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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Measurement method for the output of electroshock weapons

Méthode de mesure de la sortie des pistolets à impulsion électrique

IEC 62792:2015-02(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MEASUREMENT METHOD FOR THE OUTPUT OF ELECTROSHOCK WEAPONS

FOREWORD

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International Standard IEC 62792 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

All terms defined in Clause 3 are italicized in this standard.

The text of this standard is based on the following documents:

FDIS	Report on voting
85/490/FDIS	85/507/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Manufacturers, medical researchers, policy makers, users, and other interested parties involved with different aspects of electroshock weapons (ESWs) use a variety of different measurement methods, different terminologies, and different parameters to measure and describe the performance of an ESW. These differences generate confusion and misunderstanding within this stakeholder community, and this impacts the ability to perform accurate, reliable, and reproducible measurement comparisons. By developing a generally-accepted terminology, set of performance parameters, and test methods, this standard will facilitate accurate and precise communication for the parameters that describe the electrical output, current and high voltage, of ESWs. This improved communication will aid this stakeholder community in collectively developing uniform methods for describing the ESW output and its effect on human physiology consistently and accurately, thereby enabling the development of safe use performance standards/regulations by the appropriate standardization body.

MEASUREMENT METHOD FOR THE OUTPUT OF ELECTROSHOCK WEAPONS

1 Scope

This International Standard specifies a method for measuring the electrical outputs, current and voltage, from electroshock weapons (ESWs) that deliver an electrical stimulus to humans. This International Standard is applicable to any and all ESWs.

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 60469:2013, *Transitions, pulses and related waveforms – Terms, definitions and algorithms*

IEEE Std. 1057-2007, *IEEE Standard for digitizing waveform recorders*

BIPM, *The International System of Units (SI)*, 8th Edition, 2006

3 Terms and definitions

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

3.1
impulse amplitude
difference between the specified *level* corresponding to the *maximum peak* (*minimum peak*) of the positive (negative) *impulse-like waveform* and the *level* of the *state* preceding the first *transition* of that *impulse-like waveform*

[SOURCE: IEC 60469:2013, 3.2.3.1]

3.2
correction
operation combining the results of the conversion operation with the transfer function information to yield a *waveform* that is a more accurate representation of the *signal*

Note 1 to entry: Correction may be effected by a manual process by an operator, a computational process, or a compensating device or apparatus. Correction must be performed to an accuracy that is consistent with the overall accuracy desired in the waveform measurement process.

[SOURCE: IEC 60469:2013, 3.2.4, modified – Note 2 to entry has been deleted.]

3.3
effective number of bits
ENOB
for an input sinewave of specified frequency and amplitude, the number of bits of an ideal *waveform recorder* for which the root-mean-square (r.m.s.) quantization error is equal to the r.m.s. noise and distortion of the *waveform recorder* under test

[SOURCE: IEEE Std. 1057-2007, 3.1.29]

3.4
electroshock weapon
ESW
weapon that generates a *high-voltage* transient electrical *signal* that is transmitted to a person

Note 1 to entry: The ESW comprises, at a minimum, a signal generator located in the body of the ESW and a pair of electrical contacts to make electrical connection between the generator and a person.

3.4.1
long-range wired ESW
ESW that uses propelled, tethered, skin-penetrating or adhering (for example, to clothing) barbed darts as the electrical contacts

Note 1 to entry: Adhering darts attach sufficiently close to the surface of the person to complete a circuit capable of delivering an electrical charge to that person. These barbed darts are tethered to the *ESW cartridge* that is mechanically attached to the body of the ESW and travel away from the cartridge when deployed. The *ESW cartridge* is often used to convert a contact ESW to a long-range wired ESW.

3.4.2
long-range wireless ESW
ESW that is compact in size and that is fired or launched from a separate and independent firearm, device, or apparatus and to which there is no physical connection between the *ESW* and the firearm, device, or apparatus after it is fired or launched

3.4.3
ESW contact
ESW that uses fixed metal electrodes located on the body or cartridge of the *ESW* as the electrical contacts

3.4.4
ESW cartridge
component of the *long-range wired ESW* that contains the tethered skin-penetrating or adhering barbed darts and mechanically attaches and electrically connects to the body of the *ESW* to complete the circuit and facilitate the delivery of electrical charge

Note 1 to entry: The *ESW cartridge* is often used to convert a *contact ESW* to a *long-range wired ESW*.

3.5
high voltage
voltage having a value above a conventionally adopted limit

Note 1 to entry: For *ESW*, this limit shall be specified by the user of this standard.

[SOURCE: IEC 60050-151:2001,151-15-05, modified – Note 1 to entry has been added.].

3.6
impulse response
time response of a linear time-invariant system, which initially is in steady state U_0, V_0, produced by application of an impulse function $\Delta u_\delta(t) = K_\delta \delta(t)$ to one of the input variables, where $\Delta v_\delta(t) = v(t) - V_0$ and $\Delta u_\delta(t) = u(t) - U_0$

3.7
instant
particular time value within a *waveform* epoch that, unless otherwise specified, is referenced to the *initial instant* of that *waveform epoch*

[SOURCE: IEC 60469:2013, 3.2.13]

3.7.1
final instant
last *sample instant* in the *waveform*

[SOURCE: IEC 60469:2013, 3.2.13.1]

3.7.2
initial instant
first *sample instant* in the *waveform*

[SOURCE: IEC 60469:2013, 3.2.13.3]

3.8
interval
set of all values of time between a first *instant* and a second *instant*, where the second *instant* is later in time than the first

Note 1 to entry: These first and second instants are called the endpoints of the interval. The endpoints, unless otherwise specified, are assumed to be part of the interval.

[SOURCE: IEC 60469:2013, 3.2.15]

3.9
level
constant value having the same units as y

[SOURCE: IEC 60469:2013, 3.2.17]

3.9.1
average level
pertaining to the value of the mean of the *waveform level*

If the *waveform* takes on n discrete values, y_j, all equally spaced in time, that *average level* is,

$$\overline{y} = \left(\frac{1}{n}\right)\sum_{j=1}^{n} y_j \,. \tag{1}$$

[SOURCE: IEC 60469:2013, 3.2.17.1, modified – The formula for the *average level* of a continuous function of time has been deleted and the notes have been deleted.]

3.9.2
average absolute level
pertaining to the mean value of the absolute *waveform* value. If the *waveform* takes on n discrete values, y_j, all equally spaced in time, the *average absolute level* is,

$$\left|\overline{y}\right| = \left(\frac{1}{n}\right)\sum_{j=1}^{n}\left|y_j\right| \,. \tag{2}$$

[SOURCE: IEC 60469:2013, 3.2.17.2, modified – The formula for the *average level* of a continuous function of time has been deleted and the notes have been deleted.]

3.10
measurand
quantity intended to be measured

[SOURCE: ISO/IEC Guide 99:2007, 2.3, modified – The notes have been deleted.]

3.11
measured quantity value
measured value of a quantity
measured value
quantity value representing a measurement result

[SOURCE: ISO/IEC Guide 99:2007, 2.10, modified – The notes have been deleted.]

3.12
measurement trueness
trueness of measurement
trueness
closeness of agreement between the average of an infinite number of replicate measured quantity values and a reference quantity value

[SOURCE: ISO/IEC Guide 99:2007,2.14, modified – The notes have been deleted.]

3.13
measurement uncertainty
uncertainty of measurement
uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a *measurand*, based on the information used

[SOURCE: ISO/IEC Guide 99:2007, 2.26, modified – The notes have been deleted.]

3.14
metrological traceability
property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the *measurement uncertainty*

[SOURCE: ISO/IEC Guide 99:2007, 2.41, modified – The notes have been deleted.]

3.15
offset
algebraic difference between two specified *levels*

Note 1 to entry: Unless otherwise specified, the two levels are state 1 and the base state.

[SOURCE: IEC 60469:2013, 3.2.18]

3.16
parameter
any value (number multiplied by a unit of measure) that can be calculated from a *waveform*

[SOURCE: IEC 60469:2013, 3.2.20]

3.17
maximum peak (minimum)
pertaining to the greatest (least) value of the *waveform*

[SOURCE: IEC 60469:2013, 3.2.21 and 3.2.22]

3.18
peak-to-peak
pertaining to the value of the difference between the extrema of the specified *waveform*

[SOURCE: IEC 60469:2013, 3.2.23]

3.19
pulse duration
difference between the first and second *transition* occurrence *instants*

[SOURCE: IEC 60469:2013, 3.2.27, modified – Note 1 to entry has been deleted.]

3.20
pulse separation
duration between the 50 % reference *level instant*, unless otherwise specified, of the second *transition* of one pulse in a *pulse train* and that of the first *transition* of the immediately following pulse in the same *pulse train*

[SOURCE: IEC 60469:2013, 3.2.28]

3.21
pulse train
repetitive sequence of *pulse waveforms*

Note 1 to entry: Unless otherwise specified, all of the pulse waveforms in the sequence are assumed to be identical.

[SOURCE: IEC 60469:2013, 3.2.29, modified – The figure has been deleted.]

3.22
reconstruction
waveform deconvolution
process of removing the effect of the measurement instrument on the *acquired waveform*

Note 1 to entry: This process mathematically removes the estimated *impulse response* of the test instrument from the *acquired waveform*.

3.23
reference measurement procedure
measurement procedure accepted as providing measurement results fit for their intended use in assessing measurement trueness of measured quantity values obtained from other measurement procedures for quantities of the same kind, in calibration, or in characterizing reference materials

[SOURCE: ISO/IEC Guide 99:2007, 2.7]

3.24
reference measurement system
reference system
measurement system that is used to support a *reference measurement procedure*

3.25
sample
element of a *sampled waveform*

3.26
signal
physical phenomenon, one or more of whose characteristics may vary to represent information

Note 1 to entry: This phenomenon is a function of time.

[Source: IEC 60050-701:1988, 701-01-02, modified – the note to entry has been replaced.].

3.27
state
particular *level* or, when applicable, a particular *level* and upper and lower limits (the *upper* and *lower state boundaries*) that are referenced to or associated with that *level*

Note 1 to entry: Unless otherwise specified, multiple *states* are ordered from the most negative *level* to the most positive *level*, and the *state levels* are not allowed to overlap. The most negative *state* is called *state* 1. The most positive *state* is called *state* n. The *states* are denoted by s1, s2, ..., sn; the *state levels* are denoted by level(s1), level(s2), ..., level(sn); the upper state boundaries are denoted by upper(s1), upper(s2), ..., upper(sn); and the lower *state boundaries* are denoted by lower(s1), lower(s2), ..., lower(sn).

Note 2 to entry: *States*, *levels*, and *state boundaries* are defined to accommodate pulse metrology and digital applications. In pulse metrology, the *levels* of a *waveform* are measured and *states* (with or without associated *state boundaries*) are then associated with those *levels*. In digital applications, *states* are defined (with *state boundaries*) and the *waveform* values are determined to either lie within a *state* or not.

[SOURCE: IEC 60469:2013, 3.2.40]

3.27.1
base state
state of a *waveform* that, unless otherwise specified, possesses a *level* closest to zero

[SOURCE: IEC 60469:2013, 3.2.40.1]

3.27.2
state boundaries
upper and lower limits of the *states* of a *waveform*.

Note 1 to entry: All values of a *waveform* that are within the boundaries of a given *state* are said to be in that *state*. The *state boundaries* are defined by the user.

[SOURCE: IEC 60469:2013, 3.2.41]

3.27.3
state occurrence
contiguous region of a *waveform* that is bounded by the upper and lower *state boundaries* of a *state*, and whose duration equals or exceeds the specified minimum duration for *state* attainment

Note 1 to entry: The *state occurrence* consists of the entire portion of the *waveform* that remains within the boundaries of that *state*.

Note 2 to entry: *State occurrences* are numbered as ordered pairs (s,n), where si refers to the ith *state*, and n is the number of the occurrence of that particular *state* within the *waveform epoch*. In a given *waveform epoch*, when the *waveform* first enters a *state* s1, that *state occurrence* is (s1, 1). If and when the *waveform* exits that *state*, that *state occurrence* is over. If and when the *waveform* next enters and remains in *state* s1, that *state occurrence* would be labeled (s1, 2); and so on.

[SOURCE: IEC 60469:2013, 3.2.42]

3.28
timebase
component of a measurement instrument that provides the unique *instant* for each *sample* in a *sampled waveform*.

Note 1 to entry: The *timebase* provides a vector of sampling *instants* where each *instant* corresponds to a unique *sample* in the *waveform*.

Note 2 to entry: Often the *interval* between *sample instants* is not uniform and exhibits both systematic and random errors.

3.29
transient
any contiguous region of a *waveform* that begins at one *state*, leaves and subsequently returns to that *state*, and contains no *state occurrences*

[SOURCE: IEC 60469:2013, 3.2.46]

3.30
transition
contiguous region of a *waveform* that connects, either directly or via intervening *transients*, two *state occurrences* that are consecutive in time but are occurrences of different *states*

[SOURCE: IEC 60469:2013, 3.2.47]

3.31
transition duration
difference between the two reference *level instants* of the same *transition*

Note 1 to entry: Unless otherwise specified, these two reference *levels* are the 10 % and 90 % reference *levels*

[SOURCE: IEC 60469:2013, 3.2.48, modified – Note 2 to entry has been deleted.]

3.32
transition settling error
maximum error between the *waveform* value and a specified reference *level* within a user-specified *interval* relative to the 50 % reference *level instant*

[SOURCE: IEC 60469:2013, 3.2.50]

3.33
waveform
representation of a *signal* (for example, a graph, plot, oscilloscope presentation, discrete time series, equations, or table of values)

Note 1 to entry: Note that the term *waveform* refers to a measured or otherwise-defined estimate of the physical phenomenon or *signal*

[SOURCE: IEC 60469:2013, 3.2.54]

3.33.1
impulse-like waveform
waveform that, when convolved with an ideal step, yields a step-like *waveform*

[SOURCE: IEC 60469:2013, 3.2.54.2]

3.33.2
sampled waveform representation
waveform that is a series of sampled numerical values taken sequentially or nonsequentially as a function of time

[SOURCE: IEC 60469:2013, 3.2.61.2]

3.33.3
acquired *waveform*
sampled waveform that is the output of a measurement system before any *corrections* or *reconstructions* are applied