SLOVENSKI STANDARD
oSIST prEN 13763-22:2021

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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 à 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

Ta slovenski standard je istoveten z: **prEN 13763-22**

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71.100.30	Eksplozivi. Pirotehnika in ognjemeti	Explosives. Pyrotechnics and fireworks

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English Version

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

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

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

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.

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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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Contents

Page

European foreword

This document (prEN 13763-22:2021) 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 13763-22:2003.

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

a) Clause 1, *Scope*, now specifies that the document is applicable to explosives for civil uses;

b) Clause 4, *Principle*, has been added;

c) Clause 7, *Preparation and handling of test samples and test pieces*, has been revised and 7.2, *For determination of insulation resistance of wires stressed by kinks in low temperature*, has been added.

d) Annex A, *Range of applicability of the test method*, has been removed;

e) 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*

— *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*

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 DC 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 prEN 13763-21:2021.

1 Scope

This document specifies methods for the determination of the capacitance, insulation resistance and insulation breakdown of leading wires of electric detonators.

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

prEN 13763-6:2021, *Explosives for civil uses — Detonators and detonating cord relays - Part 6: Determination of resistance to cracking in low temperatures of leading wires*

EN ISO 3696:1995, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

3 Terms and definitions

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

4 Principle

The test piece and a copper electrode are submerged into a specified conductive solution. The capacitance, current leakage and insulation resistance are then measured between the twisted bare ends of the test piece and the copper electrode.

5 Reagents and/or other material

Conductive solution, consisting of water, conforming to grade 3 of EN ISO 3696:1995, and 3 % sodium chloride with a purity greater than 99 %.

6 Apparatus

6.1 Meter, capable of measuring capacitance with an accuracy to 1,0 %.

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

6.3 A copper electrode

6.4 Conditioning 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.

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

6.6 Meter, capable of measuring voltage in the range of 0 kV to 5 kV and accurate to 1,5 %.

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

7 Preparation and handling of test samples and test pieces[1]

7.1 For determination of capacitance, determination of resistance to high voltage and determination of insulation resistance

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

Select 25 lengths of leading wire, from 25 detonators of a specific type having the same dimensions, leading wire insulation and conductor material.

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 material 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 material 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 conditioning chamber maintained at a temperature of (20 ± 2) °C.

7.2 For determination of insulation resistance of wires stressed by kinks in low temperature

Select 25 lengths of leading wire, from 25 detonators of a specific type having the same dimensions, leading wire insulation and conductor material.

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.

Prepare the samples according to prEN 13763-6:2021, Clause 7.

Strip approximately three centimetres of insulation from each end of the wire and twist the two bare ends of the conductor material 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 material 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 conditioning chamber maintained at a temperature of (20 ± 2) °C.

[1] 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.

8 Procedure

8.1 Determination of capacitance

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

Record the capacitance in pico-Farads (pF).

8.2 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 material 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.

8.3 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 conditioning chamber maintained at a temperature of (40 ± 2) °C or higher if claimed by the manufacturer.

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

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

Record the insulation resistance in MΩ.

8.4 Determination of insulation resistance of wires stressed by kinks in low temperature

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

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

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

Record the insulation resistance in MΩ.

9 Expression of results

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

10 Test report

The test report should conform to EN ISO/IEC 17025:2017, 7.8. In addition, the following information shall be given:

a) capacitance as mean value plus 2,33 times the standard deviation;

b) resistance to high voltage as the number of breakdown(s);

c) insulation resistance as the lowest measured value;

d) insulation resistance as the lowest measured value for wires stressed by kinks in low temperature.