

TSIVIILKÄIBES OLEVAD LÕHKEAINED. DETONAATORID  
JA DETONEERNÖÖRIDE RELEED. OSA 16:  
ELEKTRILISTE JA MITTEELEKTRILISTE  
DETONAATORITE, PEALMAA ÜHENDUSKOMPLEKTIDE  
JA DETONEERNÖÖRI RELEEDE VIITEAJA TÄPSUSE  
MÄÄRAMINE

Explosives for civil uses - Detonators and detonating  
cord relays - Part 16: Verification of delay time  
accuracy of electric and non-electric detonators,  
surface connectors and detonating cord relays

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>See Eesti standard EVS-EN 13763-16:2025 sisaldab Euroopa standardi EN 13763-16:2025 ingliskeelset teksti.</p> <p>Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 01.10.2025.</p> <p>Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.</p>	<p>This Estonian standard EVS-EN 13763-16:2025 consists of the English text of the European standard EN 13763-16:2025.</p> <p>This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.</p> <p>Date of Availability of the European standard is 01.10.2025.</p> <p>The standard is available from the Estonian Centre for Standardisation and Accreditation.</p>
--	---

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 71.100.30

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele. Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis- ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis- ja Akrediteerimiskeskusega: Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation: Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

## Explosives for civil uses - Detonators and detonating cord relays - Part 16: Verification of delay time accuracy of electric and non-electric detonators, surface connectors and detonating cord relays

Explosifs à usage civil - Détonateurs et relais pour cordeau détonant - Partie 16: Vérification de la précision du temps de retard des détonateurs électriques et non électriques, des connecteurs de surface et des relais pour cordeau détonant

Explosivstoffe für zivile Zwecke - Zünder und Sprengverzögerer - Teil 16: Überprüfung der Verzögerungsgenauigkeit von elektrischen und nichtelektrischen Zündern, Oberflächenverbindern und Sprengschnurverzögerern

This European Standard was approved by CEN on 29 September 2025.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

<b>Contents</b>	<b>Page</b>
European foreword .....	3
<b>1 Scope</b> .....	<b>5</b>
<b>2 Normative references</b> .....	<b>5</b>
<b>3 Terms and definitions</b> .....	<b>5</b>
<b>4 Principle</b> .....	<b>5</b>
<b>5 Apparatus</b> .....	<b>5</b>
<b>6 Preparation of test sample<sup>1)</sup></b> .....	<b>6</b>
<b>7 Procedure</b> .....	<b>6</b>
<b>7.1 Electric detonators, non-electric detonators and surface connectors</b> .....	<b>6</b>
<b>7.2 Detonating cord relays</b> .....	<b>7</b>
<b>8 Expression of results</b> .....	<b>8</b>
<b>8.1 Electric and non-electric detonators</b> .....	<b>8</b>
<b>8.2 Surface connectors and detonating cord relays</b> .....	<b>8</b>
<b>9 Test report</b> .....	<b>8</b>
<b>Annex A (normative) Calculation procedures</b> .....	<b>10</b>
<b>A.1 Calculation of mean delay time and standard deviation</b> .....	<b>10</b>
<b>A.2 Calculation of the adjusted nominal delay time and the adjusted nominal time difference</b> .....	<b>10</b>
<b>A.3 Test for outliers according to Grubbs test<sup>2)</sup></b> .....	<b>11</b>
<b>A.3.1 Outlier criteria for electric detonators and non-electric detonators</b> .....	<b>11</b>
<b>A.3.2 Outlier criteria for surface connectors and detonating cord relays</b> .....	<b>12</b>
<b>A.4 Calculation of c-factor for electric detonators and non-electric detonators</b> .....	<b>12</b>
<b>A.5 Calculation of the mean deviation from nominal delay time</b> .....	<b>13</b>
<b>A.6 Graphical representation using acceptance triangles</b> .....	<b>13</b>
<b>Annex ZA (informative) Relationship between this European Standard and the essential requirements of Directive 2014/28/EU relating to the making available on the market and supervision of explosives for civil uses aimed to be covered</b> .....	<b>15</b>
<b>Bibliography</b> .....	<b>16</b>

## European foreword

This document (EN 13763-16:2025) has been prepared by Technical Committee CEN/TC 321 “Explosives for civil uses”, the secretariat of which is held by UNE.

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 April 2026, and conflicting national standards shall be withdrawn at the latest by April 2026.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13763-16:2003.

EN 13763-16:2025 includes the following significant technical changes with respect to EN 13763-16:2003:

- a) the document title has been changed from “Detonators and relays — Part 16: Determination of delay accuracy” to “Detonators and detonating cord relays — Part 16: Verification of delay time accuracy of electric and non-electric detonators, surface connectors and detonating cord relays”;
- b) the Introduction has been removed;
- c) the Scope has been revised to clarify the covered and not covered explosives;
- d) the normative references have been updated;
- e) the terminology entries 3.1 and 3.2 have been removed;
- f) Clause 4 “Principle” has been added;
- g) the clause “Apparatus” has been updated;
- h) the clause “Test pieces” is now called “Preparation of test sample”, the number of test pieces per nominal delay time has been reduced and the conditioning step has been moved there from the Clause “Procedure”;
- i) the clause “Procedure” has been revised and the specifications on the values to be calculated have been moved from here;
- j) Clause 8 “Expression of results” has been completely revised;
- k) the clause “Test report” does no longer require conformity with EN ISO/IEC 17025 and the information to be provided has been revised;
- l) former Annex A “Range of applicability of the test method” has been removed;
- m) former Annex B “Calculation procedure” is now Annex A;
- n) former Annex C “Guidance for theoretical verification” has been removed;
- o) Annex ZA has been updated;
- p) the Bibliography has been added and lists, e.g. EN ISO/IEC 17025:2017.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

A list of all parts in the EN 13763 series, published under the general title *Explosives for civil uses — Detonators and detonating cord relays*, can be found on the CEN website.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

## 1 Scope

This document specifies a test method for the verification of the delay time accuracy of electric detonators, non-electric detonators, surface connectors and detonating cord relays.

This document applies only to electric detonators, non-electric detonators, surface connectors and detonating cord relays that are part of a delay series.

This document does not apply to electronic detonators, shock tubes and electronic initiation systems.

**NOTE** For a test method for the verification of the delay time accuracy of electronic initiation systems with electronic detonators, see EN 13763-27:2025.

## 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.

EN 13630-1:2025, *Explosives for civil uses — Detonating cords and safety fuses — Part 1: Requirements*

EN 13763-1:2025, *Explosives for civil uses — Detonators and detonating cord relays — Part 1: Requirements*

EN 13857-1:2025, *Explosives for civil uses — Part 1: Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13857-1:2025 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <https://www.electropedia.org>

## 4 Principle

During blasting work, non-electric detonators, electric detonators, surface connectors and detonating cord relays with different delay times are used to initiate explosives in a sequence.

For the verification of the delay time accuracy, test pieces are initiated. The delay time is measured for each test piece and then a statistical calculation is carried out to identify outliers.

## 5 Apparatus

**5.1 Power source**, for testing electric detonators, providing a constant current  $I$  with  $I_s \leq I \leq 2I_s$  with  $I_s$  being the series firing current specified in accordance with EN 13763-1:2025, 4.2.1.4. The constant current shall be provided with a maximum permissible uncertainty of  $\pm 1,0\%$ .

**5.2 Means of initiation**, for testing non-electric detonators and surface connectors, as specified to the tested explosive in accordance with EN 13763-1:2025, 4.3.1.4 (for non-electric detonator) and 4.7.1.4 (for surface connectors).

**5.3 Two detonating cords and a detonator**, for testing detonating cord relay test pieces. The detonating cords shall be the ones that may be used for the tested detonating cord relay in accordance with EN 13763-1:2025, 4.8. One detonating cords shall have a length  $\geq 350$  mm and the other shall have