



**SLOVENSKI STANDARD**  
**oSIST prEN 13763-19:2021**  
**01-april-2021**

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**Eksplzivni za civilno uporabo – Detonatorji in zakasnilniki – 19. del: Ugotavljanje vžignega impulza električnih detonatorjev**

Explosives for civil uses - Detonators and relays - Part 19: Determination of firing impulse of electric detonators

Explosivstoffe für zivile Zwecke - Zünder und Verzögerungselemente - Teil 19: Bestimmung des Zündimpulses elektrischer Zünder

Explosifs à usage civil - Détonateurs et relais - Partie 19 : Détermination de l'impulsion d'allumage des détonateurs électriques

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**Ta slovenski standard je istoveten z: prEN 13763-19**

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**prEN 13763-19**

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English Version

## Explosives for civil uses - Detonators and detonating cord relays - Part 19: Determination of firing impulse of electric detonators

Explosifs à usage civil - Détonateurs et relais pour  
cordeau détonant - Partie 19: Détermination de  
l'impulsion d'allumage des détonateurs électriques

Explosivstoffe für zivile Zwecke - Zünder und  
Sprengschnurverbinder - Teil 19: Bestimmung des  
Zündimpulses elektrischer Zünder

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 321.

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.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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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 13763-19:2021) 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 the CEN Enquiry.

This document will supersede EN 13763-19:2003.

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

- a) Clause 4, *Principle*, has been added;
- b) Clause 7, *Procedure*, has been revised to adjust the statistical procedure and electrical parameters;
- c) Clause 9, *Test report*, has been updated;
- d) Annex A, *Range of applicability of the test method*, has been removed;
- e) a new Annex A, *Estimation of the normal standard deviation  $s$  from the range and sample size*, has been added;
- f) Annex ZA has been updated.

This document has been prepared under a Standardization Request (M/562) annexed to the Commission Implementing Decision C(2019)6634 final as regards Explosives for civil uses given to CEN by the European Commission and the European Free Trade Association, and supports Essential Safety requirements of Directive 2014/28/EU.

For relationship with Directive 2014/28/EU, 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*
- *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*

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- Part 11: Determination of drop resistance 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 relays
- Part 27: Definitions, methods and requirements for electronic initiation system

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## Introduction

At blasting it is very important from a safety perspective to be aware about the impulse required for possible initiation of the detonators. To avoid inadvertent initiation, the shot-firer needs to get information about the levels for all-fire current as well as the level for no-fire current.

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**prEN 13763-19:2021 (E)****1 Scope**

This document specifies a method for determining the all-fire impulse and the no-fire impulse of electric detonators.

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

EN 13763-1:2004, *Explosives for civil uses - Detonators and relays - Part 1: Requirements*

**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****all-fire impulse**

minimum electrical energy needed to initiate all of the detonators connected in series, divided by the total resistance of the complete round

**3.2****no-fire impulse**

maximum electrical energy divided by the total resistance of the complete round, which, when delivered in a short time, causes none of the detonators to initiate

**4 Principle**

The test piece is subjected to a current pulse of determined energy. Record whether initiation occurs. In a first step the pulse for 50 % firing is determined as a starting point for a subsequent PROBIT test. With the results of the latter the no-fire impulse and the all-fire impulse are calculated.

**5 Apparatus****5.1 Standard apparatus**

**Square pulse current supply**, with the following characteristics:

- a) a stabilized current with a tolerance on the output of  $\pm 1\%$  of the set value (see 7.3.2);
- b) a square pulse with a tolerance of  $\pm 1\%$  of the set duration (see 7.3.1);
- c) a current overshoot of not more than 10 % of the set current and duration not greater than 50  $\mu\text{s}$  (on pure resistive load);
- d) rise time for the current of not more than 50  $\mu\text{s}$  (on pure resistive load).

**5.2 Alternative apparatus**

Alternatively, the following apparatus may be used: a capacitor, an adjustable DC voltage generator, an adjustable resistor and a fast non-arcing and bounce-free current switch with the following characteristics:



- a) a capacitance ( $C$ ) with a tolerance not greater than  $\pm 5\%$  of the set value;
- b) a voltage with a tolerance not greater than  $\pm 1\%$  of the set value;
- c) a resistance ( $R$ ) with a tolerance not greater than  $\pm 1\%$  of the set value.

The time constant ( $RC$ ) of the circuit, which is calculated as the product of  $R$ , resistor, and  $C$ , capacitor, shall be shorter than one tenth of the thermal time constant of the fuse head. The resistance of the circuit should be varied.

## 6 Preparation and handling of test samples and test pieces<sup>1)</sup>

Test samples for detonators should be handled according to EN ISO/IEC 17025:2017, 7.4.

Depending on the number of levels of the PBBS test (see EN 13763-1:2004, Annex C), 170 to 250 detonators of the same type are needed (i.e. same bridge wire ignition system). If the detonators form part of a series with different delay times, select detonators with delay times distributed as evenly as possible throughout the series.

NOTE For the purpose of the test, bare fuse heads can be used instead of complete detonators.

## 7 Procedure

### 7.1 Test temperature

Condition the detonators for at least 2 h at a temperature of  $(20 \pm 5)$  °C and at a relative humidity not greater than 60 % and carry out the test at the same temperature and humidity.

In the case where the test items show for one level only no-fire and for the next higher level only fire, the  $t_{0,5}$  shall be calculated by taking the mean between these two levels and the standard deviation  $s$  shall be calculated by using the interval between the two levels and the number of trials as given in the Annex A.

### 7.2 Preliminary test

#### 7.2.1 Preliminary test with apparatus

Carry out a preliminary test (for example a Bruceton test), using 30 detonators, to obtain an estimate of the pulse duration for 50 % firing ( $t_{50}$ ) and the corresponding standard deviation ( $s_{50}$ ). To ensure that the pulse durations do not exceed one third of the thermal time constant, the current amplitude shall be set to a value of two to three times the series firing current specified by the manufacturer.

Thermal time constant ( $C_T$ ) of the detonator is given by the following formula:

$$C_T \approx \frac{W_{NF}}{(I_{NF})^2} \quad (1)$$

where

$C_T$  is the thermal time constant expressed in seconds (s);

$W_{NF}$  is the no-fire impulse specified by the manufacturer, expressed in  $A^2/s$ ;

$I_{NF}$  is the no-fire current specified by the manufacturer, expressed in A.

<sup>1)</sup> The choice of sample size is based on acceptable failure rate for the kind of defects that have to be avoided. The defects have been classified according to ISO 2859-1, ISO 2859-2, ISO 2859-3, ISO 2859-4 and ISO 2859-5.

**prEN 13763-19:2021 (E)****7.2.2 Preliminary test with alternative apparatus**

Carry out the preliminary test (for example a Langlie test), using 30 detonators, to obtain an estimate of the total resistance of ( $R_{tot} = R + R_{det}$ ), required for 50 % firing ( $R_{tot50}$ ) and the corresponding standard deviation ( $S_{50}$ ). Set the voltage generator for charging the capacitance ( $C$ ) to a voltage of three to four times the square root of  $W_{AF}$  multiplied with  $R_{tot} / C$ .

$R_{det}$  is the resistance of the detonator under test.

$W_{AF}$  is the all-fire impulse specified by the manufacturer, expressed in  $A^2/s$ .

**7.3 Determination with apparatus**

**7.3.1** Choose 7 to 11 levels of pulse duration covering the time interval ( $t_{50} \pm 2S_{50}$ ). If the equipment resolution makes it impossible to distribute the levels the current for 50 % firing  $I_{0.5} \pm 2$  s, an interval of  $I_{0.5} \pm 3$  s shall be used.

**7.3.2** Connect the current pulse recorder and set the square pulse current to the same value as for the preliminary test.

**7.3.3** Set the pulse duration to the first level.

**7.3.4** Connect one detonator to the circuit and apply the current pulse.

**7.3.5** Record whether the detonator initiates.

**7.3.6** Repeat steps 7.3.4 to 7.3.5 using the other 19 detonators.

**7.3.7** Repeat steps 7.3.3 to 7.3.6 for each of the other pulse durations.

**7.4 Determination with alternative apparatus**

**7.4.1** Choose 7 to 11 resistance levels, covering the range ( $R_{tot50} \pm 2S_{50}$ ). If the equipment resolution makes it impossible to distribute the resistance levels  $R_{tot50} \pm 2S_{50}$ , a resistance range of  $R_{tot50} \pm 3S_{50}$  shall be used.

**7.4.2** Set the voltage generator to the same voltage as for the preliminary test under 7.2.2.

**7.4.3** Measure the resistance  $R_{det}$  of the detonator under test and calculate the resistance ( $R = R_{tot} - R_{det}$ ) to set  $R$  for reaching the first level of  $R_{tot}$ .

**7.4.4** Charge the capacitance ( $C$ ), connect the detonator to be tested to the circuit and close the switch.

**7.4.5** Record whether the detonator initiates.

**7.4.6** Repeat steps 7.4.3 to 7.4.5 using the other 19 detonators.

**7.4.7** Repeat steps 7.4.3 to 7.4.6 for each of the other resistance levels.

**8 Expression of results**

For each pulse duration tested, determine the number of firings.

Calculate the no-fire impulse using the PBBS test method described in EN 13763-1:2004, Annex C. The probability and confidence levels are set at 0,01 % and 95 % respectively.