

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

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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

Test results with emulsions (ANE) relating to the Koenen test

Transmitted by the expert from Germany

Introduction

1. This paper is directly linked to working document ST/SG/AC.10/C.3/2016/6 which deals with the Koenen test and the steel tubes used therein. During the forty-seventh session of the TDG Sub-Committee the expert from Germany proposed to amend the quality requirement of the steel tubes (ST/SG/AC.10/C.3/2015/4). As a result from discussions Germany offered to conduct comparative tests with Ammonium nitrate emulsions with regard to the modified specification.
2. The main difference between steel tubes manufactured many years ago, and steel tubes available in Germany currently, is that the static bursting pressure is lower, and below, the specification currently given in the UN Manual of Tests and Criteria (UN-MTC) at the various occurrences of the Koenen test.
3. Tasked by the IGUS EOS Working Group and in their name tests were done with ANEs at the German Bundesanstalt für Materialforschung und -prüfung (BAM). Results from these tests are reproduced in this paper.

Test Results

4. Koenen tests were performed with 2 different emulsions. With each emulsion six tests were done, three with steel tubes of the former quality from old stock, and three with the new steel tubes.
5. The components of both emulsions were Ammonium nitrate, water, Sodium hydroxide, Acetic acid, Thiourea, fuel oil, and two different emulsifiers called “Anfumol” and “E21/70”. The emulsions were prepared such to be comparable to emulsions produced industrially.
6. The emulsions would not show violent behaviour in the Koenen test. In order to record results closest to the most critical conditions, of the three tests two were done at an orifice diameter of 1 mm and one at an orifice diameter of 2 mm.

7. During the tests no explosion of the steel tube occurred. With the “Anfumol”-emulsion the steel tubes remained fully unaffected when tested with 2 mm, however, with 1 mm consistently a light bulging of the bottom of the steel tube was observed. This bulging was independent of using the old quality steel tube or the new type. The “E21/70”-emulsion did not cause any observable changes to the steel tubes, independent of 1 mm or 2 mm orifice diameter or the steel quality.
8. For better readability the test results are summarised in a Table in an Annex to this document.

Conclusions

9. The test results underline, that also for emulsions and slow responding samples the change of steel quality, as referred to in document ST/SG/AC.10/C.3/2015/4, does not have an effect on the outcome of the Koenen test.

Annex

Koenen test results with two emulsions, as done at BAM in March 2016. The observed effects with the former type of steel tubes and the new type of steel tubes are equivalent. Heating was discontinued after 5 minutes.

<i>Emulsion</i>	<i>Steel tube</i>	<i>Orifice diameter</i>	<i># of fragments / effect</i>	<i>Remarks</i>
“Anfumol”	Former type	1 mm	0 / A	Bottom of tube slightly bulged
“Anfumol”	Former type	1 mm	0 / A	Bottom of tube slightly bulged
“Anfumol”	Former type	2 mm	0 / O	Tube unchanged
“Anfumol”	New type	1 mm	0 / A	Bottom of tube slightly bulged
“Anfumol”	New type	1 mm	0 / A	Bottom of tube slightly bulged
“Anfumol”	New type	2 mm	0 / O	Tube unchanged
“E21/70”	Former type	1 mm	0 / O	Tube unchanged
“E21/70”	Former type	1 mm	0 / O	Tube unchanged
“E21/70”	Former type	2 mm	0 / O	Tube unchanged
“E21/70”	New type	1 mm	0 / O	Tube unchanged
“E21/70”	New type	1 mm	0 / O	Tube unchanged
“E21/70”	New type	2 mm	0 / O	Tube unchanged