



BSI Standards Publication

Instruments and software used for measurement in high-voltage and high-current tests

Part 2: Requirements for software for tests
with impulse voltages and currents

National foreword

This British Standard is the UK implementation of EN 61083-2:2013. It is identical to IEC 61083-2:2013. It supersedes BS EN 61083-2:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/42, Testing techniques for high voltages and currents.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Instruments and software used for measurement in high-voltage
and high-current tests -
Part 2: Requirements for software for tests
with impulse voltages and currents
(IEC 61083-2:2013)**

Appareils et logiciels utilisés pour les
mesures pendant les essais à haute
tension et haute intensité -
Partie 2: Exigences pour le logiciel pour
les essais avec des tensions et des
courants de choc
(CEI 61083-2:2013)

Messgeräte und Software für Messungen
bei Hochspannungs- und Hochstrom-
Prüfungen -
Teil 2: Anforderungen an die Software bei
Prüfungen mit Stoßspannungen und -
strömen
(IEC 61083-2:2013)

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Foreword

The text of document 42/318/FDIS, future edition 2 of IEC 61083-2, prepared by IEC/TC 42 "High-voltage testing techniques" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61083-2:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-01-24
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-04-24

This document supersedes EN 61083-2:1997.

EN 61083-2:2013 includes the following significant technical changes with respect to EN 61083-2:1997:

- a) the test data generator software has been updated;
- b) the number of reference impulse waveforms included in the test data generator has been significantly increased;
- c) all reference values have been recalculated according to new definitions in EN 60060-1 and EN 62475;
- d) methods for estimating the uncertainty of parameter evaluation has been introduced and are in line with the procedure introduced in EN 60060-2.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61083-2:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	2010	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	2010
IEC 60060-2	-	High-voltage test techniques - Part 2: Measuring systems	EN 60060-2	-
IEC 60060-3	2006	High voltage test techniques - Part 3: Definitions and requirements for on-site testing	EN 60060-3 + corr. October	2006 2006
IEC 61083-1	2001	Instruments and software used for measurement in high-voltage impulse tests - Part 1: Requirements for instruments	EN 61083-1	2001
IEC 62475	2010	High-current test techniques - Definitions and requirements for test currents and measuring systems	EN 62475	2010
ISO/IEC Guide 98-3 -		Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-

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INTRODUCTION

IEC 61083-1 specifies the test requirements for digital recorders. Digital recorders, like analogue oscilloscopes, are susceptible to changes in their characteristics. However, the more stringent testing (than is practical for analogue oscilloscopes) specified for digital recorders for standard impulse voltage and current measurement has led to the accuracy of digital recorders being more clearly demonstrated.

This part of IEC 61083 applies to software used to process digital records to provide the values of the relevant impulse parameters. The raw data are retained for comparison with the processed data. However, since the parameters of the test impulse (including the test value) are to be read from the processed data, it is important to establish tests to ensure that the reading of parameters is adequately performed. The problem is how to ensure this, while permitting users to develop a wide range of techniques.

This problem is further complicated by the different needs of various users, ranging from single-purpose test laboratories, for example those of a cable manufacturer who may only test a few objects which are capacitive, to large high-voltage test/research laboratories, which may perform tests on a very wide range of objects, which have a correspondingly wide range of impedances.

The approach taken in this part of IEC 61083 is to provide, from a test data generator software, waveforms (and ranges of their parameters) which a user can employ to verify that a procedure gives values within the specified ranges. To reduce the amount of testing required, the waveforms are divided into groups, and the user needs only to check those groups that are appropriate for the high-voltage and/or high-current tests to be performed in his/her laboratory.

New definitions for lightning impulse parameters and switching impulse time-to-peak evaluation are introduced in IEC 60060-1. The changes in these definitions have lead to significant changes in some of the reference values in this standard. The number of impulse records in the test data generator has been increased to cover a wider range of impulse shapes seen in on-site testing.

INSTRUMENTS AND SOFTWARE USED FOR MEASUREMENT IN HIGH-VOLTAGE AND HIGH-CURRENT TESTS –

Part 2: Requirements for software for tests with impulse voltages and currents

1 Scope and object

This part of IEC 61083 is applicable to software used for evaluation of impulse parameters from recorded impulse voltages and currents. It provides test waveforms and reference values for the software required to meet the measuring uncertainties and procedures specified in IEC 60060-1, IEC 60060-2, IEC 60060-3 and IEC 62475.

Hardware with built-in firmware that cannot accept external numerical input data is not covered by this standard.

The object of this standard is to

- establish the tests which are necessary to show that the performance of the software complies with the requirements of the relevant IEC standards;
- define the terms specifically related to digital processing;
- specify reference values and the acceptance limits for the reference impulses;
- specify the requirements for the record of performance;
- define the methods to assess the contribution of software to the measurement uncertainty.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2, *High-voltage test techniques – Part 2: Measuring systems*

IEC 60060-3:2006, *High-voltage test techniques – Part 3: Definitions and requirements for on-site testing*

IEC 61083-1:2001, *Instruments and software used for measurement in high-voltage impulse tests – Part 1: Requirements for instruments*

IEC 62475:2010, *High-current test techniques – Definitions and requirements for test currents and measuring systems*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE References to definitions of relevant impulse parameters, as shown in the relevant clauses of IEC 60060-1:2010, IEC 60060-3:2006 and IEC 62475:2010 are listed in Tables 1 and 2.

3.1

raw data

original record of sampled and quantized information obtained when a digital recorder converts an analogue signal into a digital form, possibly corrected for offset or multiplied by a scale factor

3.2

processed data

data obtained by any processing (other than correction for offset and/or multiplying by a scale factor) of the raw data

[SOURCE: IEC 61083-1:2001, definition 1.3.3.5, modified – "constant scale factor" replaced by "scale factor"; NOTE not retained]

3.3

internal noise level

standard deviation of the samples recorded when a constant voltage is applied to the input of the digital recorder

3.4

reference impulse

waveform supplied by the test data generator (TDG)

3.5

sampling rate

sampling frequency
number of samples of a signal taken per unit time

[SOURCE: IEC 60050-704:1993, definition 704-23-03]

3.6

resolution (in digital processing)

measure of the accuracy with which a digital system can distinguish between the magnitudes of two samples of a signal

Note 1 to entry: Resolution is usually expressed as the number of bits necessary to express in binary form the maximum number of possible different signal levels which can be recognized by the system.

[SOURCE: IEC 60050-807:1998, definition 807-01-02]

3.7

test data generator

TDG

computer program that generates digital reference data files, representative of synthesized and recorded impulse waveforms

Table 1 – References to impulse voltage parameter definitions

	IEC 60060-1:2010								IEC 60060-3:2006				
	U_t	T_p	β	T_1	T_c	T_2	U_e		U_t	T_p	T_1	T_2	f
<i>Impulse group/ Evaluation algorithm</i>	Value of the test voltage	Time to peak	Relative overshoot magnitude	Front time	Time to chopping	Time to half- value	Extreme value	Average rate of rise	Value of the test voltage	Time to peak	Front time	Time to half- value	Oscillation frequency
Full lightning impulse voltage (LI)	7.1.15, Annex B		7.1.17, Annex B	7.1.18, Annex B		7.1.22, Annex B	7.1.9	7.1.20	(7.2.4)		(7.2.5)	(7.2.7)	
Front chopped lightning impulse voltage (LIC-A1, LIC-M1 to LIC-M3)	7.1.15, 7.2.6				7.1.27		7.1.9	7.1.20					
Tail chopped lightning impulse voltage (LIC-M4 to LIC-M5)	7.1.15, Annex B		7.1.17, Annex B	7.1.18, Annex B	7.1.27, Annex B		7.1.9	7.1.20					
Switching impulse voltage (SI)	8.1.2	8.1.3				8.1.5			(8.2.3)	(8.2.4)		(8.2.5)	
Oscillating lightning impulse voltage (OLI)									7.2.4		7.2.5	7.2.7	8.2.6
Oscillating switching impulse voltage (OSI)									8.2.3	8.2.4		8.2.5	8.2.6
NOTE Some definitions of parameters (shown in parenthesis) in IEC 60060-3:2006 are different from those in IEC 60060-1:2010. For IEC 60060-3, reference values are only provided for oscillating lightning and oscillating switching impulse parameters.													

NOTE Some definitions of parameters (shown in parenthesis) in IEC 60060-3:2006 are different from those in IEC 60060-1:2010. For IEC 60060-3, reference values are only provided for oscillating lightning and oscillating switching impulse parameters.

Table 2 – References to impulse current parameter definitions

Impulse group / Evaluation algorithm	IEC 62475:2010				
	I_p Peak value of current	T_1 Front time	T_2 Time to half-value	T_d Duration	T_t Total duration
Exponential impulse current (IC-M1 to IC-M7, IC-M9)	10.2.3	10.2.4	10.2.6		
Rectangular impulse current (IC-M8)	10.2.3			10.2.7	10.2.8

4 Test data generator (TDG)

4.1 Principle

The test data generator (TDG) is a computer program that generates digital reference data files, representative of both synthetic and recorded impulse waveforms. These reference impulses shall be processed by the software under test, and the parameters evaluated from the processed data shall fall within the acceptance limits given in Annex A. In this way the performance of the software can be verified.

The TDG is an integral part of this standard and is provided as compiled code for a computer running Windows¹ operating system. TDG is a menu-driven program with a built-in help file.

4.2 Data format

The reference data files generated by the TDG simulate the raw data, which would be obtained from the digital recorder of the user. The reference data files are written in a two column ASCII format. Their respective values are given in terms of seconds and in volts or amperes. If the data format or range expected by the software under test does not correspond to the format or range provided by the TDG, a suitable conversion program shall be used.

NOTE Software which cannot read TDG reference impulses (either in the direct or converted form) is not covered by this standard.

5 Values and acceptance limits for the parameters of the reference impulses

A round-robin test has been performed, in which a number of laboratories independently calculated values for parameters of the reference impulses. Statistical mean values from this round-robin test were taken as the reference values of the parameters listed in Tables 1 and 2.

Requirements for acceptance limits have been set based on the needs of the application.

These parameters of the reference impulses are given in Tables A.1 to A.6.

6 Software testing

6.1 General

The TDG is designed to provide data files simulating digital recorder output for the purpose of testing software used to determine the impulse parameters as defined in IEC 60060-1,

¹ Windows is the trade name of a product supplied by Microsoft. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.