SLOVENSKI STANDARD
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Eksplozivi za civilno uporabo - Detonatorji in zakasnilniki - 15. del: Ugotavljanje sposobnosti iniciranja

Explosives for civil uses - Detonators and relays - Part 15: Determination of equivalent initiating capability

Explosivstoffe für zivile Zwecke - Zünder und Verzögerungselemente - Teil 15: Bestimmung der Zündstärke

Explosifs a usage civil - Détonateurs et relais - Partie 15: Détermination de la capacité d'amorçage équivalente

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Explosives for civil uses - Detonators and relays - Part 15: Determination of equivalent initiating capability

Explosifs à usage civil - Détonateurs et relais - Partie 15: Détermination de la capacité d'amorçage équivalente

Explosivstoffe für zivile Zwecke - Zünder und Verzögerungselemente - Teil 15: Bestimmung der Zündstärke

This European Standard was approved by CEN on 9 January 2004.

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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 Central Secretariat has the same status as the official versions.

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

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

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Foreword

This document (EN 13763:2004) 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of an identical text or by endorsement, at the latest by April 2005, and conflicting national standards shall be withdrawn at the latest by April 2005.

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.

For relationship with EU Directives, see informative Annex ZA, which is an integral part of this standard.

This document is one of a series of standards on *Explosives for civil uses – Detonators and relays*. Other parts of this series are:

EN 13763-1 Part 1: Requirements

EN 13763-2 Part 2: Determination of thermal stability

EN 13763-3 Part 3: Determination of sensitiveness to impact

EN 13763-4 Part 4: Determination of resistance to abrasion of leading wires and shock tubes

EN 13763-5 Part 5: Determination of resistance to cutting damage of leading wires and shock tubes

EN 13763-6 Part 6: Determination of resistance to cracking in low temperatures of leading wires

EN 13763-7 Part 7: Determination of the mechanical strength of leading wires, shock tubes, connections, crimps and closures

EN 13763-8 Part 8: Determination of resistance to vibration of plain detonators

EN 13763-9 Part 9: Determination of resistance to bending of detonators

EN 13763-11 Part 11: Determination of resistance to damage by dropping of detonators and relays

EN 13763-12 Part 12: Determination of resistance to hydrostatic pressure

EN 13763-13 Part 13: Determination of resistance of electric detonator to electrostatic discharge

EN 13763-16 Part 16: Determination of delay accuracy

EN 13763-17 Part 17: Determination of no-fire current of electric detonators

EN 13763-18 Part 18: Determination of series firing current of electric detonators

EN 13763-19 Part 19: Determination of firing impulse of electric detonators

EN 13763-20 Part 20: Determination of total electrical resistance of electric detonators

EN 13763-21 Part 21: Determination of flash-over voltage of electric detonators

EN 13763-22 Part 22: Determination of capacitance, insulation resistance and insulation breakdown of leading wires

EN 13763-23	Part 23: Determination of the shock-wave velocity of shock tubes
EN 13763-24	Part 24: Determination of the electrical non-conductivity of shock tubes
EN 13763-25	Part 25: Determination of transfer capability of surface connectors, relays and coupling accessories
EN 13763-26	Part 26: Definitions, methods and requirements for devices and accessories for reliable and safe function of detonators and relays
CEN/TS 13763-27	Part 27: Definitions, methods and requirements for electronic initiation system

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

Introduction

General

When fired, the explosive charge of detonators must provide a pulse of sufficient energy to initiate the explosive or a detonating cord/shock tube, with which they are intended to be used.

In the test procedure described in this document, the output performance of a test piece is compared with a reference having known characteristics and mass of charge. This document describes two tests: an underwater initiating capability test and a functioning test at low and high temperatures.

Underwater initiating capability

This test is based on the principle that the detonation of an explosive charge under water generates a spherical shock-wave and a volume of gas, which expands and then collapses as the bubble rises through the water. The shock-wave and the volume of gas bear a finite relationship to the energy released. Thus, by measuring:

- the shock-wave pressure; and
- the time interval between the shock-wave pressure peak and the first collapse of the gas bubble,

and calculating the parameters proportional to:

- equivalent shock energy; and
- equivalent bubble energy,

the energy output of the test detonators can be compared with the energy output of the reference detonator to which the manufacturer claims equivalence.

Functioning test at high and low temperatures

This test checks that the energy output of the detonators does not vary when they are fired at high and low temperatures, by firing detonators in contact with aluminium witness plates at ambient, high and low temperatures and comparing the depths of indentations made in the plates.

1 Scope

This document specifies a method of determining the equivalent initiating capability of detonators.

This document also specifies a functioning test (after storage) at high and low temperatures.

This document is not applicable to surface connectors or detonating cord relays.

2 Normative references

The following referenced documents are indispensable for the application 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 573-3, *Aluminium and aluminium alloys – Chemical composition and form of wrought products - Part 3: Chemical composition*

EN 13857-1:2003, *Explosives for civil uses – Part 1: Terminology.*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13857-1:2003 apply.

4 Test pieces

4.1 Underwater initiating capability test

Select 20 detonators of each specific type, having the same construction and shell material and having the same design, quantity and type of primary and secondary charge.

4.2 Functioning test at high and low temperatures

Select 50 detonators from each specific type, having the same construction and shell material and having the same design, quantity and type of primary and secondary charge.

5 Apparatus

5.1 Underwater initiating capability test

5.1.1 Blasting tank (Water tank or outdoor facility), with a volume of at least 500 l, and constructed in such a way that shock-wave reflections from the walls are avoided, for example, in the case of a small tank (as shown in Figure 1), by lining the walls with plastics foam.

5.1.2 Positioning system, for the pressure sensor and detonator. The distance between the centre of the sensor and the detonator shall be (400 $\pm$ 5) mm. The bottom of the detonator and sensor shall be placed (400 $\pm$ 5) mm below the water surface. The distance between any wall and the detonator shall be at least 200 mm.

5.1.3 Pressure sensor, with a rise time < 2 µs.

5.1.4 Amplifier, with suitable gain and facility to connect the sensors and the oscilloscope.

5.1.5 **Storage oscilloscope**, with minimum 10 MHz sampling frequency.

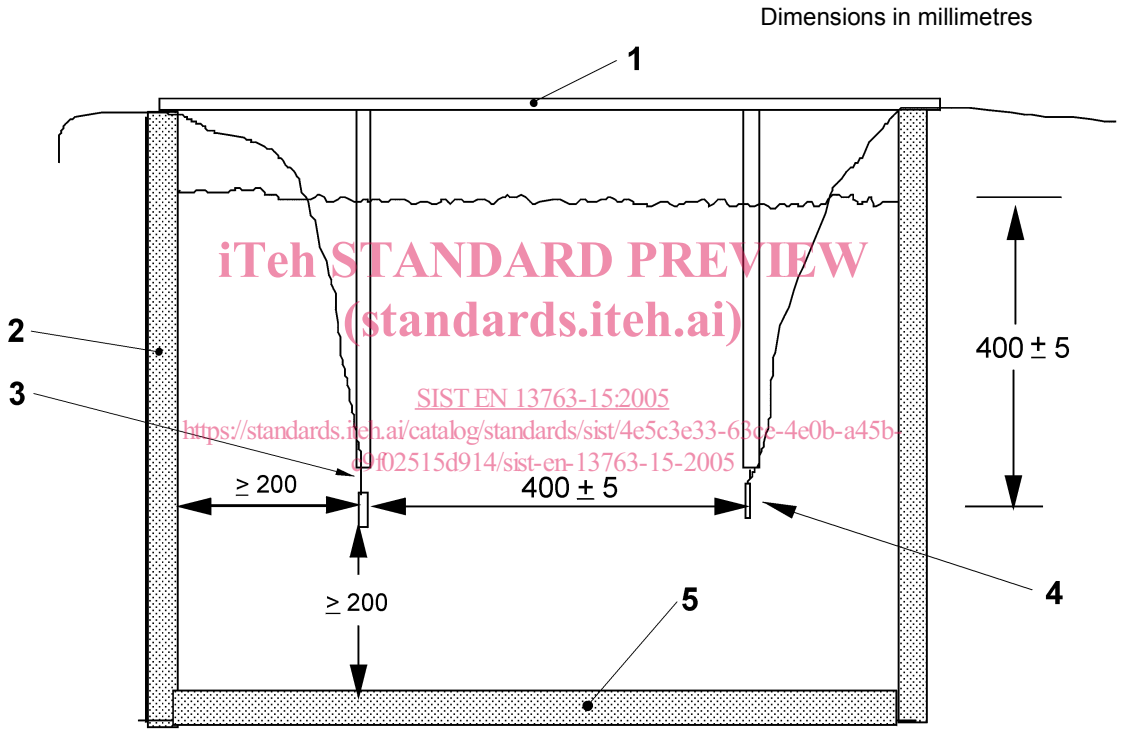
5.1.6 **Computer**, with software for calculation of results.

5.1.7 **Firing device**, for initiating the submerged detonators.

5.1.8 **Thermometer**, to measure the water temperature.

5.1.9 **Barometer**, to measure the atmospheric pressure.

5.1.10 **Reference detonators**; ten reference detonators of strength equivalent to that claimed by the manufacturer for the detonators to be tested (see 6.1.2.).



Key

1 Positioning arrangement
2 Water tank
3 Detonator
4 Pressure sensor
5 Non-reflecting, energy-absorbing material

Figure 1 - Example of water tank with positioning system for sensor and detonator

5.2. Functioning test at high and low temperatures

5.2.1 Arrangement for firing detonators against witness plates, see examples in Figure 2 and Figure 3.

5.2.2 Heating cabinet, capable of maintaining a temperature 10 ºC higher than the highest safe operating temperature claimed by the manufacturer.

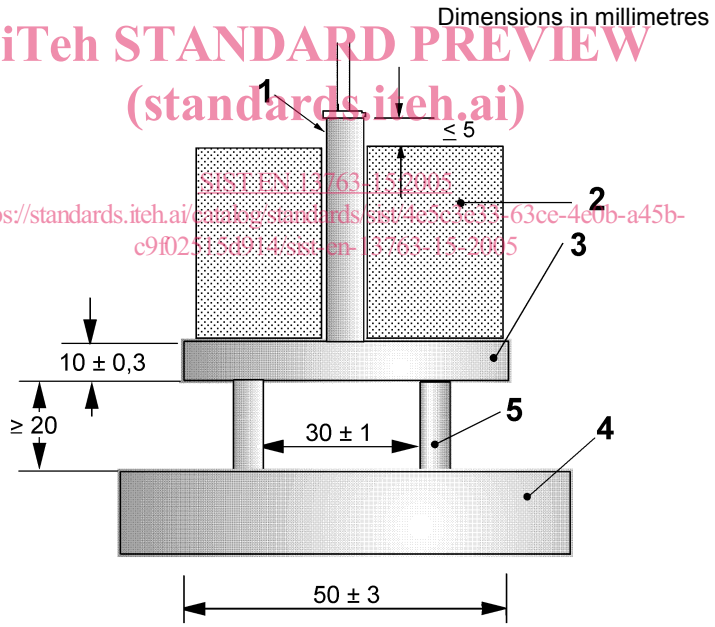
5.2.3 Freezing chamber, capable of maintaining a temperature at least 10 ºC lower than the lowest safe operating temperature claimed by the manufacturer.

5.2.4 Witness plates, size (50 ± 3) mm x (50 ± 3) mm with a thickness of (10 ± 0,3) mm, made from aluminium designated EN AW-6082 in accordance with EN 573-3.

NOTE If a hole is obtained in the witness plate, the thickness of the plate may be increased.

5.2.5 Depth indicator gauge, with a pin point diameter of 0,60 mm and measuring accuracy ± 0,01 mm.

5.2.6 Insulating foam, of expanded polystyrene foam or similar material, with an outside diameter of at least 50 mm and a hole through the centre with a diameter not more than 1 mm greater than that of the detonator. The height of the foam shall be such that, when the detonator is inserted, not more than 5 mm of detonator shell (at the closure end) remains exposed.



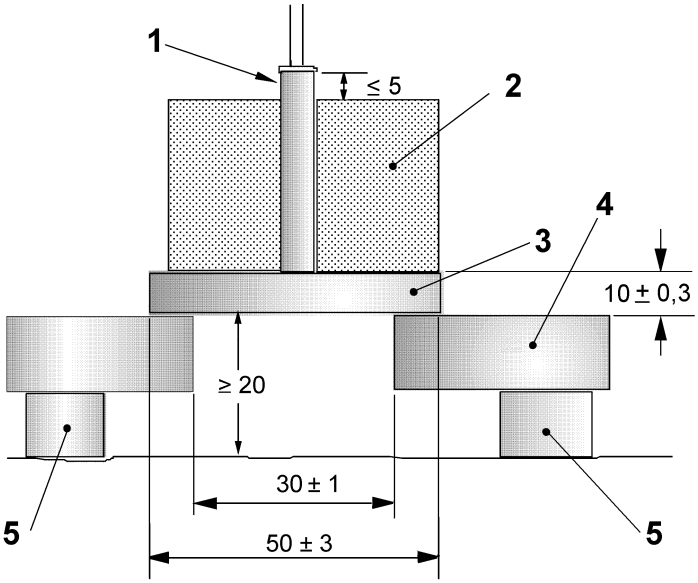
Key

1 Detonator
2 Expanded PS foam glued or taped to the witness plate
3 Witness plate
4 Steel plate
5 Section of steel tube

NOTE The witness plate is supported by a piece of steel tube, again supported by a thick steel plate.

Figure 2 - Example of arrangement for firing detonators against witness plates.

Dimensions in millimetres



Key

1 Detonator
2 Expanded PS foam glued or taped to the witness plate
3 Witness plate
4 Steel plate
5 Supports for the steel plate

NOTE The aluminium plate is placed directly on a thick steel plate with a hole in the centre so that there is free space underneath the area where an indentation from the detonation is expected.

Figure 3 - Example of an alternative arrangement for firing detonators against witness plates.

6 Procedure

6.1 Underwater initiating capability test

6.1.1 General

The water temperature shall not vary by more than ± 2 ºC, and the atmospheric pressure shall not vary by more than ± 5 kPa during the test. The amount of water in the tank and the type of sensor shall not vary during the test.

6.1.2 Firing of reference detonators

Fire 10 reference detonators (see 5.1.10), which the manufacturer claims to correspond to the strength of the detonators under testing. Fire five reference detonators before the test series and five after the completion of the test series.

Fix each detonator vertically at (400 ± 5) mm from the pressure sensor and at least 200 mm from any wall of the tank. Fire the detonators with the manufacturer's specified series firing current (for electric detonators) or with a suitable initiator (for shock tubes). Record the shock-wave pressure and the time interval between the shock-wave pressure peak and the first collapse of the gas bubble.