

# INTERNATIONAL STANDARD

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**Measurement method for the output of electroshock weapons**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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### Measurement method for the output of electroshock weapons

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

This second edition cancels and replaces the first edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of a new clause describing a method for measuring the high voltage arcing charge delivery distance; and
- b) an annex describing an impedance matching network that is necessary to calibrate the measurement system.

The text of this International Standard is based on the following documents:

Draft	Report on voting
85/988/FDIS	85/995/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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## 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 document will facilitate accurate and precise communication for the *parameters* that describe the electrical outputs, 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 or regulations by the appropriate standardization body.

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## 1 Scope

This document specifies a method for measuring the electrical outputs, current and *high voltage*, from *electroshock weapons (ESWs)* that deliver an electrical stimulus to humans. This document is applicable to any and all *ESWs*. This document describes *ESW* measurement systems to help guide the user of this document in developing their own *ESW* measurement system. It includes methods for measuring or computing a variety of *parameters* that can be used to characterize the electrical output of the *ESW*. The user of this document will select those *parameters* that are appropriate for their applications and stakeholders.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

BIPM, *The International System of Units (SI)*, 9th Edition, 2019

## 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

NOTE The *parameters* included here and suggested for use in describing the performance of an *ESW* are those typically used to describe the *waveforms* of pulse-like *signals* that are produced by pulse generators, such as an *ESW*, and the step-response or impulse-response of *waveform recorders* that are used to measure these pulse-like *signals*.

### 3.1

#### **aggregate current**

flow of charge per second delivered by the *ESW pulse train*

### 3.2

#### **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]

**3.3****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 affected by a manual process by an operator, a computational process, or a compensating device or apparatus. Correction shall 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.]

**3.4****electroshock weapon****ESW**

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

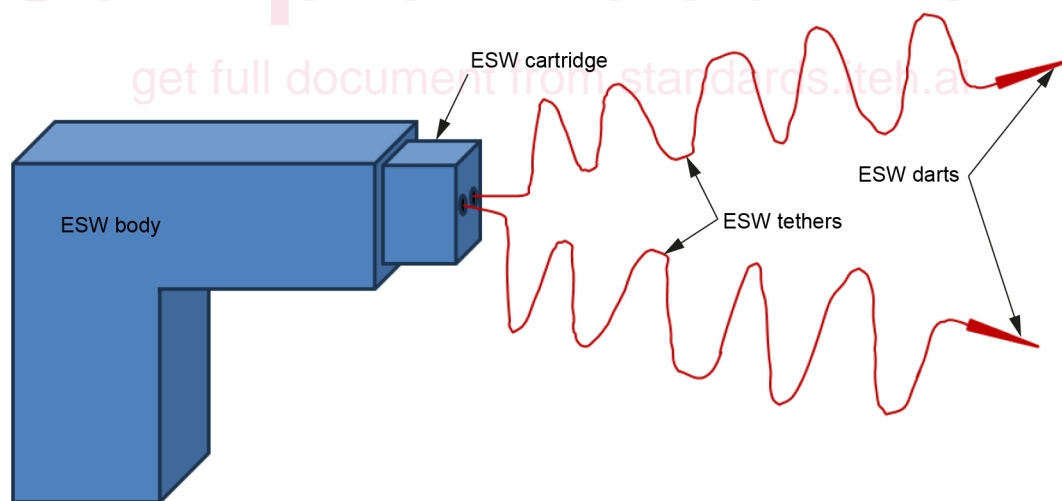
Note 1 to entry: The *ESW* comprises, at a minimum, a *signal* generator located in the body of the *ESW* and a pair of electrical contacts to make electrical connection between the generator and a person.

**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: See Figure 1.

Note 2 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*.



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**Figure 1 –Long-range wired ESW showing components**

**3.4.2****contact ESW**

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

### 3.4.3

#### **ESW cartridge**

component of the *long-range wired ESW* that contains the tethered skin-penetrating or adhering barbed darts (*ESW 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*.

### 3.4.4

#### **ESW dart probe**

component of the *long-range wired ESW* that is connected to the *ESW tether* and makes electrical contact to the target by penetrating the skin of the target or adhering to the clothing of the target

### 3.4.5

#### **ESW tether**

conductive wire providing electrical contact between the *ESW dart* and the *ESW cartridge* of the *long-range wired ESW* as the *ESW dart* travels from the *ESW* to the target

### 3.5

#### **high voltage**

voltage having a value above a conventionally adopted limit

Note 1 to entry: For *ESW*, this conventionally adopted limit is specified by the user of this document.

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

### 3.6

#### **impulse response**

time response of a linear time-invariant system to an impulse excitation

### 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  $y$

Note 1 to entry:  $y$  is the *signal*.

[SOURCE: IEC 60469:2013, 3.2.17, modified – the Note 1 to entry has been added.]

#### 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, the *average level* is,

$$\bar{y} = \left(\frac{1}{n}\right) \sum_{j=1}^n y_j \quad (1)$$

[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,

$$|\bar{y}| = \left(\frac{1}{n}\right) \sum_{j=1}^n |y_j| \quad (2)$$

[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 Note 1 to entry has 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, modified – Figure references have been deleted.]

**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**

pertaining to the greatest value of the *waveform*

[SOURCE: IEC 60469:2013, 3.2.21]