

Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods

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Item 2 (c) of the provisional agenda

Explosives and related matters:

review of tests in parts I and II of the Manual of Tests and Criteria

Design proposal for the standard detonator in the Manual of Tests and Criteria

Transmitted by the Institute of Makers of Explosives (IME)

Introduction

1. At the 47th Session, in informal document INF.10 (47th session), IME reviewed long term issues that had been previously identified¹ regarding improvement of Test Series 6. One of the issues identified was that of the specification for a Standard Detonator found in Appendix 1 of the Manual of Tests and Criteria (Manual). IME noted²:

Germany has reviewed the European version of the standard detonator and proposes some changes in ST/SG/AC.10/C.3/2015/26. Additionally, IME has begun an internal study of the USA version of the standard detonator and expects to report its recommendations at the 48th session.

2. In ST/SG/AC.10/C.3/2015/26, Germany presented a proposal to update the design specification for the European version of the standard detonator and in ST/SG/AC.10/C.3/2016/10, Germany has presented some test data supporting that proposal.

3. IME welcomes the work done by Germany and hopes to take it one step further resulting in a single specification for the standard detonator that would replace both the current European and the USA versions currently found in Appendix 1 of the Manual. IME believes that this could be accomplished by making some adjustments to the proposal by Germany that is contained in ST/SG/AC.10/C.3/2015/26 and referred to in ST/SG/AC.10/C.3/2016/10. These adjustments, with some additional comments from IME are shown in the Annex 1 to this paper. For clarity in review, Annex 2 provides a clean copy of the proposed text.

4. IME invites the Sub-Committee and its working group on explosives to consider whether the modifications to the German proposal suggested by IME could serve as a way forward to formalizing a single specification for the Standard Detonator described in Appendix 1 of the Manual.

¹ ST/SG/AC.10/C.3/2014/4

² UN/SCETDG/47/INF.10, para. 7

Annex 1

Proposed Amendments to Proposed Text in ST/SG/AC.10/C.3/2015/26

Specifications of standard detonators

1. Description of the standard detonator (European)

According to the elements of the standard detonator indicated in Figure A1.1 by letters A-G the following specifications apply:

A) ~~Blasting cap~~ Detonator

The ~~blasting cap~~ detonator shell shall be hollow-drawn from either copper (with not more than 5% zinc, where an alloy is used) or aluminium. The cap shall have an outer diameter of 7.0 mm ~~to 7.6 mm~~^(DWR) ± 0.1 mm. ~~The wall thickness shall be 0.24 mm ± 0.05 mm.~~ The thickness at the bottom of the cap shall be 0.42 mm ± 0.05 mm.

B) Secondary charge

The secondary charge shall be PETN and with a mass of ~~0.60 g ± 0.01~~ ~~0.450 to 0.475~~^(DWR) g and pressed at a minimum of 26 MPa. The secondary charge is pressed into the bottom of the ~~blasting cap~~ detonator and shall have no gaps or air spaces.

C) Primary charge

The primary charge shall be ~~fully contained in the tube (D) and shall consist of not more than 0.10 g~~ of a primary explosive (preferably lead-free). ~~The primary charge usually will not fully fill the space inside the tube (D).~~ It needs to be in direct contact to the secondary charge.

D) Tube

~~This tube acts as protection of the primary charge against fragments which could cause a sympathetic detonation. The length of the tube shall be 10-15 mm, the outer diameter shall be such to fit snugly into the detonator cap, the wall thickness of the tube shall be not less than 1 mm, and the inner diameter is typically not less than 2 mm.~~

E) Fuse head

~~The fuse head shall have a protection against electrostatic discharge. The fuse head charge shall contain not more than 50 mg of a primary explosive (preferably lead free). The distance between the fuse head (E) and the tube (D) shall be in the range of 3-10 mm. The electric parameters of the bridge wire in the fuse head shall be of an electrically insensitive type. The no fire current shall be 0.45 A (Ampere) or greater, the no fire impulse shall be 8 mJ/Ohm or greater.~~

F) Spark gap

~~There shall be a narrow air gap ("spark gap") between the exposed lead wires of the fuse head (E) and the blasting cap (A). The plug (G) must leave room for a spark to the lead wires, and a crimping may be used to generate a fold to even further narrow the gap. The distance between the fuse head and the nearest metallic parts shall be sufficiently large, such that the spark gap is functional. Suggest: Other proven methods of electrostatic protection shall be used for the construction of the detonator.~~

G) — Plug

~~The plug tightly surrounds the lead wires and forms together with the crimping of the blasting cap (A) a tight closure of the blasting cap.~~^[DWB]

The following information shall serve to understand the permissible variations in design beyond the above specifications:

A) ~~The blasting cap/detonator (A) may in principle have a hollow, indented, or stamped bottom.~~

B) ~~In order to exclude shaped-charge effects it is preferred to use only flat bottom caps.~~

C) ~~The overall length of the blasting cap/detonator (A) is not defined. Since it has to contain all elements (B) to (G) it will commonly be not shorter than 45 mm ~~and shouldn't be any longer than 80 mm.~~~~

The detonator shall be initiated by a safe, reliable, and internationally recognized means. Some examples are electric detonators, shock tube detonators, or electronic detonators.

- ~~▪ The secondary charge (A) as described above will have a length of about 12-13 mm.~~
- ~~▪ The tube (D) containing the primary charge (C) shall prevent the mass explosion of detonators packaged in bundles next to each other. The tube (D) is often made of steel. In order to prove the effectiveness of the tube to prevent a mass explosion, packaged detonators shall be subjected to test series 6 with a result other than 1.1.~~

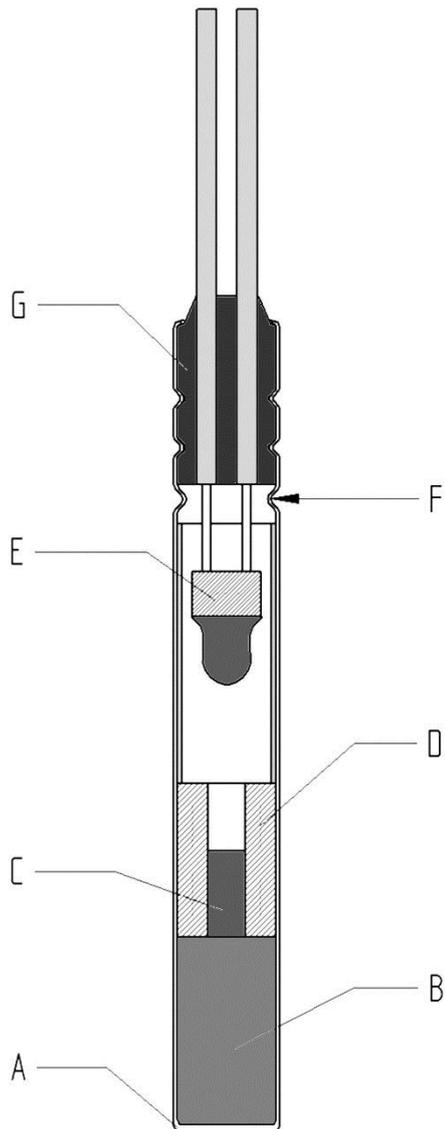
Remark:

~~Where the tube (D) is made out of sufficiently strong steel it “survives” the functioning of the detonator. I. e. it will stay intact and will not form fragments, which would be detrimental to the intended effect. The tube (D) shall not fragment upon functioning.~~

~~Protection of the fuse head (E) against electrostatic discharge can be achieved in different ways. The fuse head may be surrounded by a plastic tubing, which fits without play inside the detonator cap (A). This can be done to generate a long path for a discharge between fuse head and cap. In Figure A1.1 such a plastic tube is indicated to show this to be a permissible variation. This plastic tube is optional and protection of the fuse head can also be achieved by conductive coating.~~

~~Figure A1.1 shows a closing plug (G) with straight lead wires. Twisted lead wires within the closing plug are also common and irrelevant for the functioning or safety of the detonator. The plug (G) may extend outside the blasting cap (A), which is also irrelevant for the functioning. The plug (G), however, shall at minimum be aligned to the open end of the blasting cap (A).~~

~~—— 2. —— Schematic drawing of the standard detonator~~



- | | | | |
|---|------------------|---|-----------|
| A | Blasting cap | E | Fuse head |
| B | Secondary charge | F | Spark gap |
| C | Primary charge | G | Plug |
| D | Tube | | |

Figure A1.1: STANDARD DETONATOR (EUROPEAN) [DWB4]

Annex 2

Amended Appendix 1 to the Manual of Tests and Criteria

Specifications of standard detonator

According to the elements of the standard detonator the following specifications apply:

A) *Detonator*

The detonator shell shall be hollow-drawn from either copper (with not more than 5% zinc, where an alloy is used) or aluminium. The cap shall have an outer diameter of 7.0 mm to 7.6 mm. The thickness at the bottom of the cap shall be $0.42 \text{ mm} \pm 0.05 \text{ mm}$.

B) *Secondary charge*

The secondary charge shall be PETN and with a mass of 0.450 to 0.475 g and pressed at a minimum of 26 MPa.. The secondary charge is pressed into the bottom of the detonator and shall have no gaps or air spaces.

C) *Primary charge*

The primary charge shall be of a primary explosive (preferably lead-free). It needs to be in direct contact to the secondary charge.

The following information shall serve to understand the permissible variations in design beyond the above specifications:

- A) The detonator may in principle have a hollow, indented, or stamped bottom.
- B) In order to exclude shaped-charge effects it is preferred to use only flat bottom caps.
- C) The overall length of the detonator is not defined. Since it has to contain all elements it will commonly be not shorter than 45 mm.

The detonator shall be initiated by a safe, reliable, and internationally recognized means. Some examples are electric detonators, shock tube detonators, or electronic detonators.
