Designation: E 1761 – 95 (Reapproved 1999)

Standard Guide for Recommended Formats for Data Records Used in Computerization of Fatigue and Fracture Data of Metals[1]

This standard is issued under the fixed designation E 1761; 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 covers recommended formats for the recording of fatigue and fracture test data for inclusion in computerized material property databases. From this information, the database designer should be able to construct the data dictionary preparatory to developing a database schema. Not covered within the scope of this guide are guidelines for the identification of the materials themselves, or descriptions of the materials, or both. Those guidelines are covered in separate standards, such as Guides E 1338 and E 1339.

1.2 The recommended format specified in this guide is suggested for use in recording data in a database, that is different from contractual reporting of actual test results for a specific lot of material. The latter type of information is specified in materials specifications shown in business transactions and is subject to agreement between supplier and purchaser.

1.3 This guide is specific to plane-strain fracture toughness test data based on Test Method E 399, fatigue crack growth rate test data based on Test Method E 647, and strain-controlled fatigue testing based on Practice E 606.

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

2. Referenced Documents

2.1 *ASTM Standards:*

E 6 Terminology Relating to Methods of Mechanical Testing[2]

E 83 Practice for Verification and Classification of Extensometers[2]

E 380 Practice for Use of the International System of Units (SI)[3]

E 399 Test Method for Plane-Strain Fracture Toughness of Metallic Materials[2]

E 606 Practice for Constant-Amplitude Low-Cycle Fatigue Testing[2]

E 616 Terminology Relating to Fracture Testing[2]

E 647 Test Method for Measurement of Fatigue Crack Growth Rates[2]

E 1012 Practice for Verification of Specimen Alignment Under Tensile Loading[2]

E 1013 Terminology Relating to Computerized Systems[4]

E 1338 Guide for the Identification of Metals and Alloys in Computerized Material Property Databases[4]

E 1339 Guide for Identification of Aluminum Alloys and Parts in Computerized Material Property Databases[5]

E 1443 Terminology Relating to Building and Accessing Material and Chemical Database[4]

2.2 *Other Standard:*

BS 6835 (1988)

3. Terminology

3.1 *Definitions:*

3.1.1 Computer-related technical terms in this guide are defined in Terminologies E 1443, E 1013, and other standards referenced in those terminologies.

3.1.2 Technical terms related to fracture testing procedures are defined in Terminology E 616.

3.1.3 Technical terms related to mechanical testing and mechanical procedures are defined in Terminology E 6.

4. Significance and Use

4.1 Because of the intense activity in building computerized materials databases and the desire to encourage uniformity and ease data comparison and data interchange, these recommended formats provide for the inclusion of specific elements of test data in such databases.

4.2 This guide defines the principal data elements that are considered important and worth recording and storing permanently in computerized data storage systems from which machine-readable databases will be developed. These data

[1] This guide is under the jurisdiction of ASTM Committee E08 on Fatigue and Fracture and is the direct responsibility of Subcommittee E08.02 on Standards and Terminology.

Current edition approved Nov. 10, 1995. Published February 1996.

[2] *Annual Book of ASTM Standards*, Vol 03.01.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 14.01.

[5] Discontinued. See 1996 *Annual Book of ASTM Standards*, Vol 14.01.

elements are not intended to be requirements of any specific or single database, but if available, are likely to be valuable for building databases for various applications and so should be recorded and stored in the primary data storage file.

4.3 This guide has no implication on data required for materials production or purchase. Reporting of actual test results shall be as described in the actual material specification or as agreed to by the supplier and purchaser as shown on the purchase order and acknowledgment.

4.4 This guide is designed to encourage the builders of databases to include sufficiently complete information so that comparisons among individual sources may be made with ensurance that similarities and differences in the test procedures and conditions may be determined. Comparisons of data from various sources will be most meaningful if all of the elements are available.

4.5 The guide is designed to provide sufficient detail so that every testing variable that influences a test result is recorded.

4.6 The data elements included in this guide are presented recommended formats. These data elements provide sufficiently complete information that users may be confident of their ability to compare sets of data from individual databases and to make the database useful to a relatively broad range of users.

4.6.1 The data elements in the recommended formats are designed to be used in constructing the data dictionary preparatory for developing a database or other data storage system. Use of these data elements will facilitate comparisons among data in different databases.

4.6.2 Many databases are prepared for specific applications, and individual database builders may elect to omit certain data elements considered to be of no value for that specific application.

4.6.3 A number of data elements are considered essential to any database and need to exist in the database. These data elements must be completed to make the record meaningful according to the pertinent guidelines or standard. Data elements are considered essential if they are required for the user to have sufficient information to interpret the data and to make a comparison of data from different sources meaningful. A comparison of data from different sources may be possible if essential information is missing but the value of the comparison may be greatly reduced. In the recommended formats, these data elements are marked with asterisks. Note that situations do arise where essential data are not available. For example, failure strain cannot be provided if the strain-measuring device is not functioning when the test specimen fails. The database design and the engineer recording test data must use their judgment for such cases.

4.6.4 These recommended formats do not represent a requirement that all the data elements must be included in every database. Rather these recommended formats are guides as to those data elements that are likely to be useful to at least some users of most databases.

4.6.5 Not all of the data elements recommended for inclusion will be available for all databases; this fact should not discourage database builders and users from proceeding so long as the essential data elements are included (the items noted by the asterisks).

4.6.6 In some cases, additional data elements of value to users of a database may be available. In those cases, databases builders are encouraged to include them with the data elements in the recommended formats.

4.7 The recommended data recording formats do not include the recommended material description or the presentation of other specific types of test data. This information is covered by other recommended formats, including Guides E 1338 and E 1339.

5. Recording of Test Data

5.1 The following types of data elements are included in the recommended format for each test method; multiple data elements may be required to cover some categories satisfactorily:

5.1.1 Test identification,
5.1.2 Specimen information,
5.1.3 Test parameters and procedures,
5.1.4 Test results and analysis, and
5.1.5 Test validation.

5.2 The linkage of a data record for one or more test results with a data record for a material is done during the development of a database schema using these recommended formats and guides with recommended formats specific to the identification and description of materials.

5.2.1 A database builder has considerable flexibility in developing the database schema and the recommended formats contained in this guide are intended to support that flexibility.

5.3 It is often helpful to know values of related mechanical properties for the material in question when evaluating or interpreting fatigue and fracture data. The recommended data formats do not include fields for these related properties unless they are required for calculations given in the ASTM test methods. Therefore, it is recommended that the development of a database schema provide linkages between fatigue and fracture test records and summary values of the following properties for each material:

5.3.1 Hardness,
5.3.2 Yield strength,[6]
5.3.3 Compressive yield strength,
5.3.4 Ultimate tensile strength,
5.3.5 Percent reduction of area,
5.3.6 Percent elongation,
5.3.7 True fracture stress,
5.3.8 True fracture strain,
5.3.9 Elastic modulus,[7] and
5.3.10 Poisson's ratio.[8]

6. Recommended Formats for Standard Data Records

6.1 The recommended formats for recording test data are listed in the appendixes that follow and include four columns

[6] Included as a data element in Appendix X1.
[7] Included as a data element in Appendix X1 and Appendix X3.
[8] Included as a data element in Appendix X3.

of information: data element number, data element descriptive name, data type, and category sets, value sets, or units as listed:

6.1.1 *Data Element Number*—A reference number for ease of dealing with the individual data elements in this guide. The data element number has no permanent value and does not become part of a database itself.

6.1.2 *Data Element Descriptive Name*—The complete and unambiguous name, descriptive of the data element, descriptive of the data element being identified in the data format.

6.1.3 *Data Type*—The kind of data to be included in the data element, such as the type of numbers, character strings, logical values, date, and time.

6.1.4 *Category Sets, 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 numbers are expressed.

6.1.4.1 A category set is a closed set listing all possible values the data element may take. Category sets are usually given in separate tables in the recommended format.

6.1.4.2 A value set is a representative set listing sample, but not necessarily all, acceptable values that the data element may take. Value sets may be given as separate tables in the recommended format.

6.1.4.3 The units listed are SI, according to Practice E 380, followed by inch-pound (U.S. customary) units in parentheses (except for test methods that have both a metric and an inch-pound version).

6.2 *Worksheets*—Worksheet versions may be desirable for various purposes, such as for use in a testing laboratory for recording original test data. The worksheet set-up is not critical if all of the available data elements are recorded.

7. Summary Tables

7.1 Though this guide primarily is concerned with the recording and storage of test data upon generation, the analysis and presentation of data are also of concern. Often this takes the form of summary tables for compiling results of many tests. Depending on the design of the database system, summary tables might also be used to enable correlations between test data from a particular test method and other related properties.

7.2 Such summary tables are likely to require space for derived values, such as averages, or for statistically or parametrically generated property values.

7.3 Since the recommended formats used in summarizing, compiling, and presenting multiple test results will vary greatly with the specific application, guidelines for such tabulations are not presented herein.

APPENDIXES

(Nonmandatory Information)

X1. RECOMMENDED FORMAT FOR COMPUTERIZATION OF PLANE-STRAIN FRACTURE TOUGHNESS TEST DATA BASED ON TEST METHOD E 399

X1.1 This recommended format is for plane-strain fracture toughness data generated by Test Method E 399. The recommended format does not include the recommended material description or the presentation of other specific types of test data. These items are covered by separate formats to be referenced in material specifications or recommended formats for other test methods.

TABLE X1.1 Recommended Format for Computerization of Plane-Strain Fracture Toughness Test Data per Test Method E 399

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
	Test Identification		
(1)*	Type of test	STRING	Plane-strain fracture toughness
(2)*	ASTM, ISO, or other applicable standard method number	STRING	ASTM E 399
(3)	Date of applicable standard year	DATE	(for example 1985)
(4)	Published source of data	STRING	
	Specimen Information		
(5)*	Specimen identification	STRING	...
(6)*	Specimen type	STRING	see Table X1.2
(7)*	Specimen orientation	STRING	see Table X1.3
(8)	Specimen location	STRING	see Table X1.4
(9)*	Specimen thickness, *B*	REAL	mm (in.)
(10)*	Specimen width (depth), *W*	REAL	mm (in.)
(11)	Specimen span length, *S* (bend specimen)	REAL	mm (in.)
(12)*	Loading hole offset (arc-shaped)	REAL	mm (in.)
(13)*	Inner radius (arc-shaped)	REAL	mm (in.)
(14)*	Outer radius (arc-shaped)	REAL	mm (in.)
(15)*	Material yield strength value, *TYS*	REAL	MPa (ksi)
(16)*	Source of yield strength value	STRING	...
(17)	Material elastic modulus value, *E*	REAL	MPa (ksi)
(18)*	Source of elastic modulus value	STRING	...

TABLE X1.1 *Continued*

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
	Fatigue Precracking		
(19)	Fatigue cracking maximum load, P_{fmax}	REAL	N (lbf)
(20)	Fatigue maximum stress intensity, K_{fmax}	REAL	MPa(−m) (ksi(−in.))
(21)	Fatigue cracking load ratio	REAL	...
(22)	Cycles to complete fatigue cracking	REAL	10^3 cycles
	Test Parameters and Procedures		
(23)*	Test temperature	REAL	C (degree F)
(24)	Test environment	STRING	...
(25)	Test humidity	REAL	%
(26)	Test date K_Q determination	DATE	YYYY–MM–DD
(27)	K_Q loading rate	REAL	N/min (lbf/min)
(28)	K_Q test chart slope	REAL	%
(29)	P_5	REAL	N (lbf)
(30)	K_Q candidate load, P_Q	REAL	N (lbf)
(31)	Candidate plane-strain intensity factor, K_Q	REAL	MPa(−m) (ksi(−in.))
(32)	Maximum load, P_{max}	REAL	N (lbf)
(33)	Maximum stress intensity factor, K_{max}	REAL	MPa(−m) (ksi(−in.))
	Test Results and Analysis		
(34)	Total crack length, edge, *a*1	REAL	mm (in.)
(35)	Total crack length, quarter, *a*2	REAL	mm (in.)
(36)	Total crack length, center, *a*3	REAL	mm (in.)
(37)	Total crack length, quarter, *a*4	REAL	mm (in.)
(38)	Total crack length, edge, *a*5	REAL	mm (in.)
(39)*	Average crack length, *a*	REAL	mm (in.)
(40)	Fracture obliquity	REAL	%
(41)	Fracture crack plane angle to crack plane	REAL	degrees
(42)	$2.5 \times (K_Q/TYS)_2$	REAL	mm (in.)
(43)	P_{max}/P_Q	REAL	...
(44)	*a/W*	REAL	...
(45)	K_{fmax}/K_Q	REAL	...
(46)	K_{fmax}/E	REAL	−m (−in.)
(47)	Minimum fatigue precrack length	REAL	mm (in.)
(48)	Maximum difference between *a*2, *a*3, *a*4	REAL	mm (in.)
(49)	Difference between *a*1 and *a*5	REAL	mm (in.)
(50)	K_Q stressing rate	REAL	MPa(−m) (ksi(−in.))
	Test Validation		
(51)	Is $B \geq 2.5\ (K_Q/TYS)^2$?	LOGICAL	...
(52)	Is $a \geq 2.5\ (K_Q/TYS)^2$?	LOGICAL	...
(53)	Is $a/W = 0.45 - 0.55$?	LOGICAL	...
(54)	Is $P_{max}/P_Q \leq 1.10$?	LOGICAL	...
(55)	Is $K_{fmax}/K_Q \leq 0.6$?	LOGICAL	...
(56)	Is $K_{fmax}/E \leq 0.0032\ m^{1/2}(0.002\ in.^{1/2})$?	LOGICAL	...
(57)	Is maximum difference between *a*2, *a*3, *a*4 ≤ 0.10a?	LOGICAL	...
(58)	Is the difference between *a*1 and *a*5 ≤ 0.10a for a chevron notch or ≤ 0.15a for a straight-through notch?	LOGICAL	...
(59)	Does fatigue crack meet minimum conditions (ASTM E 399, section on Fatigue Cracking)?	LOGICAL	...
(60)	Is fatigue crack plane angle ≤ 10°?	LOGICAL	...
(61)	Is loading rate 0.55 to 2.75 MPa−m/s (30 000 to 150 000 psi−in./min)?	LOGICAL	...
(62)	Is K_Q test chart slope = 0.75 to 1.5?	LOGICAL	...
(63)*	Is K_Q valid measure of K_{Ic}? (all criteria met?)	LOGICAL	...
(64)	Plane-strain fracture toughness, K_{Ic}	REAL	MPa(−m) (ksi(−in.))
(65)	Specimen strength ratio	REAL	...

[A] Data element numbers are for reference only. They do not imply a necessity to include all these data elements in any specific database nor imply a requirement that data elements used be in this particular order.

[B] Units listed are derived from SI.

* Denotes essential information for computerization of test results.

TABLE X1.2 Category Set for Specimen Type in Plane-Strain Fracture Toughness Test Method E 399

C(T)
SE(B)
A(T)
DC(T)

TABLE X1.3 Category Set for Specimen Orientation in Plane-Strain Fracture Toughness Test Method E 399[A]

L-T	...	T-L	LT-S	C-R	R-L
L-S	...	S-L	TS-L	C-L	L-C
T-S	S-T	L-TS	R-C	L-R	...

[A] Where first letter(s) is direction normal to plane of crack and the last letter is direction of crack growth.

TABLE X1.4 Value Set for Specimen Location in Plane-Strain Fracture Toughness Test Method E 399

Center of thickness
Quarter thickness
Surface
Full thickness

X2. RECOMMENDED FORMAT FOR COMPUTERIZATION OF FATIGUE CRACK GROWTH RATE TEST DATA

X2.1 This recommended format is for fatigue crack growth rate data generated by Test Method E 647 and other test methods. The recommended format does not include the recommended material description or the presentation of other specific types of test data. These items are covered by separate formats to be referenced in material specifications or recommended formats for other test methods.

TABLE X2.1 Recommended Standard Data Format for Computerization of Fatigue Crack Growth Rate Test Data

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
	Record and Test Identification		
(1)*	Type of Test	STRING	fatigue crack growth
(2)*	ASTM, ISO, or other applicable standard method number	STRING	for example, ASTM E 647 or BS 6835
(3)*	Date of applicable standard	DATE	year
(4)	Tester name	STRING	...
(5)	Tester affiliation	STRING	...
(6)	Testing location	STRING	...
(7)	Date test performed	DATE	YYYY–MM–DD
(8)	Test remarks	STRING	...
	Specimen Characterization		
(9)	Specimen identification	STRING	...
(10)	Specimen type	STRING	see Table X2.2
(11)	Specimen location	STRING	...
(12)	Specimen orientation (per ASTM E 399)	STRING	...
(13)*	Specimen dimensions (per ASTM E 647)	STRING	...
(14)	Notch configuration	STRING	see Table X2.3
(15)	Notch preparation	STRING	see Table X2.4
(16)	Notch depth	STRING	see Table X2.5
(17)	Root radius	REAL	mm (in.)
(18)	Surface length	REAL	mm (in.)
(19)	Notch height	REAL	mm (in.)
(20)	Stress concentration factor	REAL	...
(21)	Cantilever arm for CB specimen	STRING	...
(22)	Contour definition	STRING	...
(23)	"*K* versus *a*" relation for nonstandard specimens	STRING	...
(24)	Method for calculating "*K* versus *a*"	STRING	...
(25)	Remarks about specimen	STRING	...
	Test Machine Description		
(26)	Manufacturer of test equipment	STRING	...
(27)	Equipment serial number	STRING	...
(28)	Load cell capacity	REAL	N (lbf)
(29)	Load cell range as percent of load cell capacity	REAL	%
(30)	Load cell accuracy as percent of load cell range	REAL	%
(31)	Load cell serial number	STRING	...
(32)	ASTM specification number for calibration procedure	STRING	...
(33)	Crack measuring method	STRING	see Table X2.6
(34)	Crack measuring equipment	STRING	...
(35)	Crack measuring accuracy	REAL	...
(36)	Method for calibrating crack measurement	STRING	...
(37)	Crack opening method	STRING	see Table X2.7

TABLE X2.1 *Continued*

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
(38)	Crack opening measurement equipment	STRING	...
(39)	Crack opening measurement placement	STRING	see Table X2.8
(40)	Crack opening measurement accuracy	STRING	...
(41)	Load cell location	STRING	...
(42)	Displacement measurement transducer type	STRING	...
(43)	Displacement measurement transducer location	STRING	...
	Corrosion Information		
(44)	Grip material in electrical contact with specimen	STRING	...
(45)	Pin material in electrical contact with specimen	STRING	...
(46)	Container material	STRING	...
(47)	Container volume	STRING	...
(48)	Type of plating on grips or chamber	STRING	...
(49)	Electrical isolation of specimen	STRING	...
(50)	Seal frictional force	REAL	N (lbf)
(51)	Procedure for compensation for chamber pressure	STRING	...
(52)	Temperature measurement transducer type	STRING	...
(53)	Temperature measurement transducer location	STRING	...
(54)	Temperature gradient in electrolyte	STRING	...
(55)	Aqueous mixture procedures	STRING	...
(56)	Deoxygenation procedures	STRING	...
	Test Procedure		
(57)*	Test type	STRING	see Table X2.9
(58)	Precrack terminal delta K	REAL	MPa-−m (ksi-−in.)
(59)*	Final precrack straightness	STRING	see Table X2.10
(60)*	Final precrack maximum load	REAL	N (lbf)
(61)*	Final precrack minimum load	REAL	N (lbf)
(62)	Number of cycles to initiate precrack	INTEGER	...
(63)	Temperature of precracking procedure	REAL	C (degrees F)
(64)	Precracking environment (if different from testing environment)	STRING	...
(65)*	Control parameter	STRING	see Table X2.11
(66)	Units for control parameter	STRING	...
(67)*	Maximum value for control parameter	REAL	...
(68)*	Minimum value for load parameter	REAL	...
(69)	Ratio of minimum to maximum value of control parameter for constant amplitude test	REAL	...
(70)	Waveform	STRING	see Table X2.12
(71)*	Frequency	REAL	Hz
(72)	Rise time for ramp-hold type loading	REAL	s
(73)	Hold time at max or min loads in cycle	REAL	s
(74)	Hold time at max load	REAL	s
(75)	Hold time at min load	REAL	s
(76)	Reset time to unload ramp	REAL	s
(77)	Remarks on test procedure	STRING	...
	Test Environmental Conditions		
(78)*	Environmental characterization	STRING	see Table X2.13
(79)*	Environmental temperature	REAL	C (degrees F)
(80)	Injection temperature	REAL	C (degrees F)
(81)	Environmental flow	STRING	Static/Dynamic
(82)	Chamber Flow rate	REAL	m**3/s (in.**3/s)
(83)	Chamber pressure	REAL	Pa (psi)
(84)	Chamber overpressure gas	STRING	...
(85)	Make-up tank volume	REAL	m**3
(86)	Make-up tank pressure	REAL	Pa (psi)
(87)	Make-up tank overpressure gas	STRING	...
(88)	Environmental sample point	STRING	...
(89)	Sampling technique	STRING	...
(90)	High purity water source	STRING	see Table X2.14
(91)	Method of monitoring of conductivity	STRING	...
(92)	Method of monitoring pH	STRING	...
(93)	Method of monitoring oxygen content	STRING	...
(94)	Method of monitoring chlorine content	STRING	...
(95)	Method of monitoring fluorine content	STRING	...
(96)	Other chemical monitoring	STRING	...
(97)	Electrode potential	REAL	...
(98)	Method of measuring electrode potential	STRING	...
(99)	Time specimen resided in chemical environment before the test	REAL	dd/mm/hh
(100)	Remarks about the environment	STRING	...
	Fatigue Crack Propagation Test Results		
(101)	Initial optical crack length	REAL	mm (in.)
(102)	Final optical crack length	REAL	mm (in.)
(103)*	Total number of loading cycles (final number of cycles)	INTEGER	...

TABLE X2.1 *Continued*

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
(104)*	Crack length (final crack length)	REAL	mm (in.)
(105)*	Type of crack length measurement	STRING	see Table X2.15
(106)	Crack surface length for semielliptical surface cracks	REAL	mm (in.)
(107)	Crack opening load	REAL	N (lbf)
(108)	Crack front straightness	STRING	see Table X2.16
(109)	Total test down time	REAL	dd/hh/mm
(110)	Remarks on results	STRING	...
	Data Reduction		
(111)	Are data reduced?	LOGICAL	...
(112)	Is d*a*/d*N* computed?	LOGICAL	...
(113)*	Data reduction method	STRING	see Table X2.17
	Raw "*a* versus *N*" data		
(114)*	Number of (*a, N*) data points recorded	INTEGER	...
	Repeatable data elements		
(115)*	Crack length (*a*)	REAL	mm (in.)
(116)*	Number of cycles (*N*)	INTEGER	...
(117)	Opening load	REAL	N (lbf)
	d*a*/d*N* as a Function of Delta *K*		
(118)*	Number of d*a*/d*N* data points	INTEGER	...
(119)*	d*a*/d*N*	REAL	mm/cycle (in./cycle)
(120)*	Type of delta *K* used in data reduction	STRING	*K* applied or *K* opening
(121)*	Delta $K_{applied}(K_{max} - K_{min})$	REAL	...
(122)	Delta $K_{opening}(K_{max} - K_{opening})$	REAL	...
(123)*	Data reduction equation used for d*a*/d*N*	STRING	...
(124)	Data value correction applied to raw data	STRING	...
(125)	Remarks about data reduction	STRING	...

[A] Data element numbers are for reference only. They do not imply a necessity to include all these data elements in any specific database nor imply a requirement that data elements used be in this particular order.

[B] Units listed first are for SI; those in parentheses are English.

* Denotes essential information for computerization of test results.

TABLE X2.2 Value Set for Specimen Types

C(T)—Compact tension (ASTM E 647)
M(T)—Center-cracked tension (ASTM E 647)
Other per ASTM E616 (Standard terminology relating to fracture testing)
CT—Compact tension (BS 6835: 1988)
CCT—Center-cracked tension (BS 6835: 1988)
SENB3—Three point bend single edge notch (BS 6835: 1988)
SENB4—Four point bend single edge notch (BS 6835: 1988)
Non-standard

TABLE X2.3 Value Set for Notch Configuration, per ASTM E 647

Straight through
Chevron sawcut/EDM
Hole/slot

TABLE X2.4 Value Set for Notch Preparation, per ASTM E 647

EDM
Mill
Broach
Grind
Sawcut
Other

TABLE X2.5 Value Set for Notch Depth

a for C(T)
2*a* for M(T)

TABLE X2.6 Value Set for Crack Measuring Techniques

Optical (microscope)
Compliance
Crack growth gage
ac potential drop
dc potential drop
Other

TABLE X2.7 Value Set for Crack Opening Measurement Technique

Compliance
Strain gage
Clip gage
Other

TABLE X2.8 Value Set for Placement of Crack Opening Measurement Device

Crack mouth
Crack tip
Side gage
Top gage
Back gage
Line of loading
Other

TABLE X2.9 Value Set for Test Types

Constant load amplitude
Constant stress intensity
Load shedding
Decreasing stress intensity
Increasing stress intensity
Constant K_{max}
Other

TABLE X2.10 Value Set for Precrack Straightness

Difference between front and back measurements
Angular deviation from symmetry plane
Difference between two cracks in M(T) test

TABLE X2.11 Value Set for Control Parameters

Load
Displacement
Stress intensity
Effective stress intensity

TABLE X2.12 Value Set for Waveform

Sine
Square
Saw tooth
Trapezoid
Other

TABLE X2.13 Environment Characterization

Brine solution
Air
Inert gas
Pure water
Acidic solution
Vacuum
Other

TABLE X2.14 Value Set for Source of Pure Water

Bottled
Distilled
Other

TABLE X2.15 Value Set for Type of Crack Length Measurement

One side
Both sides
Averaged

TABLE X2.16 Value Set for Crack Front Straightness

Difference between front and back measurements
Within ±5° envelope around symmetry plane
Difference between two cracks in M(T) test

TABLE X2.17 Value Set for Method of Data Reduction

Secant method (ASTM E 647)
Incremental polynomial (ASTM E 647)
Three point method (linear difference method) (BS6835: 1988)
Other

X3. RECOMMENDED FORMAT FOR COMPUTERIZATION OF STRAIN-CONTROLLED FATIGUE TEST DATA

X3.1 This recommended format is for strain-controlled fatigue test data generated by Test Method E 606 and other test methods. The recommended format does not include the recommended material description or the presentation of other specific types of test data. These items are covered by separate formats to be referenced in material specifications or recommended formats for other test methods.

TABLE X3.1 Recommended Standard Data Format for Computerization of Strain-Controlled Fatigue Testing per Test Method E 606

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
	Record and Test Identification		
(1)*	Type of Test	STRING	Strain-controlled fatigue
(2)*	ASTM, ISO, or other applicable standard method number	STRING	for example, ASTM E 606
(3)*	Date of applicable standard	DATE	year
(4)	Tester name	STRING	...
(5)	Tester affiliation	STRING	...
(6)	Testing location	STRING	...
(7)	Date test performed	DATE	YYYY–MM–DD
(8)	Test remarks	STRING	...
	Specimen Characterization		
(9)*	Specimen type	STRING	see Table X3.2

TABLE X3.1 *Continued*

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
(10)	Specimen location	STRING	see Table X3.3
(11)*	Specimen orientation (see ASTM E 399)	STRING	see Table X3.4
(12)*	Machining procedure (see ASTM E 606)	STRING	...
(13)*	Nominal specimen dimensions (see ASTM E 606)	STRING	...
(14)	Relationship used to obtain diameter at elevated temperature	STRING	...
(15)	Remarks about specimen	STRING	...
	Test Machine Description		
(16)	Manufacturer of test equipment	STRING	...
(17)	Equipment serial number	STRING	...
(18)	Load cell capacity	REAL	N (lbf)
(19)	Load cell range as percent of load cell capacity	REAL	%
(20)	Load cell accuracy as percent of load cell range	REAL	%
(21)	Load cell serial number	STRING	...
(22)	Load cell location in load train	STRING	...
(23)	ASTM specification number for calibration procedure	STRING	...
(24)	Strain measuring method	STRING	see Table X3.5
(25)	Strain measuring device	STRING	see Table X3.6
(26)	Description of method to avoid premature extensometer knife edge-induced failure	STRING	...
(27)	Strain extensometer capacity	REAL	%
(28)	Strain extensometer range as percent of the capacity	REAL	%
(29)	Strain extensometer accuracy as percent of range	REAL	%
(30)	ASTM specification number for strain calibration procedure	STRING	ASTM E 83
(31)	Displacement measurement transducer type	STRING	...
(32)	Displacement measurement location	STRING	...
(33)	Specimen fixture type (per ASTM E 606)	STRING	see Table X3.7
(34)*	Method to maintain specimen alignment	STRING	ASTM E 1012
(35)	Maximum ratio of bending strain to axial strain	REAL	%
(36)	Number of bending axes measured	INTEGER	...
(37)	Number of bending positions measured along axis	INTEGER	...
(38)	Recording systems	STRING	see Table X3.8
(39)	Accuracy of recording system	REAL	%
(40)	Load frame stiffness	REAL	N/mm (lb/in.)
(41)	How stiffness determined	STRING	...
	Corrosion Information		
(42)	Grip material in electrical contact with specimen	STRING	...
(43)	Container material	STRING	...
(44)	Container volume	REAL	L
(45)	Type of plating on grips or chamber	STRING	...
(46)	Electrical isolation of specimen	STRING	...
(47)	Seal frictional force	REAL	N (lbf)
(48)	Procedure for compensation for chamber pressure	STRING	...
(49)	Temperature measurement transducer type	STRING	...
(50)	Temperature measurement transducer location	STRING	...
(51)	Temperature gradient in electrolyte	STRING	...
(52)	Aqueous mixture procedures	STRING	...
(53)	Deoxygenation procedures	STRING	...
	Test Procedure		
(54)*	Test type	STRING	see Table X3.9
(55)*	Control parameter	STRING	see Table X3.10
(56)	Units for control parameter	STRING	...
(57)*	Maximum value for control parameter	REAL	...
(58)*	Minimum value for load parameter	REAL	...
(59)	Ratio of minimum to maximum value of control parameter for constant amplitude test	REAL	...
(60)*	Waveform	STRING	see Table X3.11
(61)*	Frequency	REAL	Hz
(62)*	Strain rate	REAL	1/s
(63)	Average elastic strain rate	REAL	1/s
(64)	Rise time for ramp-hold type loading	REAL	s
(65)	Hold time at maximum strain	REAL	s
(66)*	Hold time at minimum strain	REAL	s
(67)*	Reset time to unload ramp	REAL	s
(68)	Total strain range	REAL	...
(69)	Type of strain at first quarter cycle	STRING	see Table X3.12
(70)	Relationship converting diametral strain to axial strain	STRING	...
(71)	Elastic modulus used to convert diametral strain	REAL	GPa (Mpsi)
(72)	Poisson's ratio used to convert diametral strain	REAL	...
(73)	Remarks on test procedure	STRING	...
	Test Environmental Conditions		
(74)*	Environmental characterization	STRING	see Table X3.13
(75)*	Environmental temperature	REAL	C (degrees F)
(76)	Relative humidity	REAL	%

TABLE X3.1 *Continued*

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
(77)	Injection temperature	REAL	C (degrees F)
(78)	Environmental flow condition	STRING	see Table X3.14
(79)	Chamber flow rate	REAL	m**3/s (ft**3/s)
(80)	Chamber pressure	REAL	Pa (psi)
(81)	Chamber overpressure gas	STRING	...
(82)	Make-up tank volume	REAL	m**3
(83)	Make-up tank pressure	REAL	Pa (psi)
(84)	Make-up tank overpressure gas	STRING	...
(85)	Environmental sample point	STRING	...
(86)	Sampling technique	STRING	...
(87)	High purity water source	STRING	see Table X3.15
(88)	Method of monitoring of conductivity	STRING	...
(89)	Measured value of conductivity	REAL	ohm/m
(90)	Method of monitoring pH	STRING	...
(91)	Measured value of pH	REAL	...
(92)	Method of monitoring oxygen content	STRING	...
(93)	Measured value of oxygen content	REAL	ppm
(94)	Method of monitoring chlorine content	STRING	...
(95)	Measured value of chlorine content	REAL	ppm
(96)	Method of monitoring fluorine content	STRING	...
(97)	Measured value of fluorine content	REAL	ppm
(98)	Other chemical monitoring	STRING	...
(99)	Electrode potential	REAL	...
(100)	Method of measuring electrode potential	STRING	...
(101)	Time specimen resided in chemical environment before the test	REAL	dd/mm/hh
(102)	Remarks about the environment	STRING	...
	Test Results		
	The next block of data elements represent sets of data, one set for each specimen:		
(103)	Specimen identification	STRING	...
(104)	Minimum gage section diameter	REAL	mm (in.)
(105)	Maximum stress (first reversal)	REAL	MPa (ksi)
(106)	Minimum stress (second reversal)	REAL	MPa (ksi)
(107)	E* (first quarter cycle)	REAL	GPa (Mpsi)
(108)	Measured inelastic strain range (first cycle)	REAL	...
(109)	Elastic strain range (first cycle)	REAL	...
(110)*	Maximum stress (mid-life)	REAL	MPa (ksi)
(111)*	Maximum stress (mid-life)	REAL	MPa (ksi)
(112)*	E* (mid-life)	REAL	GPa (Mpsi)
(113)*	Measured inelastic strain range (mid-life)	REAL	...
(114)	Elastic strain range (mid-life)	REAL	...
(115)*	Number of cycles defining mid-life	INTEGER	...
(116)*	Number of cycles to crack initiation	INTEGER	...
(117)	Shape of initiated fatigue crack	STRING	see Table X3.16
(118)	Size of initiated fatigue crack	REAL	mm (in.)
(119)	Shape factor of initiated fatigue crack	REAL	...
(120)*	Method to determine initiation	STRING	...
(121)*	Number of cycles to separation	INTEGER	...
(122)	Method to monitor microcracking	STRING	see Table X3.17
(123)*	Fracture location of out-of-gage section	STRING	see Table X3.18
(124)	Mechanism or mode of crack initiation	STRING	...
(125)	Mechanism or mode of crack propagation	STRING	...
(126)	Fatigue crack size at fracture	REAL	mm (in.)
(127)	Fatigue crack shape at fracture	STRING	see Table X3.16
(128)	Shape factor of fatigue crack at fracture	REAL	...
(129)	Fracture mechanism	STRING	...
(130)	Cause or mechanistic reason association with crack initiation/fatigue failure	STRING	see Table X3.19
(131)	Relative degree of transgranular and intergranular cracking	REAL	%
(132)	Description of postmortem metallography	STRING	...
(133)	Description of postmortem fractography	STRING	...
	Hysteresis Loop Data: The Next Block of Data Elements Represent Sets of Data, One Set for Each Hysteresis Loop:		
(134)	Specimen identification (data element 102)	STRING	...
(135)	Cycle number corresponding to this loop	INTEGER	...
(136)	Number of points to discretize hysteresis loop (number of stress-strain points in this file)	INTEGER	...
(137)	Stress (repeatable data element)	REAL	MPa (ksi)
(138)	Strain (repeatable data element)	REAL	...
	Maximum Load/Strain Versus Cycle/Time Data: The Next Block of Data Elements Represent Sets of Data, One Set for Each Specimen:		
(139)	Specimen identification (data element 102)	STRING	...
(140)	Cycle number (repeatable data element)	INTEGER	...
(141)	Cycle time (repeatable data element)	REAL	s
(142)	Maximum axial stress (repeatable data element)	REAL	MPa (ksi)
(143)	Minimum axial stress (repeatable data element)	REAL	MPa (ksi)
(144)	Maximum inelastic strain (repeatable data element)	REAL	...
(145)	Minimum inelastic strain (repeatable data element)	REAL	...

TABLE X3.1 *Continued*

No.[A]	Data Element Name and Description	Data Type[B]	Category Sets, Value Sets or Units
(146)	Maximum total strain (repeatable data element)	REAL	...
(147)	Minimum total strain (repeatable data element)	REAL	...
	Relaxation Data for Hold-Time Tests: The Next Block of Data Elements Represent Sets of Data, One Set for Each Specimen:		
(148)	Cycle number associated with this entry	INTEGER	...
(149)	Hold time for this load application	REAL	s
(150)	Relaxed tensile stress during hold time at maximum strain application	REAL	MPa (ksi)
(151)	Relaxed compressive stress during hold time at minimum strain application	REAL	MPa (ksi)
(152)	Change in inelastic strain during hold time at maximum strain application	REAL	...
(153)	Change in inelastic strain during hold time at minimum strain application	REAL	...
(154)	Remarks about the results	STRING	...
	Data Reduction		
(155)	Method to compute inelastic strains	STRING	see Table X3.20
(156)	Cyclic strain-hardening exponent (n′) (ASTM E 606)	REAL	...
(157)	Cyclic strength coefficient (*K*′) (see ASTM E 606)	REAL	MPa (ksi)
(158)	Independent variable to compute *K*′ and *n*′	STRING	see Table X3.21
(159)	Data reduction method to compute *K*′ and *n*′	STRING	...
(160)	Cyclic yield strength	REAL	MPa (ksi)
(161)	Cyclic yield strength—percent offset	REAL	%
(162)	Fatigue strength coefficient − σ_f' (ASTM E 606)	REAL	MPa (ksi)
(163)	Fatigue strength exponent − *b* (ASTM E 606)	REAL	...
(164)	Specimens used to compute σ_f' and *b*	STRING	...
(165)	Independent variable used to compute σ_f' and *b*	STRING	see Table X3.22
(166)	Data reduction method to compute σ_f' and *b*	STRING	...
(167)	Fatigue ductility coefficient − ϵ_f' (ASTM E 606)	REAL	...
(168)	Fatigue ductility exponent − *c* (ASTM E 606)	REAL	...
(169)	Specimens used to compute ϵ_f' and *c*	STRING	...
(170)	Independent variable used to compute ϵ_f' and *c*	STRING	see Table X3.22
(171)	Data reduction method to compute ϵ_f' and *c*	STRING	...
(172)	Properties σ_f', *b*,ϵ_f', and *c* based on initiation (N_i) or separation (N_f)	STRING	Ni or Nf
(173)	Remarks about data reduction	STRING	...

[A] Data element numbers are for reference only. They do not imply a necessity to include all these data elements in any specific database nor imply a requirement that data elements used be in this particular order.

[B] Units listed first are for SI; those in parentheses are English.

* Denotes essential information for computerization of test results.

TABLE X3.2 Value Set for Specimen Types

Uniform-gage test section (ASTM E 606)
Hour-glass test section (ASTM E 606)
Sheet specimen (ASTM E 606)
Non-standard

TABLE X3.3 Value Set for Specimen Location

Center of thickness
Quarter thickness
Surface

TABLE X3.4 Value Set for Specimen Orientation

Longitudinal
Long transverse
Short transverse
Tangential
Radial

TABLE X3.5 Value Set for Strain Measuring Methods

Longitudinal displacement measurement
Diametral displacement measurement

TABLE X3.6 Value Set for Strain Measuring Equipment

Strain gage
Displacement
LVDT
Displacement transducer
Other

TABLE X3.7 Value Set for Fixturing Techniques

Button-head fixture
Efficiency button-head fixture
Threaded specimen fixture
Sheet specimen fixture
Straight-sided (cylindrical) specimen fixture
Wood's metal pot
Other

TABLE X3.8 Value Set for Recording Systems

Potentiometric X-Y recorder
Oscilloscope with camera storage
Oscilloscope digital
X-Y plotter
Computer data acquisition system
Other

TABLE X3.9 Value Set for Types of Test

Total strain control
Continuous plastic strain control
Load or stress control
Pseudo-strain control or strain limit control
Displacement control
Other

TABLE X3.10 Value Set for Control Parameters

Strain
Plastic strain
Displacement
Load (elastic strain)
Other

TABLE X3.11 Value Set for Waveform

Sine
Triangle
Square
Trapezoid
Other

TABLE X3.12 Value Set of Types of Strain at First Quarter Cycle

Tensile
Compressive

TABLE X3.13 Value Set for Environment Characterization

Air
Brine solution
Inert gas
Pure water
Acidic solution
Vacuum
Other

TABLE X3.14 Value Set for Environmental Flow

Static
Dynamic

TABLE X3.15 Value Set for Pure Water Sources

Bottled
Distilled
Other

TABLE X3.16 Value Set for Crack Shapes

Semi-circular surface crack
Semi-elliptical surface crack
Circular embedded crack
Elliptical embedded crack
Other

TABLE X3.17 Value Set for Methods to Monitor Microcracks

Optical (microscope)
Replica
Compliance
ac electrical potential
dc electrical potential
Crack growth gage
Acoustic emission
Other

TABLE X3.18 Value Set for Fracture Locations

Gage section
Knife edge
Other

TABLE X3.19 Value Set for Causes of Failures

Wear mark
Inclusion
Grain boundary
Casting pore
Surface scratch
Surface defect
Other

TABLE X3.20 Value Set for Methods Used to Compute Inelastic Strains

Hysteresis loop width
Total strain—elastic strain

TABLE X3.21 Value Set for Independent Variables Used to Compute K' and n'

Inelastic strain
Stress

TABLE X3.22 Value Set for Independent Variables Used to Compute σ_f' and b or ϵ_f' and c

Strain
Reversals