SLOVENSKI STANDARD
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Eksplozivi za civilno uporabo – Detonatorji in zakasnilniki – 22. del: Ugotavljanje kapacitivnosti, izolacijske upornosti in porušitve izolacije vodnikov

Explosives for civil uses - Detonators and relays - Part 22: Determination of capacitance, insulation resistance and insulation breakdown of leading wires

Explosivstoffe für zivile Zwecke - Zünder und Verzögerungselemente - Teil 22: Bestimmung der Kapazität, des Isolationswiderstandes und der Durchschlagsspannung der Zünderdrahtisolierung

Explosifs a usage civil - Détonateurs et relais - Partie 22: Détermination de la capacité électrique, de la résistance d'isolation et de la rupture d'isolation des fils d'amorce

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

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This European Standard exists 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 Management Centre has the same status as the official versions.

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Foreword

This document (EN 13763-22:2003) 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of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.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 13763-19	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 13763-23	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.

Introduction

During blasting, electric detonators are usually connected in series and often require high voltages to ensure correct initiation. Detonators can also be subjected to high voltages caused by electrostatic charging of the firing circuit during loading. To assess the ability of detonators and their leading wires to withstand these voltages, without misfire or premature initiation, it is essential;

- to determine the value of applied D.C. voltage which causes flash-over inside the detonator shell;
- to determine the capacitance of the leading wires to ensure that they cannot be charged to a dangerous level;
- to determine the insulation resistance of the leading wires;
- to check that there is no breakdown of the leading wire insulation when subjected to high voltage.

The flash-over voltage is determined in EN 13763-21.

1 Scope

This European Standard specifies methods for the determination of the capacitance, insulation resistance and insulation breakdown of leading wires 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.*

EN ISO 3696, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987).*

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 apply.

4 Reagent

Conductive solution, consisting of water, conforming to grade 3 of EN ISO 3696, and 3 % sodium chloride with a purity greater than 99 %.

5 Apparatus

5.1 Meter for measuring capacitance, accurate to 1,0 %.

5.2 Beaker, of suitable size and in a non conductive material.

5.3 A copper electrode

5.4 Temperature-controlled chamber, capable of maintaining a temperature of (20 ± 2) °C for 24 h and (40 ± 2) °C for 2 h or higher if claimed by the manufacturer.

5.5 A high voltage generator, capable of maintaining (5 000 ± 50) V between the twisted ends of the leading wire conductor and the electrode.

5.6 Voltmeter, capable of measuring in the range of 0 kV to 5 kV and accurate to 1,5 %.

5.7 Meter, capable of measuring insulation resistance up to 100 MΩ, accurate to 1,0 %, and capable of giving a voltage of (500 ± 10) V.

6 Test pieces

Select 25 lengths of leading wire, each at least 1,5 m long, from 25 detonators of a specific type having the same dimensions, leading wire insulation and conductor material.

7 Procedure

7.1 Determination of capacitance

Mark a length of (1 ± 0,05) m on the insulation of each leading wire sample.

Cut the wire a few decimetres longer than the marked length.

Fold the wire in the middle taking care not to make a sharp kink in the insulation at the mid-point.

Strip approximately three centimetres of insulation from each end of the wire and twist the two bare ends of the conductor together.

Wind the folded wire into a loose cylindrical spiral and place it inside the beaker so that the twisted bare ends of the conductor are at the top of the beaker.

Attach the twisted bare ends to the top of the beaker with adhesive tape, so that they protrude out of the beaker.

Place the copper electrode in the beaker and fill the beaker with the conductive solution so that the whole wire spiral is submerged up to the 1 m marks on the insulation of the wire, making sure that the twisted bare ends are above the liquid surface.

Store the wire in the solution for a period of at least 24 h, in the temperature-controlled chamber maintained at (20 ± 2) °C.

Remove the beaker from the chamber. Connect the capacitance meter between the twisted bare conductor ends and the copper electrode.

Record the capacitance in pico-Farads (pF).

7.2 Determination of resistance to high voltage

Without removing the wire spiral from the beaker of conductive solution, connect the high voltage generator between the twisted bare ends of the conductor and the copper electrode.

Apply a voltage of (5 000 ± 50) V and maintain it for 60 s.

The leakage current shall not be greater than 0,1 mA.

Record whether or not the insulation breaks down during the test, as demonstrated by a sudden drop in the applied voltage.

7.3 Determination of insulation resistance

Without removing the wire spiral from the beaker of conductive solution, store it for a period of 2 h in the temperature-controlled chamber maintained at (40 ± 2) °C or higher if claimed by the manufacturer.

Connect the meter between the twisted bare ends of the conductor and the copper electrode.

Apply a voltage of (500 ± 10) V for 60 s.

Record the insulation resistance in MΩ.

8 Calculation of results

Calculate the mean value of the capacitance, C, the standard deviation, s, and the value of (C + 2,33 × s).