SLOVENSKI STANDARD
oSIST prEN 13631-2:2021

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Eksplozivi za civilno uporabo – Razstreliva – 2. del: Ugotavljanje toplotne stabilnosti razstreliv

Explosives for civil uses - High explosives - Part 2: Determination of thermal stability of explosives

Explosivstoffe für zivile Zwecke - Sprengstoffe - Teil 2: Bestimmung der thermischen Stabilität von Explosivstoffen

Explosifs à usage civil - Explosifs - Partie 2: Détermination de la stabilité thermique des explosifs

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English Version

Explosives for civil uses - Explosives - Part 2: Determination of thermal stability of explosives

Explosifs à usage civil - Explosifs - Partie 2: Détermination de la stabilité thermique des explosifs

Explosivstoffe für zivile Zwecke - Explosivstoffe - Teil 2: Bestimmung der thermischen Stabilität 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.

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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 13631-2:2021) 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 13631-2:2002.

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) Clause 1, *Scope*, has been revised and black powder has been included;

c) the normative references have been updated;

d) in Clause 3, Terms and definitions, the terms 3.1, 3.2 and 3.4 have been added;

e) Clause4, *Principle*, has been added;

f) Clause 7, *Procedure*, has been revised for clarification purposes;

g) Figures 1 and 2 have been removed;

h) 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*

— *Part 13: Determination of density of explosives*

— *Part 14: Determination of velocity of detonation of explosives*

1 Scope

This document specifies a method to assess the thermal stability of boosters and explosives, including black powder, at 75 °C.

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*

3 Terms and definitions

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

3.1
mass loss
difference of the sample mass when comparing the mass before and after the test

3.2
relevant mass loss
mass loss which occurred other than through the evaporation of a volatile component, including water

3.3
self-heating
temperature increase resulting from an internal chemical reaction

3.4
thermal stability
property of the explosive, by which it does not show a chemical change, as shown by a relevant mass loss or initiation, when kept up to a given temperature

4 Principle

Thermal stability is tested by subjecting the explosive to elevated thermal conditions. It is observed whether initiation occurs, or other signs of chemical reactions are found.

NOTE 1 Knowledge on thermal stability is relevant to guarantee the safety of the explosive until it is used and to prevent inadvertent initiation under environmental conditions to which it may be exposed, also for example during transport.

NOTE 2 Thermal stability at the temperature of 75 °C is also required for transport and tested in a similar way in the UN Manual of Tests and Criteria.

NOTE 3 The thermal stability test can also be modified for a different temperature for other purposes.

5 Apparatus

5.1 Heating chamber, capable of being controlled at (75 ± 2) °C, equipped with or connected to a time-controlled switch, where the time can be set with an accuracy of within ± 1 min.

The heating chamber should have dual thermostats or some other means of protection against thermal run-away if the control thermostat malfunctions. Preferably, the heating chamber should be isolated and capable of remote operation. It should also be equipped with a ventilation system.

5.2 Balance, capable of weighing to ± 0,1 g.

5.3 Three thermocouples, of a type, which is inert to the substances under test.

5.4 Temperature recording system, capable of measuring temperature to ± 1 °C.

5.5 Two glass beakers with closure, inner diameter (50,5 ± 0,5) mm, (200 ± 50) mm long and a wall thickness of at least 3 mm. For its closure, the glass beaker containing the substance under test shall be equipped with a gas-proof device with a weak part forming a rupture disk calibrated at a static gauge pressure of 60 kPa or a continuous pressure measurement device. A means of venting the device shall be present.

5.6 Reference substance, which shall have the same physical state as that of the substance to be tested. Use either:

— quartz sand (for granular and past-like solids);

— polytetrafluoroethylene (PTFE) block (for a consolidated solids and boosters);

— silicon oil (for liquids).

6 Preparation of test samples

6.1 Liquid, paste-like or granular substances

The test sample shall have a volume of (96 ± 4) ml.

6.2 Compact solids

Compact solids shall be tested in cylindrical blocks with a diameter of $49^{+0,5}_{0}$ mm, and a length of (50 ± 1) mm. One of the sides of the block shall have a blind hole along the block axis, so as to house the thermocouple (see Clause 3). The diameter of the hole shall exceed that of the thermocouple by a maximum of 0,3 mm. Its depth shall be such that the thermocouple junction lies within 2 mm of the centre of the block.

7 Procedure

7.1 General

Prior to the test, all available information to judge a possible explosion hazard at 75 °C shall be considered. Such information could be results from differential scanning calorimetry (DSC) or another thermo-analytical method. In case a violent reaction cannot be excluded, the sample amount should be reduced in a pre-test to an amount which is compatible with the rating of the heating chamber.

7.2 Test set-up and testing

After having weighed an empty glass beaker, place the test sample into it, where the beakers are upright standing.

If the substance is a liquid, a paste or a granular solid, pour or place it into the glass beaker. Granular solids are tested without compacting. The substance shall fill the lower part of the glass beaker.

For a compact solid, the test sample comprises one of the cylindrical blocks described in 6.2. Place the block in the lower part of the glass beaker.

Pass the wires of thermocouple 1 through the closing device so that the tip of the thermocouple is within 2 mm of the centre of the test sample. In case of a compact solid it shall be placed in the blind hole of the test sample block. In other cases, push the thermocouple into the substance.

Place (96 ± 2) ml of the reference substance in the other glass beaker, using the procedure described above, but without weighing. Insert thermocouple 2 and close the glass beaker.

Finally, fix thermocouple 3 to the second glass beaker, on the outside and at the same level as the other thermocouples

The fixing may be achieved by using wire, for example.

The two glass beakers are placed 10 cm or more apart from each other inside the heating chamber. The thermocouples are connected to the temperature-recording system, which is switched on. The temperatures of the substance under test and of the reference substance are recorded with thermocouples 1 and 2. The temperature of the heating chamber is recorded with thermocouple 3.

Place the sample and reference substance inside the heating chamber and set the temperature control of the heating chamber to 75 °C.

After the sample and reference substance have reached a temperature of (75 ± 2) °C, release the pressure by means of opening and closing the venting device and set the time control for switch-off to 48 h. The heating shall be interrupted when one of the following phenomena occurs:

a) report or flame;

b) significant release of gas leading to breakage of the rupture disk or pressure rise above 60 kPa;

c) self-heating, as observed by a temperature difference between the sample and the reference substance of 3 K or more.

If one of above phenomena has occurred the test shall be terminated. Switch off the heating chamber and, after it has cooled to no more than 5 K above the temperature of the room where it is operated, examine its contents.

If none of the reactions a, b, or c have occurred within the given 48 h, switch off the heating chamber. After it has cooled to no more than 5 K above the temperature of the room where it is operated, recover the glass beaker containing the substance under test and weigh it to determine whether any mass loss has occurred. Record any change of colour by visual inspection.

7.3 Assessment criteria

If the phenomena a), b), c) in 7.2 have been observed or a relevant mass loss indicating a chemical reaction has been determined, record the result as “reaction”. Otherwise, record “no reaction”.

8 Test report

The test report should conform to EN ISO/IEC 17025:2017, 5.10.2 and 5.10.3. In addition, the following information shall be given:

a) a reference to this document;

b) the result, as “reaction” or “no reaction”;

c) details of any change of colour or loss of mass;

d) in case of a reaction, the following indications shall be given:

   1) report or flame;

   2) maximum self-heating to … °C;

   3) rupture of the disk or pressure rise of 60 kPa in the closed system;