in a particular database is left to the designer. The environment data element is used to indicate a nonstandard environment such as an aqueous environment.

9.7 Moisture content should be measured as close to testing as possible. This measurement may be taken before testing or after testing, or both. This measurement should be made from a traveler accompanying the individual specimen if one is available. If a traveler is not available, the measurement should be made after bonding of the tabs.

9.8 *Method of Calculating Elastic Constants*—Data elements to describe the method of calculation and fit are provided each time the modulus or Poisson's ratio are presented. Data elements are provided for the method of calculation, such as chord or tangent; the method of fitting the data, such as least squares or graphical; and the end points of the curve. If a chord is used, the initial and final strains for the calculation are required. A secant is considered a special case of a chord where the initial strain is zero, For a tangent, only the initial strain data element is used to indicate the point where the tangent was taken.

9.9 *Curve-Fitting*—Data elements for describing the method of curve-fitting and the curve-fitting equation are provided for modulus, Poisson's ratio, and tabulated or graphical data. In each case, the curve-fitting parameters and the parameter values may be included. If the curve-fitting equation is "None," no entries would be expected for the parameters and parameter values. The parameter and parameter value data elements may be repeated for each variable in the fitting equation.

9.10 *Normalization*—Fiber-dominated properties are frequently normalized to a common fiber volume fraction or specimen thickness. Unidirectional longitudinal tension and compression data are commonly normalized. A common normalizing value of fiber volume or specimen thickness is selected. If the fiber volume method is used, the common value is often 60 % fiber volume. When normalized, the strength and the modulus are multiplied by the ratio of the common fiber volume to the measured fiber volume. When normalizing by specimen thickness, the strength and modulus are multiplied by the ratio of the measured thickness to the average thickness. Data elements are provided for the normalization method and the normalizing value. An additional data element is provided for the fiber volume test method if that method of normalization is used.

9.11 *Test Conditions*—Data elements are provided for test conditions and laboratory conditions for cases where a test chamber is used. If testing continues for more than one day, the date on which the test was completed should be reported.

9.12 *Test Results*—The test results can be presented for individual specimens or an ensemble of specimens, or both. A database design for including individual results needs to provide a method for repeating those data elements required for each specimen. All calculated results should be calculated as specified in the relevant test method. For tests such as Practice D 3518/D 3518M, the strain reported should be the shear strain calculated in accordance with the test method. The data elements for progressive damage parameter and progressive damage parameter value allow for one or more parameters used to indicate the progressive change in behavior or damage to the specimen.

9.12.1 If bending strain was measured, the maximum measured bending strain is reported as a percentage of the axial strain in the direction of the applied deformation or strain. The point or range where the bending strain was measured is reported using the initial and final strain data elements.

9.13 *Failure Location and Mode*—If the test method provides a series of codes that identify the failure location and mode, for example, Test Method D 3039/D 3039M, those codes should be reported as the failure mode. (This information may also be presented as the failure location at the database designer's discretion.) If these codes are not available, value sets are provided.

9.14 *Data Quality Indicator*—Any appropriate designator(s) provided to indicate the confidence level associated with this particular test. See Guide E 1484.

9.15 *Footnotes*—A brief statement of any significant deviations from a standard test. The method for including this information in a database should be determined by the database designer. If no footnotes are included as part of a data reported, that should be documented in this data element.

10. Keywords

10.1 databases; fiber-reinforced composite materials; mechanical test data

ANNEX

(Mandatory Information)

A1. Data Elements for Property-Level Information of Fiber-Reinforced Composite Materials

A1.1 This annex provides data elements for data that have been generally grouped, analyzed, and reviewed and are considered property-level data rather than test data see Table A1.1). Data element numbers in this annex are coordinated with data element numbers in Table 1. As Table 1 is the second part of a modular approach with Guide E 1309, Table 1, this annex is coordinated with Guide E 1309, Annex A.

A1.2 Note that the specimen geometry and test environment blocks are inverted in the Annex as compared to Table 2 as it seemed a more logical progression for property-level data. The specimen geometry block also contains several data elements from Guide E 1309 as part of the progression of measurements.

A1.3 An additional requirement level for groups of statistical parameters is included in this annex. Mean, coefficient of variation, number of specimens, and number of batches should be considered as VT. Additional statistical parameters may be appropriate for a given data application.

NOTE A1.1—All table numbers refer to Guide E 1434.

TABLE A1.1 Data Elements for Property-Level Information of Fiber-Reinforced Composite Materials

NOTE—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 or 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 —					
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
I7	Ply count	INTEGER	RM	RM	RM	RM	RM	RM	RM	RM	
I22	Nominal width to diameter ratio	REAL	-	-	-	-	ET	-	-	-	
I23	Nominal thickness to diameter ratio	REAL	-	-	-	-	ET	ET	-	-	
I24	Nominal edge distance ratio	REAL	-	-	-	-	-	ET	-	-	
I25	Nominal pitch distance ratio	REAL	-	-	-	-	-	ET	-	-	
I26	Nominal bypass ratio	REAL	-	-	-	-	-	ET	-	-	
					NDE Subblock Tab/Hinge/Loading-Block Subblock						
					J. Specimen Conditioning Block						
J1	Specimen-conditioning method	[Test_Method]				— ET —					
J2	(Number of conditioning steps)	INTEGER				— ET —					
J3	Conditioning temperature	REAL				— ET —					C (F)
J4	Conditioning parameter	STRING				— ET —					
J5	Conditioning parameter value	REAL				— ET —					
J6	Conditioning time	REAL				— ET —					h
J7	Conditioning environment	STRING				— ET —					Table 12
J9	Equilibrium condition	STRING				— ET —					Table 13
					K. Test Equipment Block Test Machine Subblock						
K17	Fastener or pin type	STRING	-	-	-	-	ET	ET	-	-	
K26	Mating material identification	STRING	-	-	-	-	-	ET	-	-	
K27	Mating material width	REAL	-	-	-	-	-	ET	-	-	mm (in.)
K28	Mating material thickness	REAL	-	-	-	-	-	ET	-	-	mm (in.)
K29	Mating material lay-up	STRING	-	-	-	-	-	ET	-	-	
					L. Transducer Block						
					N. Test Environment Block						
N1	Date of test—minimum	DATE				— ET —					
N1	Date of test—maximum	DATE				— ET —					
N2	Test environment	STRING				— ET —					Table 20
N3	Test temperature	REAL				— ET —					C (F)
N4	Test humidity	REAL				— ET —					%
N8	Moisture content—minimum	REAL				— RT—					%
N8	Moisture content—maximum	REAL				— RT—					%
N10	Nominal moisture state	STRING				— O —					Table 21
					M. Specimen Geometry Block						
M1	Number of specimens	INTEGER	ET	ET	ET	ET	ET	ET	ET	ET	
M3	Coupons meets test method requirements?	LOGICAL	ET	ET	ET	ET	ET	ET	ET	ET	
G4	Cured ply thickness—minimum	REAL	RM	RM	RM	RM	RM	RM	RM	RM	mm (in.)
G4	Cured ply thickness—maximum	REAL	RM	RM	RM	RM	RM	RM	RM	RM	mm (in.)
G7	Part resin content by weight—minimum	[Auxiliary Test]	RM	RM	RM	RM	RM	RM	RM	RM	wt%
G7	Part resin content by weight—maximum	[Auxiliary Test]	RM	RM	RM	RM	RM	RM	RM	RM	wt%
G8	Part fiber content, by vol—minimum	[Auxiliary Test]	EM	EM	EM	EM	EM	EM	EM	EM	vol%
G8	Part fiber content, by vol—maximum	[Auxiliary Test]	EM	EM	EM	EM	EM	EM	EM	EM	vol%
G10	Part void content, by vol—minimum	[Auxiliary Test]	EM	EM	EM	EM	EM	EM	EM	EM	vol%
G10	Part void content, by vol—maximum	[Auxiliary Test]	EM	EM	EM	EM	EM	EM	EM	EM	vol%

TABLE A1.1 *Continued*

No.	Data Element Name or Description	Data Type or Standard Data Element Set	Tension	Compression	Shear	Flexure	Open/Filled Hole	Bearing	Fracture Toughness	Fatigue	Value Sets or Units
G11	Part mass density—minimum	[Auxiliary Test]	EM	EM	EM	EM	EM	EM	EM	EM	g/cm^3
G11	Part mass density—maximum	[Auxiliary Test]	EM	EM	EM	EM	EM	EM	EM	EM	g/cm^3
				O. Loading Block							
O8	Fastener torque	REAL	-	-	-	-	ET	ET	-	-	(in.-lb)
O9	Fatigue test control parameter	STRING	-	-	-	-	-	-	-	ET	Table 24
O10	Fatigue frequency	REAL	-	-	-	-	-	-	-	ET	
O11	Fatigue waveform	STRING	-	-	-	-	-	-	-	ET	Table 25
O12	Loading parameter ratio	REAL	-	-	-	-	-	-	-	ET	
				P. Raw Data Block Failure Subblock							
P1	Strength	REAL	S	S	S	S	S	S	-	-	
P2	Strain offset	REAL	-	-	ET	ET	-	ET	-	-	%
P3	Offset strength	REAL	-	-	S	S	-	S	-	-	
P4	Method of linear fit for offset strength		-	-	-	-	-	ET	-	-	
P5	Initial strain for offset fit	REAL	-	-	-	-	-	ET	-	-	με
P6	Final strain for offset fit	REAL	-	-	-	-	-	ET	-	-	με
P7	Initial stress for offset fit	REAL	-	-	-	-	-	ET	-	-	MPa (ksi)
P8	Final stress for offset fit	REAL	-	-	-	-	-	ET	-	-	MPa (ksi)
P10	Test truncated at 5 % shear strain	LOGICAL	-	-	ET	-	-	-	-	-	MPa (ksi)
P13	Strain at failure	REAL	S	S	S	S	-	S	-	-	
				Modulus Subblock							
P16	Modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	
P17	Method of calculating modulus/stiffness	STRING	ET	ET	ET	ET	-	ET	-	-	
P19	Initial strain for modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	με
P20	Final strain for modulus/stiffness	REAL	ET	ET	ET	ET	-	ET	-	-	με
				Poisson's Ratio Subblock							
P21	Poisson's ratio value	REAL	S	S	-	-	-	-	-	-	
P22	Method of calculating Poisson's ratio	STRING	ET	ET	-	-	-	-	-	-	
P24	Initial strain for Poisson's ratio	REAL	ET	ET	-	-	-	-	-	-	με
P25	Final strain for Poisson's ratio	REAL	ET	ET	-	-	-	-	-	-	με
				Bending Subblock							
				Fracture Toughness Subblock							
P38	Method of calculating fracture toughness	STRING	-	-	-	-	-	-	ET	-	Table 30
P39	Fracture toughness	REAL	-	-	-	-	-	-	S	-	kJ/m^2
				Fatigue Subblock							
P40	Number of cycles to 1 % compliance increase	INTEGER	-	-	-	-	-	-	-	ET	
P41	Number of cycles to 5 % compliance increase	INTEGER	-	-	-	-	-	-	-	ET	
P42	Number of cycles to failure	INTEGER	-	-	-	-	-	-	-	ET	
P45	Load/strain ratio	REAL	-	-	-	-	-	-	-	ET	
P46	Condition leading to failure	STRING	-	-	-	-	-	-	-	ET	
P47	Failure criterion	STRING	-	-	-	-	-	-	-	ET	
				Tabulated/Graphical Data Subblock (See Table 33)							
P48	Tabulated data reference	STRING	ET	ET	ET	ET	-	ET	-	ET	
P49	Tabulated data independent variable	STRING	ET	ET	ET	ET	-	ET	-	ET	Table 34
P50	Tabulated data dependent variable	STRING	ET	ET	ET	ET	-	ET	-	ET	Table 34
P51	Graphical data reference	STRING	ET	ET	ET	ET	-	ET	ET	ET	
P52	Graphical data independent variable	STRING	ET	ET	ET	ET	-	ET	ET	ET	Table 34
P53	Graphical data dependent variable	STRING	ET	ET	ET	ET	-	ET	ET	ET	Table 34
P54	Curve-fitting method	STRING	RT	RT	RT	RT	-	RT	RT	-	
P55	Curve-fitting equation	STRING	RT	RT	RT	RT	-	RT	RT	-	
P56	Curve-fitting parameter	STRING	RT	RT	RT	RT	-	RT	RT	-	
P57	Curve-fitting parameter value	REAL	RT	RT	RT	RT	-	RT	RT	-	
P58	Progressive damage parameter	STRING	RT	-	RT	RT	-	-	-	-	Table 35
P59	Progressive damage parameter value	REAL	S	-	S	S	-	-	-	-	
P60	Progressive damage parameter method of fit	STRING	RT	-	RT	-	-	-	-	-	
P61	Progressive damage parameter initial strain	REAL	RT	-	RT	-	-	-	-	-	με
P62	Progressive damage parameter final strain	REAL	RT	-	RT	-	-	-	-	-	με

TABLE A1.1 *Continued*

No.	Data Element Name or Description	Data Type or Standard Data Element Set	Tension	Compression	Shear	Flexure	Open/Filled Hole	Bearing	Fracture Toughness	Fatigue	Value Sets or Units
P63	Footnotes	STRING	ET	ET	ET	ET	ET	ET	ET	ET	
				Q. Normalized Data Block							
Q1	Data normalization method	STRING	ET	ET	-	-	ET	-	-	-	Table 36
Q2	Baseline cured ply thickness	REAL	ET	ET	-	-	ET	-	-	-	mm (in.)
Q3	Baseline fiber areal weight	REAL	O	O	-	-	O	-	-	-	g/m^2
Q4	Baseline fiber volume	REAL	ET	ET	-	-	ET	-	-	-	vol%
Q5	Normalized strength	REAL	S	S	-	-	S	-	-	-	MPa (ksi)
Q6	Normalized modulus value	REAL	S	S	-	-	S	-	-	-	GPa (Msi)
				R. Statistical Analysis Block							
				Summary - Ensemble Subblock							
R64	Failure mode—ensemble	STRING	ET	ET	ET	ET	ET	ET	-	ET	Table 27
R65	Data quality indicator—ensemble	STRING	ET	ET	ET	ET	ET	ET	ET	ET	
R66	Footnotes—ensemble	STRING	ET	ET	ET	ET	ET	ET	ET	ET	