BRITISH STANDARD

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13763-13:2004

Explosives for civil uses — Detonators and relays —

Part 13: Determination of resistance of electric detonators to electrostatic discharge

The European Standard EN 13763-13:2004 has the status of a British Standard

ICS 71.100.30

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 13763-13:2004.

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

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Summary of pages

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Explosives for civil uses - Detonators and relays - Part 13: Determination of resistance of electric detonators to electrostatic discharge

Explosifs à usage civil - Détonateurs et relais - Partie 13: Détermination de la résistance à la décharge électrostatique des détonateurs électriques

Explosivstoffe für zivile Zwecke - Zünder und Verzögerungselemente - Teil 13: Bestimmung der Widerstandsfähigkeit elektrischer Zünder gegen elektrostatische Entladungen

This European Standard was approved by CEN on 2 January 2004.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This document (EN 13763-13:2004) 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of an identical text or by endorsement, at the latest by September 2004 and conflicting national standards shall be withdrawn at the latest by September 2004

Annex A is informative, annex B is normative.

This European Standard 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.

For the relationship with EU Directive, see informative annex ZA, which is an integral part of this standard.

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:

EN 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 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
EN 13763-14	Part 14: Determination of resistance of electric detonators to the influence of radio frequency radiation
EN 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 13763-19	Part 19: Determination of firing impulse 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
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 tubes
EN 13763-24	Part 24: Determination of the electrical non-conductivity of shock tubes
EN 13763-25	Part 25: Determination of transfer capacity of 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 system

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

1 Scope

This European Standard specifies a method for determining whether electric detonators can withstand an electrostatic discharge (ESD) without detonating.

This European Standard is not applicable to magnetically-coupled 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 13763-17, *Explosives for civil uses - Detonators and relays - Part 17: Determination of no-fire current of electric detonators.*

EN 13763-21, *Explosives for civil uses - Detonators and relays - Part 21: Determination of flash-over voltage of electric detonators.*

EN 13857-1:2003, *Explosives for civil uses - Part 1: Terminology.*

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 13857-1:2003 and the following apply.

3.1
bridgewire ignition system
internal components of an electric detonator that convert electrical energy into the first pyrotechnical output by the mean of a resistive bridgewire heated by Joule effect

3.2
«pins-to-case» configuration
configuration in which the electrostatic discharge occurs between the two short-circuited leading wires ends and the detonator casing

3.3
«pin-to-pin» configuration
configuration in which the electrostatic discharge occurs through the bridgewire of the ignition system

4 Apparatus

4.1 Electrostatic discharge generator (ESD generator), with capacitance ranging from 500pF to 3 500pF and voltage sufficient to give the required impulse.

4.2 Equipment to record the ESD current and calculate the ESD impulse delivered to the detonator.

4.3 Conditioning chamber for maintaining a temperature of (20 ± 2) °C and a relative humidity of not greater than 60%.

5 Test pieces

Select 50 detonators of a specific type, having a bridgewire ignition system and charge composition ignited by a fusehead of the same design.

Note: Protective elements added to the bridgewire ignition system to increase resistance to mechanical, electrostatic or electromagnetic stress, such as a plastics sleeve on the fusehead, are regarded as part of the bridgewire ignition system.

Test 25 detonators in each configuration (see 6.4.2 and 6.4.3). The detonators selected for testing in the “pins-to-case” configuration shall have leading wires of length (3,50 ± 0,05) m.

If only shorter lengths are available from the manufacturer, these may be used at a fixed length ± 0,05 m.

If the detonators form part of a series with different delay times, use 25 detonators with delay times distributed as evenly as possible throughout the series, with at least one from each delay time, in each configuration.

6 Procedure

6.1 Preparation of the test pieces

If necessary, remove between 10 mm and 20 mm of insulation from the ends of the leading wires to allow them to be connected to the ESD generator.

6.2 Adjustment of the ESD generator

Adjust the ESD generator for each type of detonator in accordance with annex B.

The ESD impulse to be applied to the detonator shall be in accordance with Table 1.

Table 1 – ESD impulse

Class of the detonator [1)]	**Class I**	**Class II**	**Class III**	**Class IV**
No-fire current stated by the manufacturer, in amperes (A)	$0{,}18 < I_{nf} < 0{,}45$	$0{,}45 \leq I_{nf} < 1{,}20$	$1{,}20 \leq I_{nf} < 4{,}00$	$4{,}00 \leq I_{nf}$
Minimum ESD impulse for the “pin-to-pin” configuration, mJ/Ω	0,3	6	60	300
Minimum ESD impulse for the “pins-to-case” configuration, mJ/Ω	0,6	12	120	600
1) based on the manufacturer's stated value of the no-fire current				

For the pins-to-case configuration, the applied voltage shall be greater than the 99% flash-over voltage level determined in accordance with EN 13763-21.

6.3 Test conditions

Carry out the test at ambient temperature and at a relative humidity not greater than 60%.

The leading wires shall be coiled as produced by the manufacturer.

Ensure that the leading wires and cables (if any) are kept at a distance of at least 100 mm from the ground and from any conductive objects that might cause leakage paths to earth.

Ensure that the leading wires and all measuring equipment are kept in the same positions as they were when adjusting the ESD generator in accordance with annex B.

6.4 Application of the electrostatic discharge

6.4.1 General

Monitor the ESD impulse applied each time. If it deviates from the specified value, adjust it as described in annex B before continuing with the test.

6.4.2 Pin-to-pin configuration

Apply the ESD between the two separate ends of the leading wires.

Observe whether the detonator detonates.

Repeat the operation five times successively for each detonator, allowing at least 10 s between each pulse.

Repeat these operations with all the detonators to be tested in this configuration.

6.4.3 Pins-to-case configuration

Twist together the ends of the two leading wires.

Apply the ESD between the ends of the leading wires and the metal shell of the detonator.

Observe whether the detonator detonates.

Repeat the operation five times successively for each detonator, allowing at least 10 s between each pulse.

Repeat these operations with all the detonators to be tested in this configuration.

7 Test report

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

a) for every tested detonator: class of the detonator, configuration and detonation / no detonation;

b) length of the leading wires if shorter than 3,5 m.

Annex A
(informative)

Range of applicability of the test method

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

Annex B
(normative)

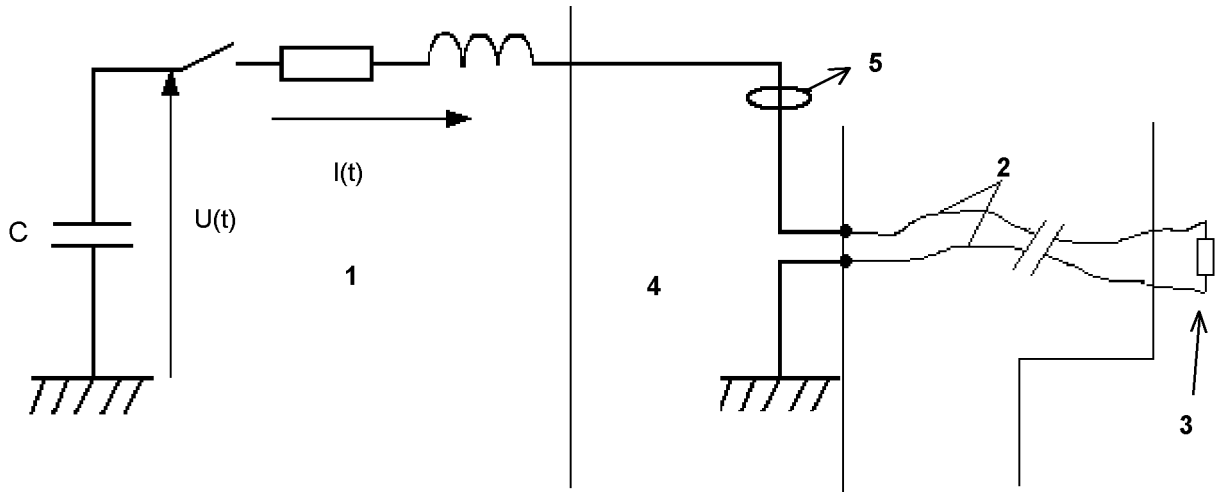
Adjustment of the electrostatic discharge generator

B.1 Apparatus

The apparatus is shown schematically in Figure B1 and comprises the following:

- ESD generator;
- cables if required, to connect the ESD generator and the leading wires;
- pair of leading wires, cut from the detonator;
- resistor, with a d.c. resistance equivalent to that of the bridgewire system of the detonator;
- inductively-coupled current probe, with a bandwidth of at least 10MHz;
- oscilloscope, capable of integrating and of calculating square functions, with a bandwidth of at least 20 MHz.

The leading wires, resistors and all measuring equipment shall be placed in the same positions as those used for the testing of the detonators under test.



Key
1 ESD Generator
2 Leading wires
3 Direct current equivalent resistance
4 Cable to detonator
5 Current probe to oscilloscope

Figure B1 – Arrangement of apparatus for adjusting the ESD generator

B.2 Procedure

Assemble the ESD generator and the apparatus as shown in Figure B1. Ensure that the leading wires, cables (if any) and resistor are kept at a distance of at least 100 mm from the ground and from any conductive objects that might cause leakage paths to earth.

The current probe shall be placed on one of the leading wires or on a connecting cable.

Select an initial applied voltage of twice the mean flash-over voltage of the detonator to be tested.

Apply the discharge, and record the current versus time.

Note : the shape of the curve should be a decaying and oscillating form (weakly damped).

Calculate the ESD impulse, W_{ESD}, from the equation

$$W_{ESD} = \int_{t_1}^{t_2} i^2 dt$$

where

i is the current, in amperes.

t_1 is the time at which the current begins to flow, in seconds.

t_2 is the time, in seconds, at which the current has decayed to the extent that the oscillations no longer exceed the no-fire current of the detonator, determined in accordance with EN 13763-17.

Adjust the voltage and repeat the procedure described above until the calculated impulse is equal to the required value. If the voltage necessary to achieve the required impulse is less than the flash-over voltage of the detonator, change the capacitance to the nearest available lower value.

Annex ZA
(informative)

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

This European Standard 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.

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 standard are likely to support requirements I.1, II.1(i) of Directive 93/15/EEC.

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

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