SLOVENSKI STANDARD
oSIST prEN 13763-27:2021

01-november-2021

Nadomešča:
SIST-TS CEN/TS 13763-27:2003

Eksplozivi za civilno uporabo – Detonatorji in zakasnilniki – 27. del: Definicije, metode in zahteve za elektronske sisteme za aktiviranje

Explosives for civil uses - Detonators and detonating cord relays - Part 27: Risk analysis and test methods for electronic initiation systems

Explosivstoffe für zivile Zwecke - Zünder und Verzögerungselemente - Teil 27: Definitionen, Verfahren und Anforderungen für elektronische Zündsysteme

Explosifs à usage civil - Détonateurs et relais - Partie 27: Définitions, méthodes et exigences relatives aux systèmes d'amorçage électronique

Ta slovenski standard je istoveten z: **prEN 13763-27**

ICS:

71.100.30	Eksplozivi. Pirotehnika in ognjemeti	Explosives. Pyrotechnics and fireworks

oSIST prEN 13763-27:2021 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 13763-27

October 2021

ICS 71.100.30

Will supersede CEN/TS 13763-27:2003

English Version

Explosives for civil uses - Detonators and detonating cord relays - Part 27: Risk analysis and test methods for electronic initiation systems

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If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 13763-27:2021) has been prepared by Technical Committee CEN/TC 321 "Explosives for civil uses", the secretariat of which is held by UNE.

This document is currently submitted to CEN Enquiry.

This document will supersede CEN/TS 13763-27:2003.

In comparison with the previous edition, the following technical modifications have been made:

a) the third element of the title of this part of EN 13763 has been changed from "Part 27: Definitions, methods and requirements for electronic initiation systems" to "Part 27: Risk analysis and test methods for electronic initiation systems" since the requirements for electronic initiation systems have been moved to prEN 13763-1:2021;

b) the technical specification CEN/TS 13763-27 has been transformed into a European Standard prEN 13763-27. prEN 13763-1:2021 gives the requirements for electronic initiation systems and the test methods are given in prEN 13763-27;

c) Clause 1, Scope, has been clarified;

d) Clause 2, Normative references, the references have been updated;

e) Clause 3, Terms and definitions, definitions for the following terms have been added: 3.11 defect, 3.18 to 3.23. The following terms have been modified 3.3 non-programmable electronic detonator, 3.4 programmable electronic detonator, 3.5 firing unit, 3.5 testing unit, 3.7 programming unit, 3.12 Critical defect, 3.14 minor defect, 3.15 fault, 3.16 failure. The following term has been moved to terminology standard prEN 13857-1: electronic detonator;

f) Clause 4, Risk analysis, 4.1 General, the document states that it is the task of the manufacturer to perform the risk analysis;

g) Clause 4.2, Risk analysis, Identification of characteristics related to electronic initiation system, some of the questions and examples have been clarified;

h) Clause 4.5.2.5, Risk analysis, Maximum capacity, has been added;

i) Clause 4.5.4, Risk analysis, user manual, has been moved to prEN 13857-3;

j) Clause 4.5.5, Test methods referring to standards for detonators, blasting machines, test apparatus and resistance meters, have been removed, and requirements have been moved to prEN 13763-1:2021. Electronic detonators have been added in the scopes of each part in EN 13763 series where there are applicable;

k) Clause 4.10, Risk analysis, Test report, was the former Clause 5 (Test report);

l) Clause 5, Test methods for electronic detonators and electronic initiation systems, has been introduced and contains new test methods;

   1) Determination of resistance of electronic detonator against electrostatic discharge;

2) Determination of resistance of electronic detonators to overvoltage;

3) Determination of resistance of electronic detonators to dynamic pressure;

4) Determination of insulation resistance between exposed conducting parts for blasting machines;

5) Determination of insulation resistance between exposed conducting parts for field circuit testers,;

6) Determination of delay accuracy for electronic initiation systems;

7) Climatic and mechanical tests of electronic initiation systems;

8) Corrosion resistance test;

m) the former Annex C, Proposals for the detonator fuse head replaced (dummy detonators), has been removed;

n) former Clause 4.5.6.5, Detonator function test and 4.5.6.6 System function test have been updated and placed in Annex C, Function test;

o) Annex D, Determination of resistance to dynamic pressure, has been removed, Annex D now addresses Dynamic Pressure Failure and 5.3 addresses the Determination of resistance of electronic detonators to dynamic pressure;

p) Annex ZA, Relationship between this European Standard and the essential safety requirements of Directive 2014/28/EU relating to the making available on the market and supervision of explosives for civil uses aimed to be covered has been added. It contains explanations on links to Essential Safety requirements in the directive.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports Essential Safety requirements of EU Directive(s) / Regulation(s).

For relationship with Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

EN 13763, *Explosives for civil uses — Detonators and detonating cord relays*, is currently composed with the following parts:

— *Part 1: Requirements;*

— *Part 2: Verification of thermal stability at high temperatures;*

— *Part 3: Determination of sensitiveness to impact;*

— *Part 4: Determination of resistance to abrasion of leading wires and shock tubes;*

— *Part 5: Determination of resistance to cutting damage of leading wires and shock tubes;*

— *Part 6: Determination of resistance to cracking in low temperatures of leading wires;*

— *Part 7: Determination of the mechanical strength of leading wires, shock tubes, connections, crimps and closures;*

— *Part 8: Determination of resistance to vibration;*

— *Part 9: Determination of resistance to bending of detonators;*

— *Part 11: Determination of resistance to damage by dropping of detonators and relays;*

— *Part 12: Determination of resistance to hydrostatic pressure;*

— *Part 13: Determination of resistance of electric detonator to electrostatic discharge;*

— *Part 15: Determination of equivalent initiating capability;*

— *Part 16: Determination of delay accuracy;*

— *Part 17: Determination of no-fire current of electric detonators;*

— *Part 18: Determination of series firing current of electric detonators;*

— *Part 19: Determination of firing pulse of electric detonators;*

— *Part 20: Determination of total resistance of electric detonators;*

— *Part 21: Determination of flash-over voltage of electric detonators;*

— *Part 22: Determination of capacitance, insulation resistance and insulation breakdown of leading wires;*

— *Part 23: Determination of the shock-wave velocity of shock tube;*

— *Part 24: Determination of the non-conductivity of shock tube;*

— *Part 25: Determination of transfer capacity of relay and coupling accessories;*

— *Part 26: Definitions, methods and requirements for devices and accessories for reliable and safe function of detonators and detonating cord relays;*

— *Part 27: Risk analysis and test methods for electronic initiation systems.*

Introduction

From a safety and reliability point of view electronic initiation systems are more complex than electric and non-electric detonator systems, which results in new risk factors.

This document specifies a risk analysis procedure to be used by the manufacturer to investigate the safety and reliability of electronic initiation systems by identifying hazards and estimating the risks associated with the system.

The step in the risk analysis procedure, which refers to acceptability of risks, includes both references to testing and evaluation methods, which apply where appropriate for the specific system. The document also stipulates levels of acceptability.

Manufacturers of electronic initiation systems have used significantly different design and system solutions in order to fulfil acceptable safety and reliability criteria. The product development in the field is rapid. Therefore, the document aims to be valid for different system solutions.

The requirements for electronic initiation systems are specified in prEN 13763-1:2021 and the manufacturer uses the tests in this document or other relevant parts of the EN 13763 series to verify that these requirements are met.

1 Scope

This document specifies evaluation and testing procedures to be used to investigate the safety and reliability of electronic detonators and electronic initiation systems.

This document specifies a methodology for risk analysis of electronic initiation systems.

This document is applicable to explosives for civil uses.

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.

prEN 13763-15:2021, *Explosives for civil uses — Detonators and detonating cord relays — Part 15: Determination of equivalent initiating capability*

prEN 13857-1:2021, *Explosives for civil uses — Part 1: Terminology*

EN 60068-2-2:2007, *Environmental testing - Part 2-2: Tests - Test B: Dry heat*

EN 60068-2-14:2009, *Environmental testing - Part 2-14: Tests - Test N: Change of temperature*

EN 60068-2-27:2009, *Environmental testing — Part 2: Tests — Test Eb and guidance: Bump*

EN 60068-2-30:2005, *Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

EN 60068-2-31:2008, *Basic environmental testing procedures - Part 2: Tests — Test Ed: Free fall*

EN 60068-2-64:2008, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance*

EN 60068-2-78:2013, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

EN 60870-5-1:1993, *Telecontrol equipment and systems - Part 5: Transmission protocols - Section 1: Transmission frame formats*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code)*

EN 61000-4-6:2014, *Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields*

EN IEC 61000-4-3:2020, *Electromagnetic compatibility (EMC) - Part 4-3 : Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2020)*

EN ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 13857-1:2021 and the following apply.

3.1
electronic initiation system
system generally composed of a firing unit and/or a testing unit and/or a programming unit, and a certain number of electronic detonators

3.2
non-programmable electronic detonator
electronic detonator with a pre-programmed delay time

Note 1 to entry: This programming is made by the manufacturer.

3.3
pre-programmed electronic detonator
electronic detonator with a pre-programmed delay number programmed by the manufacturer

Note 1 to entry: The firing time of these detonators is a multiple of this delay number and is determined on the field.

3.4
programmable electronic detonator
electronic detonator of which the functioning delay time is programmable, on the field, by means of a programming unit and/or a firing unit

3.5
firing unit
apparatus used in an electronic initiation system to initiate a blast

Note 1 to entry: Such a device can control and/or program and/or test the electronic detonators and charge the firing capacitor of the electronic detonators before the initiation of the blast.

Note 2 to entry: This device can be driven by a computer.

3.6
testing unit
field tester intended to test the electronic detonators and/or the initiating circuit in an electronic initiation system

3.7
programming unit
apparatus used, on the field, to program a delay time and/or an address to a programmable electronic detonator

Note 1 to entry: This apparatus can also test the electronic detonator.

3.8
electronic initiation system using no data communication
electronic initiation system in which the electronic detonator receives only firing energy from the firing unit

Note 1 to entry: By non-electric or electric means.

3.9
electronic initiation system using one-way data communication
electronic initiation system in which the electronic detonator receives commands from the programming/testing unit and/or from firing unit but cannot send back any information to programming/testing and/or to firing unit

3.10
electronic initiation system using two-way data communication
electronic initiation system in which the electronic detonator receives commands from the programming/testing unit and/or to firing unit and send back information to programming/testing and/or from firing unit

3.11
defect
non-fulfilment of an intended usage requirement

[SOURCE: ISO 2859-1:1999, 3.1.6]

3.12
critical defect

defect that, according to judgement and experience, is likely to result in hazardous or unsafe conditions for individuals using, maintaining or depending upon the considered product; or that is likely to prevent performance of the function of a major end item

EXAMPLE An unintended initiation caused during transport, storage and handling.

[SOURCE: ISO 8641:2008, 3.8]

3.13
major defect
defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the considered product for its intended purpose, e.g. misfire of one or more than one detonator in a blasting round

[SOURCE: ISO 8641:2008, 3.9]

3.14
minor defect
defect that is not likely to reduce materially the usability of the considered product for its intended purpose, or that is incorrect function (delay time) of a detonator

[SOURCE: ISO 8641:2008, 3.10]

3.15
fault
condition that can cause the system to fail to perform its intended function

3.16
failure
deviation from the intended function

Note 1 to entry: This problem can be observed.

3.17
independent circuits
two circuits are independent if they are physically separated and if a failure of one circuit cannot put the second one in fault

3.18
remote firing system
firing system consisting of a control unit separated from a firing unit, the latter which provides the firing code and energy to the detonator

3.19
trigger detonator
electronic part of a detonator equipped with an electronic output for triggering a measurement device

Note 1 to entry: This can be a detonator without explosives where the fuse head has been replaced with an opto-coupler.

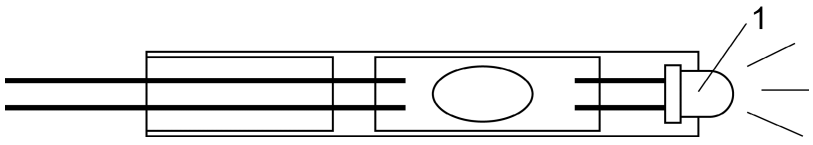
3.20
twisted wire
a pair of wires that is isolated by lacquer that have been twisted together.

Note 1 to entry: Usually, the wire material is copper.

Note 2 to entry: When taped to the outside of a detonator close to the base charge this could be used as a stop signal for delay time measurements.

Note 3 to entry: Delay time is measured until the two wires melt together, e.g. by detecting an electrical shortcut of the wires.

3.21
dummy detonator
non-dangerous test piece where all energetic materials have been replaced by inert materials and the fuse head has been replaced by a lead

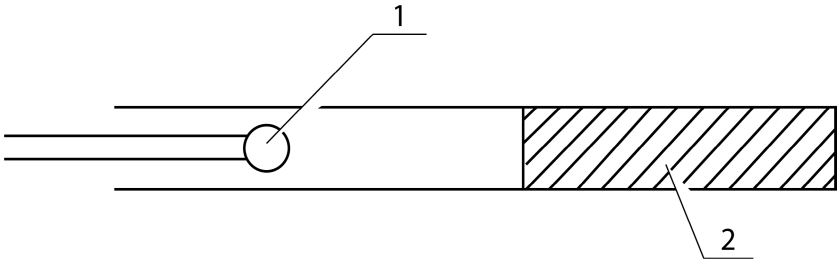


Key
1 LED

Figure 1 — Dummy detonator

Note 1 to entry: Figure 1 shows a schematic drawing of a dummy detonator.

3.22
unloaded detonator
detonator where the base charge has been removed or replaced by inert material and used in initiation/no initiation tests. Only the fuse head remains as an energetic material



Key
1 fuse head
2 inert material

Figure 2 — Unloaded detonator

Note 1 to entry: Figure 2 shows a schematic drawing of an unloaded detonator.

3.23
misplaced detonator
any detonator that is in the blasting plan but not physically located where it is intended to be used

4 Risk analysis

4.1 General

NOTE This clause is shown as Step 1 in Figure 3.

The manufacturer shall perform a risk analysis, evaluation and testing procedure on the electronic initiation system, as described in 4.2 to 4.9 and 5 and illustrated in the flow diagram shown in Figure 3.

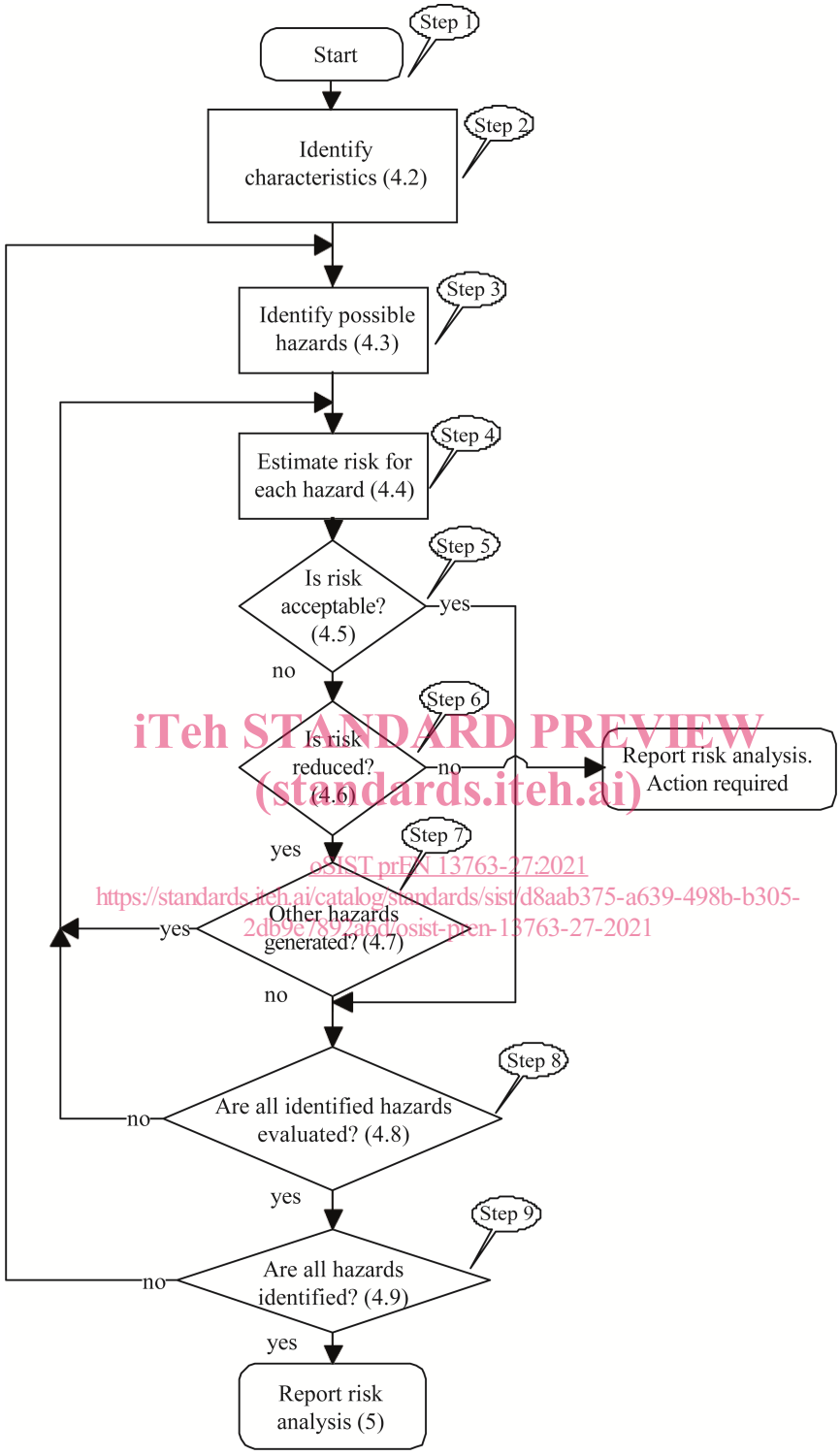


Figure 3 — Flow chart of risk analysis evaluation and testing procedure

4.2 Identification of characteristics related to electronic initiation system

NOTE This clause is shown as Step 2 in Figure 3.

For the particular electronic initiation system, characteristics that can affect its safety and reliability shall be listed.

The following list of questions shall be answered:

a) What is the intended use and how is the electronic initiation system to be used?

   The following factor shall be considered:

   1) During which phases of operation is the operator potentially exposed to risks?

b) How is the system designed?

   1) Complete design drawings provided by the manufacturer;

c) Which devices and accessories are included in the system?

   The manufacturer shall provide description, principles and intended application (on the blast site, only in safe area, etc.) of e.g.:

   1) programming units;

   2) testing units;

   3) firing units;

d) Which functions are provided by the system?

   Examples of functions:

   1) general functions;

   2) safety functions;

   3) reliability functions;

   4) time out functions (detonator, firing/testing/programming units);

   5) possibilities to abort the blasting sequence;

   6) programming functions;

   7) calibration function (e.g. for delay accuracy);

   8) self-check functions (e.g. start up check, run-time check of device and detonator, information transfer and storing; detonator timer operation, fuse head, voltage level, capacitor level, error handling);

   9) limits for safe functioning;

   10) output strength of detonator;