

## 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 (f) of the provisional agenda

**Explosives and related matters: miscellaneous**

## Recommendations related to the Test Series 6(c) Bonfire Test

### Transmitted by the Sporting Arms & Ammunition Manufacturers' Institute (SAAMI)

#### I. Introduction

1. The expert from the United States of America has submitted a proposal for the current session (ST/SG/AC.10/C.3/2012/57) to change the United Nations Manual of Tests and Criteria 5th Revised Edition (hereafter referred to as the Manual). The proposal requests amendments to: (1) the requirement for recording equipment and (2) the test criteria for evaluation of fireballs/jet flames. SAAMI believes the procedures as currently written clearly and robustly ensure safety, while the proposed amendments represent significant departures from current philosophy and practice.

#### II. Discussion of Cameras Used In Test 6 (c)

2. The Manual states in 16.6.1.2(h) that for the Test 6 (c): External fire (bonfire) test, necessary test apparatus includes "Cine or video cameras, preferably high speed and normal speed, to record events in colour." No further reference is made to the use of cameras. The same treatment appears for the Test 5 (c): External fire test and for the Series 8 Type (d) Vented pipe test.

3. According to the Manual, the word "cameras" is used in the plural because sometimes it may be advantageous to have a high speed camera in addition to one of normal speed. A high speed camera may be used, for instance, to assess the speed and energy of metal projectiles, if applicable. They are not normally relevant to the evaluation of flame effects or packages which contain no metal. High speed cameras represent specialty equipment which is expensive, not readily available and may require a trained technician to operate. Usually they would only be used when considered desirable in the judgment of the competent authority or manufacturer. Some sophisticated test operations might often use a high speed camera because they have one and choose to get the most out of the investment, whereas other test operations may never need or use one. Some authorities might wish to have two different zooms if they anticipate a large reaction. Therefore there are a variety of purposes and products for which optimal camera choices may differ, and the Manual is appropriately flexible and realistic in addressing the need.

4. Paper ST/SG/AC.10/C.3/2012/57 proposes to amend only the Test 6 (c) to add the following statement: "Video cameras should be set up so as to observe effects toward all witness screens and in all directions from the grate." The Manual does not contemplate the use of multiple cameras to give different observation perspectives. The reason that three

and not four witness stands are erected around the bonfire is to allow observation from one direction where the camera should be placed. The addition of the proposed statement could require an unlimited number of cameras, and could easily be interpreted to mean four. The fact is that, to some degree, the witness screens and smoke may obscure the effects from perspectives other than the one specifically left open. The second proposal in ST/SG/AC.10/C.3/2012/57 asks to measure flame balls in all directions, including height and at differing angles to the witness screens. This could conceivably include perspectives from above. However the current arrangement has been found quite adequate to assess results, and to our recollection, previously there has been no discussion of video cameras being a problem.

5. In the United States of America tests must be performed, or at least supervised and witnessed, by a laboratory approved by the competent authority. The approved laboratory creates a test report which is forwarded by the manufacturer with additional supporting information to the competent authority. A video is also taken which the competent authority may request from the approved laboratory if they wish to visually assess a test. The procedure varies from country-to-country and, in some, competent authorities do not certify or approve laboratory representatives for this purpose. Testing is often done by the manufacturer at a facility of their choosing. Competent authorities may or may not attend this testing as required by the specific situation, but usually they rely on assessment of only one video rather than witnessing tests. These competent authorities do not require multiple camera angles to be presented. The situation in the USA, where a representative from an approved laboratory is always present plus a video is assessed already exceeds the norm. Therefore SAAMI does not support an additional requirement to add cameras pointed from all directions.

### **III. Discussion of Fireball Measurement In Test 6 (c)**

6. The Manual states in 16.6.1.4.4: “If none of the events occur which would require the product to be assigned to Division 1.1 or 1.2 but any one of the following events occurs: (a) a fireball or jet of flame which extends beyond any of the witness screens; ... then the product is assigned to Division 1.3.” Otherwise it is assigned to Division 1.4.

7. It is obvious that the criterion as written in Manual does not refer to a flame ball extending vertically beyond the screens. According to the procedure in the Manual, product in the Test 6 (c) is placed on a grate one meter high. The product is routinely one half meter high, therefore reaching a height of 1.5 meters. As the witness stands are two meters high and placed on the ground, a fire ball only has to be one half meter high before it extends beyond the witness stands in a vertical direction. Flames from the wood alone usually exceed the height of the witness stands, and may reach periodic heights of eight meters.

8. Flames can extend 4 meters horizontally from the product and be classified in Division 1.4. Heat naturally rises, so it is normal to see flames considerably taller than they are wide. A vertical flame limit of four meters above the product would result in mass reclassification of Division 1.4 products to Division 1.3, which would seriously impede commerce. No safety justification exists.

9. Dangerous goods other than Class 1 would often fail the proposed criterion, as these products can also reach tall flame heights of many meters. As one of the earliest dangerous goods, explosives safety regulations were developed independently of those for Classes 2 – 9. However, like other classes with varying degrees of hazard, Class 1 comprises a broad range of hazards ranging from mass explosion to fire hazard to virtually no hazard and deregulated status. We often find a situation where Class 1 products with a fire hazard are treated more severely than products of other classes which present a greater hazard to first

responders. As a matter of principle, integration and alignment of Class 1 effects into the transport regulations must be pursued, rather than aggravating existing inconsistencies.

10. The current flame ball criterion provides appropriate protection for fire fighters, who are trained not to fight Class 1 fires other than those involving only products of Division 1.4 Compatibility Group S. The Emergency Response Guidebook widely used by fire fighters instructs them in case of an incident as follows:

- Isolate spill or leak area immediately for at least 100 meters (330 feet) in all directions.
- For a large spill - consider initial evacuation for 250 meters (800 feet) in all directions.
- Fire - If rail car or trailer is involved in a fire, ISOLATE for 500 meters (1/3 mile) in all directions; also initiate evacuation including emergency responders for 500 meters (1/3 mile) in all directions.

Therefore the horizontal 4 meter limit is highly conservative.

11. In the event fire fighters are fighting a Division 1.4 fire for some reason, they will approach it horizontally, not vertically from directly above. The current 4 meter flame ball radius adequately protects them from realistic hazards encountered. Fire hoses may be used effectively at distances which will protect the fire fighter. It is common to find other products not classified as explosives which give significant heat radiation, vertical flame and projectiles, so the hazard is not exceptional compared to what may be regularly expected as part of fire fighting risk.

12. The current criterion of horizontal flame ball radius not extending past the witness screens is easy to assess. No flame is allowed beyond the screens in any amount or shape. Vertical assessment however would bring a whole new set of problems for evaluation. The wood fire is significant and flames from the wood alone may periodically extend eight meters or higher. Flames may separate from the fire and rise upwards, as heat does. Flames are ambiguous rather than discrete objects, and determining if flames are from the material or the wood, or where one flame ball stops and another starts, can be uncertain. Flames which satisfy the criterion on the ground could be blown by wind beyond the witness screens as they rise. In the proposed text these would fail the criterion.

13. The proposal in ST/SG/AC.10/C.3/2012/57 wishes to use additional camera angles to assess “downwind and upward projections where witness screens are not present”. The test measures effects at four meters in three directions, not a four meter radius. The proposal contemplates that an asymmetrical flame could go between the witness stands. Based on the discussion above, if somehow a flame ball had a 5 meter flame ball rather than 4 meters it would not be crucial. Multiple camera angles could be added and still not capture every effect. The current test is a simple and assessable method for practically determining hazard, which should be maintained.

14. Some competent authorities interpret a fireball as a sudden, usually short duration event caused by ignition of most of the test material. In this case a flame ball is significant in size and more or less a spherical phenomenon, and there is no need to look from multiple directions. On the other hand, a jet of flame is directional, and those which may be significant to attaining Division 1.4 would normally be caused by the burning of one or more large articles. To address directional effects the Committee might consider the statement in the Manual (16.6.1.3.1) “Packages should be oriented in such a way that a maximum probability for projections hitting the witness screens is obtained.” While this addresses projections, authorities can take unusual directional effects into account by

orienting packages or articles in such a way that the jet would go to the witness screens left and right allowing clearly visible and discreet measurements. This scenario is exceptional, and normally does not apply to substances.

#### **IV. Summary**

15. The UN Manual of Tests & Criteria ensures safety for fire fighters and first responders by conservatively limiting the size of flame balls for products classified as Division 1.4C. The method is working well and appropriately balances the need for good observation with practical and easy assessment of criteria. The current text should be maintained.

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