

Explosives for civil uses — Detonators and relays —

Part 19: Determination of firing impulse of electric detonators

The European Standard EN 13763-19:2003 has the status of a
British Standard

ICS 71.100.30

National foreword

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The UK participation in its preparation was entrusted to Technical Committee CII/61, Explosives for civil uses, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 9 and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 12 January 2004

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ISBN 0 580 43224 6

ICS 71.100.30

English version

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

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

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

This European Standard was approved by CEN on 10 November 2003.

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Foreword

This document (EN 13763-19:2003) has been prepared by Technical Committee CEN/TC 321 "Explosives for civil uses", the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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

Annex A is informative.

This European Standard is one of a series of standards with the generic title *Explosives for civil uses – Detonators and relays*. The other parts of this series are listed below:

prEN 13763-1	Part 1: Requirements
EN 13763-2	Part 2: Determination of thermal stability
EN 13763-3	Part 3: Determination of sensitiveness to impact
EN 13763-4	Part 4: Determination of resistance to abrasion of leading wires and shock tubes
EN 13763-5	Part 5: Determination of resistance to cutting damage of leading wires and shock tubes
EN 13763-6	Part 6: Determination of resistance to cracking in low temperatures of leading wires
EN 13763-7	Part 7: Determination of the mechanical strength of leading wires, shock tubes, connections, crimps and closures
EN 13763-8	Part 8: Determination of the resistance to vibration of plain detonators
EN 13763-9	Part 9: Determination of resistance to bending of detonators
EN 13763-11	Part 11: Determination of resistance to damage by dropping of detonators and relays
EN 13763-12	Part 12: Determination of resistance to hydrostatic pressure
prEN 13763-13	Part 13: Determination of resistance of electric detonators against electrostatic discharge
prEN 13763-15	Part 15: Determination of equivalent initiating capability
EN 13763-16	Part 16: Determination of delay accuracy
EN 13763-17	Part 17: Determination of no-fire current of electric detonators
EN 13763-18	Part 18: Determination of series firing current of electric detonators
EN 13763-20	Part 20: Determination of total electrical resistance of electric detonators
EN 13763-21	Part 21: Determination of flash-over voltage of electric detonators

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- EN 13763-22 Part 22: Determination of capacitance, insulation resistance and insulation breakdown of leading wires
- EN 13763-23 Part 23: Determination of the shock-wave velocity of shock tube
- EN 13763-24 Part 24: Determination of the electrical non-conductivity of shock tube
- prEN 13763-25 Part 25: Determination of transfer capability of surface connectors, relays and coupling accessories
- prEN 13763-26 Part 26: Definitions, methods and requirements for devices and accessories for reliable and safe function of detonators and relays
- CEN/TS 13763-27 Part 27: Definitions, methods and requirements for electronic initiation systems

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

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

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 13857-1, *Explosives for civil uses - Part 1: Terminology*.

prEN 13763-1:2001, *Explosives for civil uses - Detonators and relays - Part 1: Requirements*.

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999)*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 13857-1 and the following apply.

3.1

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 in seconds (s)

W_{NF} is the no-fire-impulse specified by the manufacturer, in A²/s

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

3.2

all-fire-impulse

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

3.3

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 fire

3.4

PBBS test

statistical method used to characterise the sensitivity, to a physical stimulus, of "one shot" pyrotechnical components

The principle of the test is to measure the firing frequency at predefined levels of the physical stimulus. The physical stimulus in this standard is the firing impulse. Sensitivity levels corresponding to the required probability and confidence limits are then determined by extrapolation.

A detailed description of the test is given in prEN 13763-1.

4 Test pieces

Depending on the number of levels of the PBBS test (see annex C of prEN 13763-1:2001), 170 to 250 detonators of the same type are needed (i.e. same bridgewire 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. In the case of magnetically coupled detonators, where complete detonators are used, the transformer coupling unit shall be removed before testing.

NOTE Fuseheads can be used instead of complete detonators.

5 Apparatus

5.1 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 6.3.2);
- b) a square pulse with a tolerance of $\pm 1\%$ of the set duration (see 6.3.1);
- c) a current overshoot of not more than 10 % of the set current and duration not greater than 50 μs (on pure resistive load);
- d) a rise time for the current of not more than 50 μs (on pure resistive load).

5.2 Alternative apparatus

Alternatively, the following apparatus may be used: a capacitor, an adjustable d.c. voltage generator, an adjustable resistor and a fast non-arcing 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 fusehead. The resistance of the circuit should be varied.

6 Procedure

6.1 Test temperature

Condition the detonators for at least 2 h at a temperature of (20 ± 2) °C and carry out the test at the same temperature.

6.2 Preliminary test

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.

6.3 Determination

6.3.1 Choose 7 to 11 levels of pulse duration covering the time interval $(t_{50} \pm 2s_{50})$.

6.3.2 Connect the current pulse recorder and set the square pulse current to a value of two to three times the series firing current specified by the manufacturer.

6.3.3 Set the pulse duration to the first level.

6.3.4 Connect one detonator to the circuit and apply the current pulse.

6.3.5 Record whether the detonator fires.

6.3.6 Repeat steps 6.3.4 to 6.3.5 using the other 19 detonators.

6.3.7 Repeat steps 6.3.3 to 6.3.6 for each of the other pulse durations.

7 Calculation of test results

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

Calculate the no-fire impulse using the method described in annex C of prEN 13763-1:2001. The probability and confidence levels are set at 0,01 % and 95 % respectively.

Calculate the all-fire impulse using the method described in annex C of prEN 13763-1:2001. The probability and confidence levels are set at 99,99 % and 95 % respectively.

8 Test report

The test report shall conform to EN ISO/IEC 17025. In addition the following information shall be given:

- a) all-fire-impulse;
- b) no-fire-impulse;
- c) the impulse levels, mean values, standard deviations, number of ignitions and number of non ignitions.

Annex A
(informative)

Range of applicability of the test method

Range of applicability of the test method: - 30 °C to + 80 °C.

Annex ZA (informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive 93/15/EEC.

Compliance with the clauses of this standard provides one means of conforming with the specific essential requirements of the Directives concerned and associated EFTA regulations.

WARNING : Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The clauses of this document are likely to support requirements I.1, I.2, II.1.(a), and II.1.(i) of the Directive 93/15/EEC.

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