



SLOVENSKI STANDARD

SIST EN 16701:2014

01-september-2014

Energetski materiali za obrambo - Varnost, ranljivost - Krhkost

Energetic materials for Defence - Safety, vulnerability - Friability

Energetische Wehrmaterialien - Sicherheit, Verwundbarkeit - Sprödigkeit

Matériaux énergétiques de défense - Sécurité, vulnérabilité - Friabilité

Ta slovenski standard je istoveten z: **EN 16701:2014**

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EUROPEAN STANDARD

EN 16701

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Energetic materials for defence - Safety, vulnerability - Friability

Matériaux énergétiques de défense - Sécurité, vulnérabilité
- Friabilité

Energetische Wehrmaterialien - Sicherheit, Verwundbarkeit
- Sprödigkeit

This European Standard was approved by CEN on 10 April 2014.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 16701:2014) has been prepared by Technical Committee CEN/TC SS C20 “Explosives and firework”, the secretariat of which is held by CCMC.

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of an identical text or by endorsement, at the latest by November 2014 and conflicting national standards shall be withdrawn at the latest by November 2014.

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

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EN 16701:2014 (E)

Introduction

This document is derived from procedure SEN-216-01, promulgated by the Groupe d'Études des Modes Opératoires (French Test Procedures Study Group) in February 2003.

Annexes known as “informative” are given for information purposes. Annexes A to E are informative.

The term friability covers the notions of fragmentation following mechanical stress and burning vivacity of the fragments.

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1 Scope

This European Standard describes a method for assessing the deflagration to detonation transition (DDT) risk of an explosive material subjected to a mechanical threat.

Testing applies to any compact solid explosive material.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NF T 70-714, *Energetic materials for defence — Performance — Closed Vessel firing*

3 Test method principle

A cylinder of bare explosive material is projected against a flat steel plate, under normal incidence and according to its axis of revolution.

The friability of the explosive material is characterised as a function of the impact velocity (IV), by the maximum value taken by the dP/dt function derived from the P(t) signal measured by burning the fragments collected following impact at a constant volume in a closed vessel.

All of these operations are generally carried out at ambient temperature, unless otherwise specified.

4 Apparatus

4.1 Launching device

The launching device shall be able to transmit to the sample, without damaging it, a velocity between 70 m/s and at least 200 m/s.

For example, the following pneumatic launch device may be used, which includes (see general diagram in Annex A):

- an air tank with a volume of 3,3 L, consisting of a tube with an inside diameter of 50 mm and outside diameter of 60 mm, equipped with a pneumatic control valve at each end. This tank is connected to a compressed air bottle used for establishing a pressure of 1,2 MPa;
- a launcher tube with an inside diameter between 18,2 mm and 18,6 mm and a length of 1,50 m connected to the pneumatic valve by means of a connection ring.

A gun propellant launch device may also be used; it consists of the following elements:

- a test tube with a calibre 12 cylindrical core (inside diameter between 18,2 mm and 18,6 mm) and 70 mm counter boring, with an effective length of 700 mm;
- a gun propellant cartridge whose description is given in Annex B.

4.2 Fragment collection and impact device

This device includes (see Figure A.1):

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- a flat steel plate with a diameter of 630 mm and 20 mm thick. The front face is machined with a roughness Ra 3,2 (see EN ISO 12085:1997, EN ISO 4287:1998, and EN ISO 1302:2002). This disk is fixed to a concrete wall;
- a fragment collecting box consisting of a tube (for example made of PMMA.) with an inside diameter of 630 mm and a length of 1,50 m. The PMMA tube slots on to the impact disk.

The other end of the tube is sealed using a PMMA disk in which a 100 mm square central hole has been made on the side in the cylinder's axis.

NOTE An impact disk and a fragment collecting box with a diameter of 200 mm can be used for the characterisation of highly friable explosive materials, in order to limit the dispersion of fine dust.

4.3 Closed vessel

It consists of a combustion chamber sealed by one or two plugs supporting the ignition electrodes, a pressure sensor and a blow down. The unit shall withstand a minimum static pressure of 300 MPa. Its volume should be around 130 cm³ (see Figure C.1).

NOTE A more complete description is given in French Standard NF T 70–714.

It is possible to check the suitability of the combustion chamber using (9 ± 0,1)g of double - base propellant with the following characteristics: 5,225 kJ/g formed as square pellets: 8 mm × 8 mm × 0,8 mm.

With this sample it is necessary to obtain:

- $P_{\max} = (80 \pm 5) \text{ MPa}$;
- $(dP/dt)_{\max} = (14,5 \pm 1,0) \text{ MPa/ms}$;

in compliance with the specifications regarding:

- the geometry of the combustion chamber;
- the acquisition and processing of the signal;
- the definition of the ignition mechanism.

These specifications are stated in French Standard NF T 70–714.

These results are obtained with a closed vessel whose combustion chamber has a constant volume of approximately 130 cm³ (see Figure C.1).

4.4 Measurement apparatus**4.4.1 Measurement of the impact velocity**

The impact velocity is measured 1,55 m from the impact disk using, for example, two optical barriers that are 10 cm away and connected to a chronometer (see layout in Annex A).

This velocity shall be measured at ± 1 m/s.

4.4.2 Recording of the pressure when burning inside the closed vessel

In general, reference should be made to French Standard NF T 70–714 for the choice of elements for the measurement chain (pressure sensor, charge amplifier, numbering and memory storage apparatus).

For example, a KISTLER 6203 piezoelectric sensor can be used combined with a KISTLER 5001 charge amplifier.

5 Test specimen

The test specimen is cylindrical, with a diameter of $(18,0 \pm 0,1)$ mm. Its length is adjusted to obtain a mass of $(9,0 \pm 0,1)$ g.

It is obtained either directly by casting, or by punching, or by machining a block, or by compression.

6 Procedure

6.1 Performing a trial

6.1.1 Impact of the test specimen

Several methods could be used to attain the desired impact velocity. The chosen launching method should not damage the sample.

The sequence of operations is as follows, according to the launch procedure used:

- with a pneumatic launch device, the plastic tamping plug is inserted into the tube muzzle then pushed in using a variable depth index rod according to the expected velocity. The sample is then inserted through the tube muzzle and pushed in until it stops against the tamping plug;

The pressure is established in the air tank by opening valve 1. Firing is triggered by opening valve 2 (see Annex A);

- with a gun device, are successively inserted through the muzzle a plastic tamping plug using an indexed rod, then the sample to test on contact with the tamping plug

The propellant cartridge is inserted into the chamber and the moving head is locked using the breech.

Then, firing is triggered.

The impact velocity (IV) of the test specimen is recorded and all of the fragments are carefully collected then weighed.

The mass loss for each sample shall be lower than or equal to 0,3 g, before burning it in the closed vessel.

In case of an explosive event at the impact, the highest velocity for which there is no reaction is noted in the test report.

6.1.2 Firing in the closed vessel

6.1.2.1 Verification of the apparatus

Before each test series in the manometric vessel, test firing can be performed with the Double – Based Propellant (defined in 4.3).

The maximum pressure derivative obtained is noted and a variation of $\pm 1,0$ MPa/ms of this derivative is permitted in relation to the reference value:

$$\left(\frac{dP}{dt} \right)_{\max} = 14,5 \text{ MPa/ms}$$