



SLOVENSKI STANDARD
oSIST prEN 13631-14:2021
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Eksplozivi za civilno uporabo - Razstreliva - 14. del: Ugotavljanje hitrosti detonacije

Explosives for civil uses - High explosives - Part 14: Determination of velocity of detonation

Explosivstoffe für zivile Zwecke - Sprengstoffe - Teil 14: Bestimmung der Detonationsgeschwindigkeit

Explosifs à usage civil - Explosifs - Partie 14: Détermination de la vitesse de détonation

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ICS:

71.100.30	Eksplozivi. Pirotehnika in ognjemeti	Explosives. Pyrotechnics and fireworks
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

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ICS 71.100.30

Will supersede EN 13631-14:2003

English Version

Explosives for civil uses - Explosives - Part 14: Determination of the velocity of detonation of explosives

Explosifs à usage civil - Explosifs - Partie 14:
Détermination de la vitesse de détonation des explosifs

Explosivstoffe für zivile Zwecke - Explosivstoffe - Teil
14: Bestimmung der Detonationsgeschwindigkeit von
Explosivstoffen

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.

This draft European Standard was established by CEN 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.

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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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European foreword

This document (prEN 13631-14:2021) 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 for the CEN Enquiry.

This document will supersede EN 13631-14:2003.

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

- a) the main element of the document’s title has been changed from “High explosives” to “Explosives”;
- b) the normative references have been updated;
- c) a new method for measuring the velocity of detonation by means of a continuous wire probe has been added;
- d) the description of the preparatory steps and for performing the test have been clearly separated;
- e) Annex A, *Range of applicability of the test method*, has been removed and the content has been moved to Clause 1, *Scope*;
- f) 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 13631, *Explosives for civil uses — Explosives*, is currently composed with the following parts:

- *Part 1: Requirements*
- *Part 2: Determination of thermal stability of explosives*
- *Part 3: Determination of sensitiveness to friction of explosives*
- *Part 4: Determination of sensitiveness to impact of explosives*
- *Part 5: Determination of resistance of explosives to water*
- *Part 6: Determination of resistance of explosives to hydrostatic pressure*
- *Part 7: Determination of safety and reliability of explosives at extreme temperatures*
- *Part 10: Method for the verification of the means of initiation of explosives*
- *Part 11: Determination of transmission of detonation of explosives*

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- *Part 13: Determination of density of explosives*
- *Part 14: Determination of velocity of detonation of explosives*

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1 Scope

This document specifies a test method for determining the velocity of detonation of boosters and explosives, excluding black powder, explosive pre-products and other non-detonating explosives.

Applicability of the test method is under environmental conditions of a field test range or blast bunker.

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 13631-13:2021, *Explosives for civil uses — Explosives — Part 13: Determination of density*

prEN 13857-1:2021, *Explosives for civil uses — Part 1: Terminology*

EN 10025-2:2005, *Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels*

3 Terms and definitions

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

4 Principle

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The time is measured it takes for the detonation front to travel a distance. The velocity of detonation (see prEN 13857-1:2021, abbreviated VOD) is the quotient of this distance over the measured time. The velocity of the detonation front has to stabilize under the given conditions (diameter of explosive charge, with or without confinement) which is why a propagation length (see prEN 13857-1:2021, abbreviated VOD) has to be given, before a meaningful value of the VOD can be determined.

The VOD is influenced by the density of the explosive, however only to a small extent. Therefore, the VOD depends little on temperature, as long as the explosive does not undergo a physical or chemical change due to low or high temperatures.

NOTE The VOD is one of the performance characteristics of an explosive.

5 Apparatus

5.1 Means of initiation

As specified by the explosives' manufacturer.

5.2 Steel tubes

The dimensions of the steel tubes shall be in accordance with Table 1.

The steel quality shall be structural steel with a minimum yield strength of 235 MPa at 16 mm, which is specified in accordance with EN 10025-2:2005 as "S 235 xx".

In case of cartridge explosives, the internal diameter of the steel tube shall be the smallest where the cartridges still can be inserted into it without difficulty.

In case of bulk explosives, the internal diameter of the steel tube shall be the nearest diameter equal or less to the smallest diameter which the manufacturer specifies for use of the bulk explosive.

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In case the start-stop-method (5.4.2) is used, holes shall be drilled in the tube to allow the insertion of the sensors of the measuring equipment at positions in accordance with 6.2. The diameter of the holes shall be no larger than to allow the insertion of the sensors (5.4.2).

Table 1 — Dimensions of steel tubes

Internal diameter [mm]	Wall thickness [mm]
17,3	2,0
22,9	2,0
29,1	2,3
37,2	2,6
43,1	2,6
54,5	2,9
70,3	2,9
82,5	3,2
107,1	3,6
131,7	4,0
159,3	4,5
206,5	6,3
260,4	6,3
309,7	7,1

NOTE The dimensions are in accordance with ISO 4200:1991, Table 1, “range of preferred thickness E”, which are commercial steel tubes for general use. To facilitate the use in this standard the outer diameter dimensions given in ISO 4200:1991, Table 1 have been converted to inner diameter values.

5.3 Thermometer

The thermometer shall be capable of measuring the temperature of the test environment and the temperature of the explosive with an accuracy of ± 1 °C.

5.4 Measuring equipment**5.4.1 General**

The measuring equipment shall allow the measurement of the velocity of detonation to an accuracy of 100 m/s and be one of the following:

5.4.2 Measuring equipment for the “start-stop-method”

The measuring equipment for the “start-stop-method” shall consist of:

- two sensors for detecting the passing of the detonation front;
- electronic equipment to record the time between the signals produced by the two sensors.

The manufacturer shall specify what the shortest permitted distance l between the two sensors is, which still allows a reliable measurement of the velocity of detonation.

NOTE Examples of sensors are optical fibres, self-shortening pins, ionization pins, and piezoelectric pins.

5.4.3 Measuring equipment for the “continuous method”

The measuring equipment for the “continuous method” shall consist of:

- a continuous wire velocity probe, and
- electronic equipment to record and analyse the signal from the continuous wire velocity probe.

The manufacturer shall specify what the shortest permitted length l of the continuous wire velocity probe is, which still allows a reliable measurement of the velocity of detonation.

5.5 Equipment for determination of density

As specified in prEN 13631-13:2021, 5.1 to 5.4.

5.6 Measuring tape

The measuring tape shall be capable of measuring length up to 200 cm with an accuracy of 1 mm.

5.7 Calliper

The calliper shall be capable of measuring length up to 200 mm with an accuracy of 0,1 mm.

5.8 Balance

The balance shall have an accuracy to 1 g.

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6 Test pieces

6.1 Cartridged Explosives

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For the test with cartridged explosives, cartridges shall be used of the smallest diameter placed on the market by the manufacturer.

The test piece shall comprise a cartridge or column of cartridges of length of at least L , expressed as formula:

$$L = 5 d + l$$

where:

- L is the length of cartridge or column of cartridges necessary for conducting this test;
- l is the length between sensors as specified for the measuring equipment of velocity of detonation;
- d is the cartridge diameter.

NOTE 1 The length $5 d$ is larger than the propagation length for the explosives in cartridge form.

NOTE 2 In view of limiting damage to the environment, noise and impact on work safety it is acceptable to use test pieces of length L only but in some cases the test piece may be longer than length L .

When the length of an individual cartridge is less than L , prepare each test piece by joining two or more cartridges together. In case of clipped cartridges or cartridges with rounded ends, the end portions of two cartridges shall be cut off to form a flat surface, with the cross section not less than the diameter of the cartridge, and the cartridges shall be joined by butting together and taping securely.

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Measure the diameter of the explosives using the calliper (5.7). Measure the length of the test piece with measuring tape (5.6). Weigh the mass of test piece using the balance (5.8). Record all the values.

6.2 Bulk explosive

The test piece shall be prepared up by filling a steel tube (5.2) with the bulk explosives. The length of the steel tube shall be at least of length L , expressed as formula:

$$L = 5 d + l$$

where:

- L is the length of cartridge or column of cartridges necessary for conducting this test;
- l is the length between sensors as specified for the measuring equipment of velocity of detonation;
- d is the cartridge diameter.

NOTE 1 The length $5 d$ is larger than the propagation length for the explosives in bulk form.

NOTE 2 In view of limiting damage to the environment, noise and impact on work safety it is acceptable to use test pieces of length L only but in some cases the test piece may be longer than length L .

In the case of bulk explosives, where the density may be changing over time, the density shall lie within the bounds specified by the manufacturer for correct functioning of the explosive and be determined either:

- in accordance with prEN 13631-13:2021, or
- by determining the mass m of the explosive in the steel tube, and the volume V inside the steel tube filled with the explosive, and calculating the density as:

$$\rho = m/V$$

where:

- m is the mass;
- V is the volume.

Record all the values.

6.3 Assembly of the test piece and means of initiation**6.3.1 General**

Fit the sensors to the test piece at one end and fit the means of initiation to the test piece at the other end.

The distance between the sensors S (Figures 1, 4 and 6) or the length of the continuous probe wire C (Figures 2, 5 and 7) shall be not smaller than the shortest permitted length, l , (5.4). When the “start-stop-method” (5.4.2) is used, the distance between the sensor nearest to the means of initiation and the means of initiation shall be at least five times the diameter d of the charge. When a continuous probe is used, the wire shall be placed along the entire length of the cartridge, without an overlap with the means of initiation.