BRITISH STANDARD

BS EN
13938-3:2003

Explosives for civil uses — Propellants and rocket propellants —

Part 3: Determination of deflagration to detonation transition

The European Standard EN 13938-3:2003 has the status of a British Standard

ICS 71.100.30

National foreword

This British Standard is the official English language version of EN 13938-3:2003.

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.

Cross-references

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This British Standard, was published under the authority of the Standards Policy and Strategy Committee on 25 July 2003

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 9 and a back cover.

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English version

Explosives for civil uses - Propellants and rocket propellants - Part 3: Determination of deflagration to detonation transition

Explosifs à usage civil - Poudre propulsive et propergol - Partie 3: Méthode de détermination du passage de la déflagration à la détonation

Explosivstoffe für zivile Zwecke - Treibladungspulver und Raketentreibstoffe - Teil 3: Bestimmung des Überganges der Deflagration in die Detonation

This European Standard was approved by CEN on 28 November 2002.

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 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 Management Centre has the same status as the official versions.

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

Ref. No. EN 13938-3:2003 E

Contents

Foreword

This document (EN 13938-3:2003) 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 September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003.

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 the relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

This European Standard is one of a series of standards on *Explosives for civil uses – Propellants and rocket propellants.* The other parts of this series are listed below:

WI 00321046 Part 1: *Requirements*.

WI 00321050 Part 2: *Determination of resistance to electrostatic energy*.

prEN 13938-4 Part 4: *Determination of burning rate under ambient conditions*.

prEN 13938-5 Part 5: *Solid rocket propellants. Guide for the determination of voids and fissures*.

prEN 13938-6 Part 6: *Solid rocket propellants. Guide for the determination of integrity of inhibitor coatings*.

prEN 13938-7 Part 7: *Determination of the properties of black powder*.

Annex A is informative.

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.

1 Scope

This European Standard specifies a method to determine the tendency of a propellant to undergo transition from deflagration to detonation. It applies to propellants of a grain size up to 8 mm. This method does not apply to black powder.

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 ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999).*

prEN 13857-1:2001, *Explosives for civil uses – Part 1: Terminology.*

ISO 3304, *Plain and seamless precision steel tubes – Technical conditions for delivery.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in prEN 13857-1:2001 apply.

4 Apparatus

The apparatus is shown in Figures 1 and 2.

4.1 Seamless steel tube conforming to ISO 3304, external diameter 48,3 mm 0,5 mm, thickness 4,0 mm 0,6 mm and length 1200^{+5}_{0} mm. The tube is threaded at both ends and it is closed by two cast-iron screw caps.

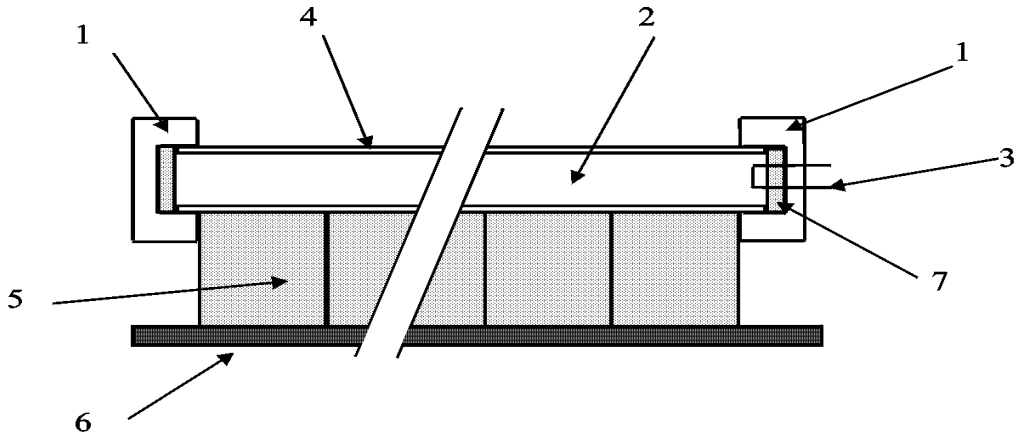
4.2 Lead witness plate(s), thickness 30 mm 10 mm.

4.3 Ignition device consisting of an insulated Ni/Cr wire, diameter 0,40 mm 0,05 mm, length 15 mm 1 mm, located at one end of the tube and internally attached to the cap.

4.4 Inert rod, of at least 1300 mm length, with major length indications at every 100 mm and minor length indications at every 5 mm and a diameter slightly smaller than the inner diameter of the steel tube.

4.5 Inert fill plate, consisting of an inert non-metallic material for filling the free space in caps.

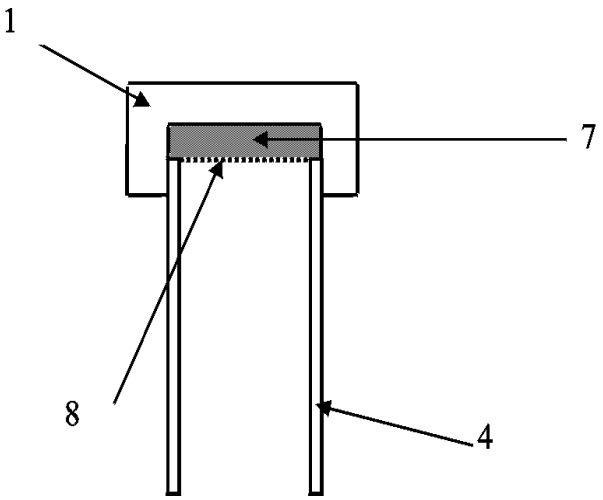
4.6 Anvil, consisting of a steel plate, minimum thickness 80 mm, to be put on the ground for supporting lead witness plate(s).



Key

1 Screw cap
2 Propellant charge
3 Ignition device
4 Steel tube
5 Lead witness plate(s)
6 Anvil
7 Inert fill plate

Figure 1 – Apparatus (not to scale)



Key

1 Screw cap
4 Steel tube
7 Inert fill plate
8 Height of propellant charge after filling

Figure 2 – Apparatus (detail)

5 Test sample

The test sample shall comprise approximately 5 kg of the propellant.

6 Preparation of test sample

The test sample shall be conditioned at 20 °C 5 °C for at least 24 h.

7 Procedure

Close the tube at both ends with the screw caps. At each end note the length of tube penetrating into the screw caps. After removal from the tube, fit the screw caps internally with an inert fill plate up to the position to which the end of tube penetrated. Then close the tube at one end with the appropriate screw cap including the internal inert fill plate.

Fill the tube with the test sample in portions of 100 g.

After each portion, place the inert rod in the steel tube and note the height of the propellant. Remove the inert rod and submit the tube to five vertical free falls from about 50 mm height. Measure the height of the propellant again with the inert rod. Repeat until no further settling is detected. Add another portion of propellant and repeat the whole process. For the last increment a slightly different way of filling is necessary because the tube shall be filled to 5 mm from the end. This can be achieved by using a portion *m* of propellant, determined by the following equation:

$$m = 100 \quad \frac{l \quad 5}{l_{100}}$$

where

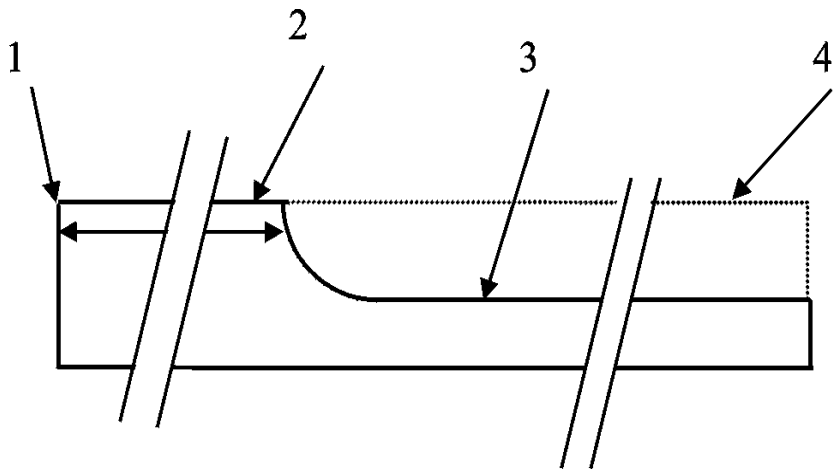
m is the portion of propellant, expressed in grams (g);

l is the remaining height of tube, expressed in millimetres (mm);

l_{100} is the height corresponding to a portion of 100 g, expressed in millimetres (mm);

Add this last portion *m* without the five vertical free falls.

After completion of filling up to 5 mm from the end of the tube close the tube carefully with the other screw cap containing an inert plate and equipped with the ignition device, i.e. the metal wire attached to the inside of the screw cap. Place the closed tube horizontally on the witness plate(s) so that the tube is in direct contact throughout its length with the plate(s). Use an electric direct current of up to 8 A for a maximum of 3 min to heat the wire and to ignite the propellant. Perform the test twice. "Deflagration to Detonation Transition" (DDT) is shown by the compression of the lead witness plate or plates in a manner characteristic of detonation (see Figure 3). If DDT occurs record the "Length Before Detonation" (LBD) by measuring on the lead witness plate(s) the length without indentation before detonation (see Figure 3, key number 2) and adding the length of tube penetrating into the screw cap equipped with the ignition device.



Key

1 End of the plate
2 Section of plate(s) without indentation
3 Compression of the plate(s)
4 Initial upper level of the plate(s)

Figure 3 – Compression of the lead witness plate(s)

Record the individual results as follows:

- deflagration to detonation transition: LBD = ... mm

or

- no deflagration to detonation transition: LBD > 1200 mm

The test result is given by the value of LBD.

8 Test report

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

a) a reference to this standard;

b) the complete identification of the sample, including loading density and grain size distribution;

c) the individual results (LBD value).

Annex A
(informative)

Range of applicability of the test method

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

Annex ZA
(informative)

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

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 93/15/EEC.

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

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 document are likely to support requirements I.1 and II.2.D.(a) of Directive 93/15/EEC.

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