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Standard Guide for Identification of Fibers, Fillers, and Core Materials in Computerized Material Property Databases[1]

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1. Scope

1.1 This guide establishes the essential and desirable elements of data required for the identification in computerized material property databases of fibers, fillers, and core materials used in composite materials. A recommended format for entry of these fields into a computerized database is provided. Examples of the application of this guide are also included.

1.2 The recommended format described in this guide is suggested for use in recording data in a database, which is different from contractural reporting of actual test results. The latter type of information is described in materials specifications shown in business transactions and is subject to agreement between vendor and purchaser.

1.3 The materials covered by this guide include fibers, both continuous and discontinuous, and fillers of various geometries which are used as reinforcements in composite materials, as well as core materials used in sandwich composites. Cores may be foam, honeycomb, or naturally occurring materials such as balsa wood. These materials are distinguished from bulk materials by the importance of their specialized geometric forms to their properties. This difference is reflected in the use of geometry, along with chemistry, as a primary basis for classification. Identification of composite materials is discussed in Guide E 1309.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 274 Terminology of Structural Sandwich Constructions

D 123 Terminology Relating to Textiles

D 883 Terminology Relating to Plastics

D 3878 Terminology for Composite Materials

E 1309 Guide for Identification of Fiber-Reinforced Polymer-Matrix Composite Materials in Computerized Material Property Databases

E 1443 Terminology Relating to Building and Accessing Material and Chemical Databases[3]

3. Terminology

3.1 *Definitions*—Terminology D 3878 shall be used where applicable.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *core, n*—a generally, centrally located layer or composite component of a sandwich construction, usually low density, which separates and stabilizes the facings and transmits shear between them and provides most of the shear rigidity of the construction (see Terminology C 274).

3.2.2 *essential field, n*—a field in a record which must be filled to meet the requirements of a stated type of database (see Terminology E 1443).

3.2.2.1 *Discussion*—Fields are considered essential if they are required to make a meaningful comparison of property data from different sources. 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.

3.2.3 *fiber, n—in textiles*, the general term for a filamentary material having a length at least ten times its nominal diameter.

3.2.4 *field, n*—an elementary unit of a record that may contain a data item, a data aggregate, a pointer, or a link (see E 1443).

3.2.5 *field name, n*—a name or code associated with a field and used for identification (see Terminology E 1443).

3.2.6 *filler, n*—a relatively inert material added to a plastic to modify its strength, permanence, working properties, or other qualities, or to lower cost (see Terminology D 883).

3.2.7 *strand, n—in textile fibers*, a normally untwisted bundle of filaments.

3.2.8 *value set, n*—an open listing of representative, acceptable strings which could be included in a particular field of a record (see Terminology E 1443).

4. Significance and Use

4.1 This guide defines the information which is considered essential to uniquely describe a fiber, filler, or core material in a computerized database. A format is recommended for placing these data in fields suitable for a computerized database.

[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.

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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.

[3] Withdrawn.

Additional fields which are considered desirable, but not essential, are also defined. The purpose is to facilitate efficient storage and retrieval of the information with a computer and to allow meaningful comparison of data from different sources.

4.2 Comparison of property data from different sources will be most meaningful if all the essential information defined by the guidelines is present. Comparison may still be possible if essential information is omitted, but the value of the comparison may be greatly reduced.

4.3 While at this time there is no generally accepted numbering system for these materials, analogous to those for metals and alloys, a field for an identifying number (Material Reference Number) is included should such a system be developed in the future.

4.4 This information should not be considered restrictive. For example, a database designer may find it useful to aggregate several fields, such as the material and chemical class fields, into a single field. This may affect search strategies and other database operations. These considerations are beyond the scope of this guide.

5. Guidelines

5.1 The following fields are recommended for identification of fibers, fillers, and core materials used in composites. For certain fields, lists of recommended entries are included. Where possible, entries should be chosen from these lists. However, these lists should not be regarded as exhaustive.

5.2 *Primary Identifiers*:

5.2.1 *Material Reference Number*—Identifying number or code, if any, for the particular material.

5.2.2 *Class*—Classification by form, either fiber, filler, or core.

5.2.3 *Subclass*—Further subdivision by geometric form within the class. See Table 1 for list.

TABLE 1 Class, Subclass, Chemical Family, and Forms for Fibers, Fillers, and Core Materials

NOTE 1—These are lists. The table is not intended to be read horizontally.

Class	Subclass	Chemical Family	Form
Fiber	continuous	aramid	tow or end or impregnated tow strand
	discontinuous, long	glass	plied yarn
	discontinuous, short	silicon carbide	yarn roving
	staple	aluminum oxide	mat
	milled	aluminum	other (specify)
	whisker	boron	
	pulp	other (specify)	
	other (specify)		
Filler	particulate	calcium carbonate	powder
	platelet	kaolin clay	slurry
	hollow sphere	titanium dioxide	other (specify)
	hollow cylinder	mica	
	other (specify)	talc	
		other (specify)	
Core	honeycomb	glass reinforced	block
	foam	aluminum	other (specify)
	other (specify)	aramid reinforced	
		polyvinyl chloride	
		balsa wood	
		polyurethane	
		polymethacrylimide	
		other (specify)	

5.2.4 *Chemical Family*—Classification of the material by its generic chemical composition family. See Table 1 for list.

5.3 *Commercial Specification*:

5.3.1 *Common Name*—Name by which the material is known in the industry.

5.3.2 *Additional Name Information*—Additional information on the name, such as chemical composition details on the material.

5.3.3 *Specification Organization*—A company, industry, government, national, regional, or international organization issuing the specification; for example, ASTM.

5.3.4 *Specification Number*—The specification number within the organization referenced.

5.3.5 *Specification Version*—The year or revision code of the specification.

5.3.6 *Specification Designation*—The designation used for the material in the specification.

5.4 *Characteristics*:

5.4.1 *Density*.

5.4.2 *Cross-Section Type*—Geometry of cross section of the material. See Table 2 for list.

5.4.3 *Dimension Parameter*—Name of dimension characteristic of the material; for example, diameter. Dimension parameter, units, and value should be given for each characteristic dimension. See Table 3 for list.

5.4.4 *Dimension Value*—Mean or nominal numerical value of the specified dimension in appropriate units.

5.4.5 *Dimension Distribution Parameter Type*—Name of the parameter used to characterize the distribution of values for the specified dimension. See Table 4 for list.

5.4.6 *Dimension Distribution Parameter Value*—Numerical value of the distribution parameter for the specified dimension. Units are assumed to be the same as those of the dimension itself.

5.4.7 *Dimension Distribution Sample Size*—The number of samples from which the dimension distribution parameter value is determined.

5.5 *Source*:

5.5.1 *Manufacturer*.

5.5.2 *Manufacturer's Identification*—Code, part number, or other identification used by the manufacturer to identify this material.

5.5.3 *Lot Number*—Manufacturer's reference for traceability of this lot of material.

5.5.4 *Date of Manufacture*—YYYYMMDD.

5.6 *Process Descriptors*:

5.6.1 *Process Conditions*—Conditions under which the material was produced. (This refers to production of the primary form of the material; for example, fiber. If a secondary form such as fabric or braid is actually tested, its processing should be described according to Guide E 1309.)

TABLE 2 Cross-Section Types for Fibers, Fillers, and Core Materials

Circular
Rectangular
Oval
Irregular
Other (specify)

TABLE 3 Dimension Parameters for Fibers, Fillers, and Core Materials

Length
Width
Inside diameter
Outside diameter
Thickness
Wall thickness
Cell size
Percent open cell
Denier
Filament count
Fiber yield
Other (specify)

TABLE 4 Dimension Distribution Parameters for Fibers, Fillers, and Core Materials

Standard deviation
Range (+−)
Coefficient of variation (%)
Other (specify)

5.6.2 *Surface Treatment Type*—Type of process used to modify the surface chemistry. See Table 5 for list.

5.6.3 *Surface Treatment Detail*—Details of the surface treatment, including time, temperature, pressure, and environment, if applicable.

5.7 *Sample Formats*—The format in Table 6 identifies, with an asterisk (*), the essential information for computerized data retrieval as defined in 4.2. There are three columns of information:

5.7.1 *Field Number*—A reference number for ease of dealing with the individual fields within this format guideline. It has no permanent value and does not become part of the database itself.

5.7.2 *Field Name and Description*—The complete name of the field, descriptive of the element of information that would be included in this field of the database.

TABLE 5 Surface Treatment Types for Fibers, Fillers, and Core Materials

Chemical oxidation
Plasma etching
Adhesion promoting
Sizing
Anti-corrosion
Finish free
Lubricant
Release treatment
Other (specify)

TABLE 6 Generic Format for Identification of Fibers, Fillers, and Core Materials

Field Number[A]	Field Name	Value Sets or Units
Primary Identifiers:		
1	Material reference number	alphanumeric string
2	* Class	fiber, filler, or core
3	* Subclass	See Table 1
4	* Chemical family number	See Table 1
Commercial Specification:		
5	* Common name	alphanumeric string
6	Additional name information	alphanumeric string
7	Specification organization	alphanumeric string
8	Specification number	alphanumeric string
9	Specification version	alphanumeric string
10	Specification designation	alphanumeric string
Characteristics:		
11	* Density	g/cm^3(lb/in.^{3})
12	Cross-section type	See Table 2
13	* Dimension parameter[B]	See Table 3
14	* Dimension value	floating point
15	Dimension distribution parameter[C]	See Table 4
16	Dimension distribution parameter value	floating point
17	Dimension distribution sample size	integer
Source:		
18	Manufacturer	alphanumeric string
19	Manufacturer's identification	alphanumeric string
20	Lot number	alphanumeric string
21	Date of manufacture	YYYYMMDD
Process History:		
22	Process conditions	alphanumeric string
23	Surface treatment type	See Table 5
24	Surface treatment detail	alphanumeric string

[A] Field numbers are for information only.

[B] Dimension parameter and value should be given for each relevant dimension. Type is essential information if value is given.

[C] For each dimension in which distribution width is relevant. Parameter is essential if parameter value is given.

* Denotes essential information.

5.7.3 *Value Sets or Units*—A listing of the types of information that would be included in the field or, in the case of properties or other numeric fields, the units in which the numbers are expressed. Value sets are representative sets, listing sample (but not necessarily all acceptable) inputs to the field.

5.7.4 Examples of the application of this guide to fibers, fillers, and cores are included in Tables 7-9. Only those fields appropriate to the particular material form should be used.

6. Keywords

6.1 computerization; core material; fiber; filler; materials databases; material identification

TABLE 7 Example—Identification of a Fibrous Reinforcement

Field Number	Field Name	Value
Primary Identifiers:		
1	Material reference number	to be assigned
2	Material class	fiber
3	Material subclass	continuous
4	Chemical family	carbon
Commercial Specification:		
5	Common name	IM-6[A]
6	Additional name information	PAN-based
7	Specification organization	Advanced Composites Corp.
8	Specification number	C22-457
9	Specification version	Release 1.2
10	Specification designation	Type III
Characteristics:		
11	Density	1.72 g/cm^3 (0.062 lb/in.^{3})
12	Cross-section type	circular
13	Dimension parameter	diameter
14	Dimension value	0.145 mm (0.0057 in.)
13′	Dimension parameter	Filament count
14′	Dimension value	12 000
15	Dimension distribution parameter	not applicable
16	Dimension distribution parameter value	not applicable
17	Dimension distribution sample size	not applicable
Source:		
18	Manufacturer	Hercules, Inc.
19	Manufacturer's identification	IM6-G-12K
20	Lot number	X627-31
21	Date of manufacture	19841204
Process History:		
22	Process conditions	unknown
23	Surface treatment type	chemical oxidation
24	Surface treatment detail	unknown

[A] Registered trademark of Hercules, Inc.

TABLE 8 Example—Identification of Filler

Field Number	Field Name	Value
Primary Identifiers:		
1	Material reference number	to be assigned
2	Class	filler
3	Subclass	particulate
4	Chemical family	calcium carbonate
Commercial Specification:		
5	Common name	calcium carbonate
6	Additional name information	MgCO:3 3 % max; acid insolubles 3 % max
7	Specification organization	Texas Composites, Inc.
8	Specification number	TC25-654
9	Specification version	Revision 89-2
10	Specification designation	Filler 3
Characteristics:		
11	Density	2.71 g/cm^3 (0.0978 lb/in.^{3})
12	Cross-section type	irregular
13	Dimension parameter	median size
14	Dimension value	2.3 µm
15	Dimension distribution parameter	standard deviation
16	Dimension distribution parameter value	1.2 µm
17	Dimension distribution sample size	5
Source:		
18	Manufacturer	Georgia marble
19	Manufacturer's identification	
20	Lot number	G1634
21	Date of manufacture	unknown
Process History:		
22	Process type	unknown
23	Process conditions	unknown
24	Surface treatment type	none

TABLE 9 Example—Identification of a Core Material

Field Number	Field Name	Value
Primary Identifiers:		
1	Material reference number	to be assigned
2	Class	core
3	Subclass	honeycomb
4	Chemical family	aramid
Commercial Specification:		
5	Common name	nomex[A] aramid honeycomb
6	Additional name information	phenolic coated
7	Specification organization	Aircraft, Inc.
8	Specification number	143.67
9	Specification version	original issue
10	Specification designation	Organic HC
Characteristics:		
11	Density	0.048 g/cm^3 (1.73E-3 lb/in.^{3})
12	Cross-section type	rectangular
13	Dimension parameter	thickness
14	Dimension value	13 mm (0.5 in.)
13′	Dimension parameter	cell size
14′	Dimension value	3.18 mm (0.125 in.)
15	Dimension distribution parameter	not applicable
16	Dimension distribution parameter value	
Source:		
17	Manufacturer	Hexcel
18	Manufacturer's identification	HRH 10 (1) 3 pcf
19	Lot number	XXXXX
20	Date of manufacture	19860930
Process History:		
21	Process conditions	unknown
22	Surface treatment type	impregnated
23	Surface treatment detail	phenolic resin dip

[A] Registered trademark of Hexcel, Inc.