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**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**

**Forty-fifth session**
Geneva, 23 June – 2 July 2014
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**

# Manual of Tests and Criteria

# Recommendations for Improvement of Series 1 (a) and 2 (a) Gap Tests and Series 1 (c) and 2 (c) Time/Pressure Tests

**Transmitted by the Institute of Makers of Explosives (IME)**[1]

## Introduction

1. At the thirty-ninth session of the Sub-Committee, the Working Group on Explosives (EWG) discussed issues of difficulty in conducting tests outlined in the Manual of Tests and Criteria, and recommended to the Sub-Committee[2] that the EWG conduct a review of the tests mentioned in Parts I and II of the Manual with a view to:

(a) Better defining the specifications of the tests,

(b) Better defining the tolerances associated with those specifications, and

(c) To remove any unnecessary or over-specifications.

2. The Sub-Committee agreed that this work should be carried out[3].

[1] In accordance with the programme of work of the Sub-Committee for 2013-2014 approved by the Committee at its sixth session (refer to ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

[2] Informal document INF.58, para. 13

[3] ST/SG/AC.10/C.3/78, paras. 24 - 25

3. At the forty-third session of the Sub-Committee, IME's informal document INF.10 (43rd session) was considered by the Sub-Committee and its Working Group on Explosives (EWG). In informal document INF.10, IME proposed amendments to the specifications of the pipe used in the 1(a) and 2(a) tests and to the type of washer used in the 1(b) and 2(b) tests. Comments were received from the EWG and IME agreed to submit a formal proposal at the 45th session taking into account those comments[4].

## Discussion

1. Gap Tests. The expert from the United Kingdom observed that in test 1(a) and 2(a) the amendment proposed by IME would probably have no effect on results. The proposed revision for the steel tube thus specifies the type of material, and its diameter and length with tolerances.

Revisions in the booster charge materials to reflect those that are commercially available were accepted by the EWG. The expert from Canada recommended adding Composition C-4 as another alternate material.

2. Time/Pressure tests. Since there was not complete agreement in removing the lead washer for reasons of toxicity and replacing this material with one made from a deformable material, the original wording was retained, with the addition of the use of alternate deformable materials, such as polyoxymethylene.

## Proposals

### *Section 11*

1. Amend 11.4.1.2.1 of the 1(a) test procedure as indicated below:

11.4.1.2.1 Solids

The apparatus for solids is shown in Figure 11.4.1.1. The test sample is contained in a ~~cold-drawn, seamless,~~ carbon steel tube with an external diameter of 48 ± 2 mm, a nominal wall thickness of ~~4.0 ± 0.1~~ mm and a length of 400 ± 5 mm. If the test substance may react with the steel, the inside of the tube may be coated with fluorocarbon resin. The bottom of the tube is closed with two layers of 0.08 mm thick polythene sheet pulled tightly (so that it plastically deforms) over the bottom of the tube and held in place with rubber bands and insulating tape. For samples which affect polythene, polytetrafluoroethylene sheet can be used. The booster charge consists of 160 g RDX/wax (95/5) or PETN/TNT that has a minimum of 50% PETN in the mixture, or Composition C-~~4(50/50), 50 ± 1 mm in diameter with a density of 1 600 ± 50 kg/m$^3$ giving a length of about 50 mm~~. The RDX/wax charge may be pressed in one or more pieces, as long as the total charge is within the specifications, and the PETN/TNT charge is cast. A mild steel witness plate, 150 ± 10 mm square and 3.2 ± 0.2 mm thick, is mounted at the upper end of the steel tube and separated from it by spacers 1.6 ± 0.2 mm thick.

4. Amend 11.6.1.2.2 of the 1(c) test procedure as indicated below:

11.6.1.2.2 The end of the pressure vessel furthest from the side-arm is closed with a firing plug which is fitted with two electrodes, one insulated from, and the other earthed

[4] Informal document INF.61/Rev.1, para. 8 (43rd session) and ST/SG/AC.10/C.3/86, para. 22

to, the plug body. The other end of the pressure vessel is closed by an aluminium bursting disc 0.2 mm thick (bursting pressure approximately 2 200 kPa) held in place with a retaining plug which has a 20 mm bore. A soft lead washer or a washer of a deformable material (for example, polyoxymethylene) is used with both plugs to ensure a good seal. A support stand (Figure 11.6.1.2) holds the assembly in the correct attitude during use. This comprises a mild steel base plate measuring 235 mm × 184 mm × 6 mm and a 185 mm length of square hollow section (S.H.S.) 70 × 70 × 4 mm.

### *Section 12*

1. Amend 12.4.1.2 of the 2(a) test procedure as indicated below:

12.4.1.2 Solids

The apparatus is shown in Figure 12.4.1.1. The test sample is contained in ~~cold drawn, seamless,~~a carbon steel tube with an external diameter of 48 ± 2 mm, a nominal wall thickness of 4~~.0 ± 0.1~~ mm and a length of 400 ± 5 mm. If the test substance may react with the steel, the inside of the tube may be coated with fluorocarbon resin. The bottom of the tube is closed with two layers of 0.08 mm thick polythene sheet pulled tightly (so that it plastically deforms) over the bottom of the tube and held in place with rubber bands and insulating tape. For samples which affect polythene, polytetrafluoroethylene sheet can be used. The booster charge consists of 160 g RDX/wax (95/5) or PETN/TNT that has a minimum of 50% PETN in the mixture, or Composition C-4~~(50/50), 50 ± 1 mm in diameter with a density of 1 600 ± 50 kg/m$^3$ giving a length of about 50 mm~~. The RDX/wax charge may be pressed in one or more pieces, as long as the total charge is within the specifications, and the PETN/TNT charge is cast. A polymethyl methacrylate (PMMA) spacer is required of diameter 50 ± 1 mm and length 50 ± 1 mm. A mild steel witness plate, 150 ± 10 mm square and 3.2 ± 0.2 mm thick, is mounted at the upper end of the steel tube and separated from it by spacers 1.6 ± 0.2 mm thick.

5. Amend 12.6.1.2.2 of the 2(c) test procedure as indicated below:

12.6.1.2.2 The end of the pressure vessel furthest from the side-arm is closed with a firing plug which is fitted with two electrodes, one insulated from and the other earthed to, the plug body. The other end of the pressure vessel is closed by an aluminium bursting disc 0.2 mm thick (bursting pressure approximately 2 200 kPa) held in place with a retaining plug which has a 20 mm bore. A soft lead washer or a washer of a deformable material (for example, polyoxymethylene) is used with both plugs to ensure a good seal. A support stand (Figure 12.6.1.2) holds the assembly in the correct attitude during use. This comprises a mild steel base plate measuring 235 mm × 184 mm × 6 mm and a 185 mm length of square hollow section (S.H.S.) 70 × 70 × 4 mm.

## Consideration

6. IME recommends that an alternate to primed cambric, which is the ignition system for the Time/Pressure test, continue to be sought and welcomes further discussion on this topic at the EWG.

7. IME remains at the service of the Sub-Committee and the EWG to continue to coordinate any future work on the review of Test Series 1 and 2 subject to those groups' desires and instructions.