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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**

REPORT OF THE COMMITTEE OF EXPERTS  
ON ITS THIRD SESSION

(Geneva, 14 December 2006)

Addendum

Annex 2

Amendments to the fourth revised edition of the Recommendations on the Transport  
of Dangerous Goods, Manual of Test and Criteria

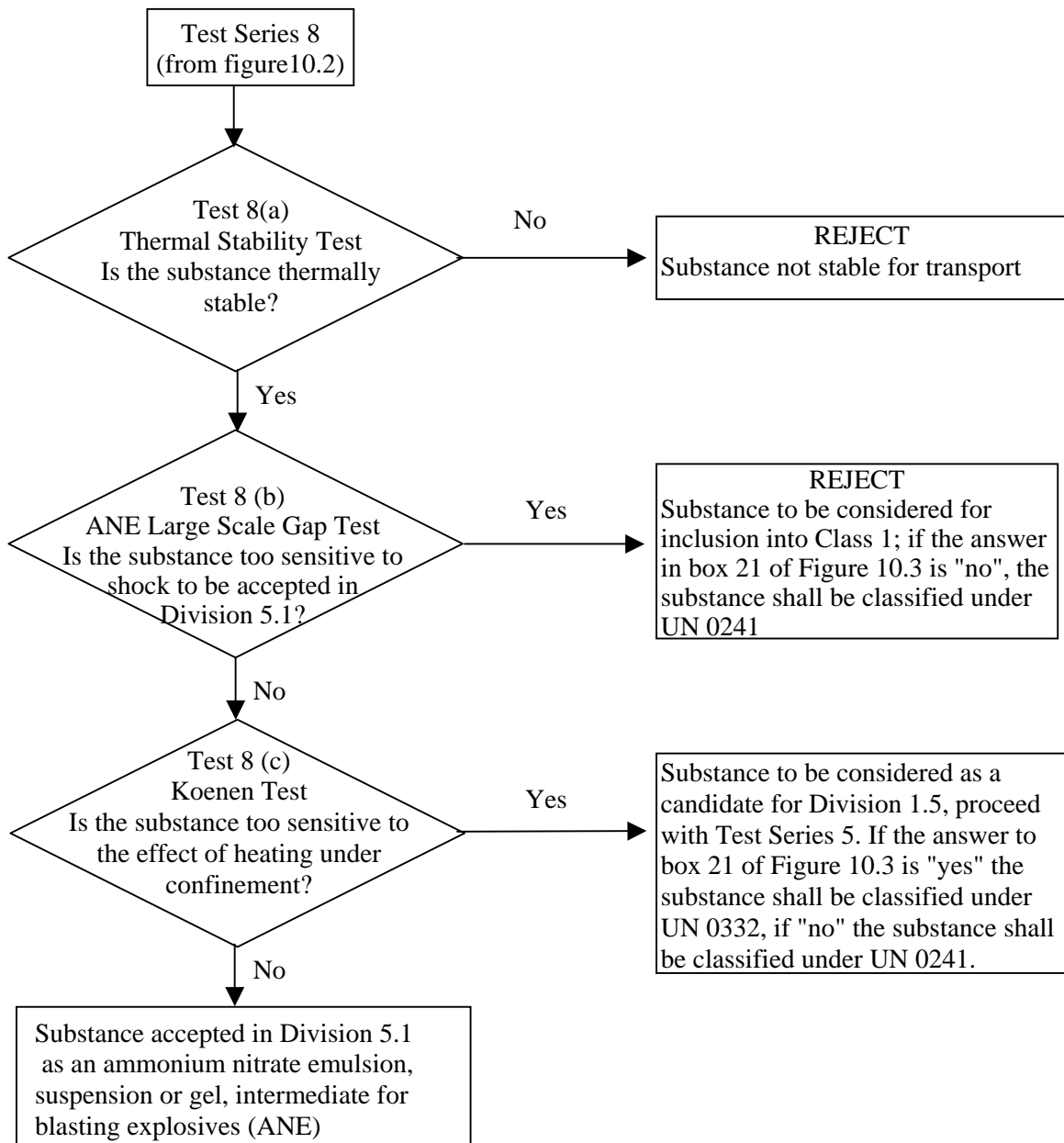
This annex contains amendments to the fourth revised edition of the Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.4), adopted by the Committee at its third session.

**AMENDMENTS TO THE FOURTH REVISED EDITION OF THE RECOMMENDATIONS ON  
THE TRANSPORT OF DANGEROUS GOODS, MANUAL OF TESTS AND CRITERIA  
(Refer to ST/SG/AC.10/11/Rev.4)**

**PART I**

10.4.3.3 (a) Replace "a qualified explosives expert" with "the competent authority".

Figure 10.4 Amend to read as follows:



11.5.1.2.1, 12.5.1.2.1, 18.6.1.2.1 and 25.4.1.2.1 In the second sentence, replace "of suitable quality" with "with the specification DC04 (EN 10027-1), or equivalent A620 (AISI/SAE/ASTM), or equivalent SPCEN (JIS G 3141)" and delete the third sentence.

Insert the following text at the end:

"For quality control of the steel tubes, 1% of the tubes from each production lot shall be subjected to quality control and the following data shall be verified:

- (a) The mass of the tubes shall be  $26.5 \pm 1.5$  g, tubes to be used in one test sequence shall not differ in mass by more than 1 g;
- (b) The length of the tubes shall be  $75 \pm 0.5$  mm;
- (c) The wall thickness of the tubes measured 20 mm from the bottom of the tube shall be  $0.5 \pm 0.05$  mm; and
- (d) The bursting pressure as determined by quasi-static load through an incompressible fluid shall be  $30 \pm 3$  MPa."

17.6.1.4 Replace "277 kPa" with "27 kPa". (*Correction*)

Table 18.1 Against "8 (d)", replace "test" with "tests".

In note b after the table, replace "This test is" with "These tests are".

18.7.1 Replace "8 (d)" with "8 (d) (i)".

18.7.1.2 (a) Replace " $31 \pm 1$  cm" with " $310 \pm 10$  mm", " $61 \pm 1$  cm" with " $610 \pm 10$  mm" and "38 cm" with "380 mm" (twice).

Figure 18.7.1.1 Replace "1.2" with "10" (twice) and change the measurements to millimetres. Insert the following new sentence below the figure: "All measurements are in millimetres."

Add a new 18.7.2 to read as follows:

**"18.7.2 Test 8 (d) (ii): Modified vented pipe test**

18.7.2.1 *Introduction*

This test is not intended for classification but is included in this Manual for evaluating the suitability of bulk substances to be transported in tanks.

The modified vented pipe test is used to assess the effect of exposure of a candidate for "ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives" to a large fire under confined, vented conditions.

#### 18.7.2.2 *Apparatus and materials*

The following items are needed:

- (a) A vented vessel consisting of mild drawn steel pipe with an inner diameter of  $265 \pm 10$  mm, a length of  $580 \pm 10$  mm and a wall thickness of  $5.0 \pm 0.5$  mm. Both the top and the base plates are made from 300 mm square,  $6.0 \pm 0.5$  mm thick mild steel plates. The top and base plates are fixed to the pipe with a fillet weld with a thickness of at least 5 mm. The top plate has a vent diameter of  $85 \text{ mm} \pm 1.0$  mm. A further two small holes are drilled in the top plate to accommodate neatly thermocouple probes;
- (b) A concrete block about 400 mm square and 50 to 75 mm thick;
- (c) A metal stand for supporting the vessel at a height of 150 mm above the concrete block;
- (d) A gas burner capable of accommodating a propane flow rate of up to 60 g/min. This rests on the concrete block under the stand. A typical example of a suitable burner is a 32-jet Mongolian wok burner;
- (e) A sheet metal shield to protect the propane flame from side winds. This can be fabricated from approximately 0.5 mm thick galvanised sheet metal. The diameter of the wind shield is 600 mm and the height is 250 mm. Four adjustable vents 150 mm wide and 100 mm high are spaced equally around the shield to ensure adequate air reaches the gas flame;
- (f) Propane bottle(s) connected via a manifold and fed into a pressure regulator. Other fuel gases may be used providing the specified heating rate is obtained. The pressure regulator should reduce the propane bottle pressure from 600 kPa down to about 150 kPa. The gas then flows through a gas rotameter capable of measuring up to 60 g/min of propane and a needle valve. An electrical solenoid valve is used to switch the propane flow on and off remotely. Typically three 9 kg propane bottles will achieve the desired gas flow rate for the duration of up to five tests. The gas pressure and flow are regulated to give a heating rate of  $3.3 \pm 0.3$  K/min when measured by the calibration procedure;

- (g) Three thermocouples with 500 (2) and 100 (1) mm long stainless steel probes and fiber-glass coated lead wires;
- (h) A data-logger capable of recording the output from the thermocouples;
- (i) Cine or video cameras, preferably high speed and normal speed, to record events in colour;
- (j) Pure water for calibration;
- (k) The ANE to be tested;
- (l) Blast gauges, radiometers and associated recording equipment may also be used.

### 18.7.2.3 *Calibration*

18.7.2.3.1 The vessel is filled to the 75% level (i.e. to a depth of 435 mm) with the pure water, and heated using the procedure specified in 18.7.2.4. Water is heated from ambient temperature up to 90 °C, monitoring temperature by the thermocouple in the water. Temperature-time data must fit a straight line whose slope will be the “calibration heating rate” for the given combination of vessel and heat source.

18.7.2.3.2 The gas pressure and flow must be regulated to give a heating rate of  $3.3 \pm 0.3$  K/min.

18.7.2.3.3 This calibration must be performed prior to the testing of any ANE substance, though the same calibration can be applied to any test conducted within a day of the calibration provided no change is made to the vessel construction or gas supply. New calibration has to be made every time that the burner is changed.

### 18.7.2.4 *Procedure*

18.7.2.4.1 The concrete block is placed on a sandy base and levelled using a spirit level. The propane burner is positioned in the centre of the concrete block and connected to the gas supply line. The metal stand is placed over the burner.

18.7.2.4.2 The vessel is placed vertically on the stand and secured from tipping over. The vessel is filled to 75 % of its volume (to a height of 435 mm) with the ANE under test without tamping during loading. The initial temperature of the ANE must be recorded. The substance is carefully packed to prevent adding voids. The wind shield is positioned around the base of the assembly to protect the propane flame from heat dissipation due to side winds.

18.7.2.4.3 The thermocouple positions are as follows:

- the first 500 mm long probe (T1) in the gas flame;
- the second 500 mm long probe (T2) extending all the way into the vessel so that the tip is positioned 80 to 90 mm from the bottom of the vessel;
- the third 100 mm long probe (T3) in the headspace 20 mm into the vessel.

The thermocouples are connected to the data-logger and the thermocouple leads and data-logger are adequately protected from the test apparatus in case of explosion.

18.7.2.4.4 Propane pressure and flow is checked and adjusted to the values used during the water calibration described in 18.7.2.3. Video cameras and any other recording equipment are checked and started. Thermocouple functioning is checked and data logging is started, with a time set between thermocouple readings not exceeding 10 seconds, and preferably shorter. The test should not be performed under conditions where the wind speed exceeds 6 m/s. With higher wind speed, additional precautions against side winds are required to avoid dissipation of the heat.

18.7.2.4.5 The propane burner may be started locally or remotely and all workers immediately retreat to a safe location. Progress of the test is followed by monitoring thermocouple readings and closed circuit television images. The start time of the trial is defined by the time at which the flame thermocouple trace T1 first begins to rise.

18.7.2.4.6 The gas reservoir should be large enough to bring the substance to a possible reaction and provide a fire duration lasting beyond total consumption of the test sample. If the vessel does not rupture, the system should be allowed to cool down before carefully dismantling the test set-up.

18.7.2.4.7 The test outcome is determined by whether or not a rupture of the vessel is observed when the test reaches conclusion. Evidence of test conclusion is based on:

- The visual and aural observation of vessel rupture accompanied by loss of thermocouple traces;
- The visual and aural observation of vigorous venting accompanied by peaking of both vessel thermocouple traces and no substance remains in the vessel; or
- The visual observation of decreased levels of fuming following the peaking of both vessel thermocouple traces at temperatures in excess of 300 °C and no substance remains in the vessel.

For the purposes of assessing results, the term "rupture" includes any failure of welds and any fracture of metal in the vessel.

18.7.2.4.8 The test is performed two times unless a positive result is observed.

18.7.2.5 *Test criteria and method of assessing results*

The test result is considered "+" and the substance should not be transported in tanks as a dangerous substance of Division 5.1 if an explosion is observed in any trial. Explosion is evidenced by rupture of the vessel. Once the substance is consumed in both trials and no rupture of the vessel is observed, then the result is considered "-".

18.7.2.6 *Examples of results*

<b>Substances</b>	<b>Result</b>
76.0 ammonium nitrate / 17.0 water / 5.6 paraffin oil / 1.4 PIBSA emulsifier	-
84.0 ammonium nitrate / 9.0 water / 5.6 paraffin oil / 1.4 PIBSA emulsifier	+
67.7 ammonium nitrate / 12.2 sodium nitrate / 14.1 water / 4.8 paraffin oil / 1.2 PIBSA emulsifier	-
67.4 ammonium nitrate / 15.0 methylamine nitrate / 12.0 water / 5.0 glycol / 0.6 thickener	-
71.4 ammonium nitrate / 14.0 hexamine nitrate / 14.0 water / 0.6 thickener	-

".

## **PART II**

23.2.1 Insert "of one, or if necessary both," after "of the results".

### PART III

32.3.1.6 (b) Insert "or environmentally hazardous" at the end.

32.3.1.7 (c) In the table, replace "-5 and below" with "no limit".

38.3 Amend the heading to read: "Lithium metal and lithium ion batteries".

38.3.1 Replace "lithium cells" with "lithium metal and lithium ion cells" and, in the parenthesis, replace "and 3091" with ", 3091, 3480 and 3481".

38.3.2.1 In the first sentence, replace "Lithium cells" with "Lithium metal and lithium ion cells".

In the second sentence, replace "Lithium cells" with "Cells" at the beginning.

In the last sentence, replace "lithium cell" with "cell".

38.3.2.2 In the definitions of *Large battery* and of *Small battery*, at the beginning, replace "lithium battery" with "lithium metal battery".

In the definitions of *Large cell* and of *Small cell*, at the beginning, replace "lithium cell" with "lithium metal cell".

In the definition of *Large cell*, delete "or lithium equivalent content".

In the definition of *Aggregate lithium content* delete "or lithium equivalent content".

Delete the definitions of *Equivalent lithium content* and *Lithium-equivalent content*.

In the definition of *Large battery*, insert the following phrase at the end ", or in the case of a lithium ion battery, means a battery with a Watt-hour rating of more than 6200 Wh."

In the definition of *Large cell*, insert the following phrase at the end ", or in the case of a lithium ion cell, means a cell with a Watt-hour rating of more than 150 Wh."

In the definition of *Small battery*, insert the following phrase at the end ", or in the case of a lithium ion battery, means a battery with a Watt-hour rating of not more than 6200 Wh".

In the definition of *Small cell*, insert the following phrase at the end ", or in the case of a lithium ion cell, means a cell with a Watt-hour rating of not more than 150 Wh".



In the definition of *Small cell*, delete “ou d'équivalent lithium” in the French text.

Add a new definition to read as follows:

"*Watt-hour rating*, expressed in Watt-hours, is calculated by multiplying a cell's or battery's rated capacity, in ampere-hours, by its nominal voltage."

- 38.3.3 In the last sentence, replace "in which the aggregate lithium content of all anodes, when fully charged, is more than 500g" with "of a size comparable to a large battery".

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