



---

**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 the Transport of  
Dangerous Goods and on the Globally Harmonized System of  
Classification and Labelling of Chemicals on its ninth session**

held in Geneva on 7 December 2018

**Addendum**

**Annex II**

**Amendments to the sixth revised edition of the Recommendations on  
the Transport of Dangerous Goods, Manual of Tests and Criteria  
(ST/SG/AC.10/11/Rev.6 and Amend.1)**

## General table of contents

PART I Delete “OF CLASS 1” at the end.

12 Replace “for inclusion in Class 1” with “for inclusion into the class of explosives”.

13 Amend the sentence between parentheses to read: “(To determine if a substance is an unstable explosive in the form it was tested)”.

14 At the end, after “too dangerous for transport” add “... and classified as a GHS unstable explosive”.

16 Replace “Class 1” with “the class of explosives”.

18 Replace “for inclusion in Division 5.1,” with “for classification as an oxidizing substance” and “suitability for transport” with “suitability for containment”.

PART II Replace “SELF-REACTIVE SUBSTANCES OF DIVISION 4.1 AND ORGANIC PEROXIDES OF DIVISION 5.2” with “SELF-REACTIVE SUBSTANCES, ORGANIC PEROXIDES AND POLYMERIZING SUBSTANCES”.

PART III Replace “CLASS 2, CLASS 3, CLASS 4, DIVISION 5.1, CLASS 8 AND CLASS 9” with “VARIOUS HAZARD CLASSES”.

31 Replace “FLAMMABLE” by “THE FLAMMABILITY OF” and delete “OF CLASS 2”.

32 Delete “OF CLASS 3”.

33 Replace “CLASS 4” by “FLAMMABLE SOLIDS, SOLID DESENSITIZED EXPLOSIVES, SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION AND SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES”.

34 Replace “SUBSTANCES OF DIVISION 5.1” by “SOLIDS AND LIQUIDS”.

36 Delete “*for classification procedures, test methods and criteria relating to Class 7*”.

37 Replace “OF CLASS 8” by “CORROSIVE TO METALS”.

38 Insert “SUBSTANCES AND ARTICLES OF TRANSPORT” before “CLASS 9”.

Add the following new entry:

“39. CLASSIFICATION PROCEDURE AND CRITERIA RELATING TO SOLID AMMONIUM NITRATE BASED FERTILIZERS”.

PART IV The amendment does not apply to the English version.

Add the following new entries:

“Appendix 10 STABILITY TESTS FOR NITROCELLULOSE MIXTURES”

“Appendix 11 COMPILATION OF CLASSIFICATION RESULTS ON INDUSTRIAL NITROCELLULOSE FOR THE PURPOSES OF SUPPLY AND USE ACCORDING TO GHS CHAPTER 2.17, WHICH CAN BE USED FOR THE CLASSIFICATION OF INDUSTRIAL NITROCELLULOSE PRODUCTS”

## Section 1

Initial note The amendment does not apply to the English version.

1.1.1 Amend to read as follows:

“The purpose of the Manual of Tests and Criteria (hereafter referred to as the “Manual”) is to present the United Nations schemes for the classification of dangerous goods subject to transport regulations, and hazardous substances and mixtures in accordance with the Globally Harmonized System of Classification and Labelling of Chemicals. Furthermore, it gives descriptions of the test methods and procedures considered to be the most useful for providing classifiers with the necessary information to arrive at a proper classification. Although the term “classifier(s)” is used generically throughout the manual to indicate the entity providing the classification, in some sectors this may be limited specifically to a competent authority or designated testing authority, whereas in others it may allow for self-classification by manufacturers or suppliers. The sector for classification should be taken into account for each occurrence of this term to correctly identify the entity responsible for classification.”

1.1.2 Current paragraph 1.1.2 becomes new paragraph 1.1.7.

Insert a new paragraph 1.1.2 to read as follows:

“1.1.2 This Manual should be used in conjunction with the latest versions of:

(a) the Recommendations on the Transport of Dangerous Goods (hereafter referred to as the Recommendations) and the Model Regulations annexed thereto (hereafter referred to as the Model Regulations); and

(b) the Globally Harmonized System of Classification and Labelling of Chemicals (hereafter referred to as the GHS).”

1.1.3 Current paragraph 1.1.3 becomes new paragraph 1.1.8.

1.1.3 to 1.1.6 Insert the following new paragraphs:

“1.1.3 Definitions of terms used in the Manual may be found in Chapter 1.2 and Appendix B of the Model Regulations and in the GHS. The term substance as it is used in this Manual includes substances, mixtures and solutions, unless otherwise stated.

1.1.4 The test methods and criteria in this Manual were originally developed to address classification for transport purposes, and therefore in previous editions of the Manual (up to the sixth revised edition) frequent reference is made to “as packaged for transport”. As for physical hazards the GHS refers to the tests contained in this Manual, to facilitate its use in the context of the GHS (i.e.: in sectors other than transport), the phrase “as offered for classification” is now used instead when appropriate. For example, if the classification to be determined is for products as packaged for transport, “as offered for classification” means “as offered for transport”. On the other hand, if the classification to be determined is for sectors other than transport in the context of the GHS, then “as offered for classification” means “in the condition relevant to the particular application, e.g. supply and use”. More details on the reasons for this change are provided below.

1.1.5 The outcome of the tests in this Manual is predominantly related to the intrinsic properties of the substance being tested. However, the test results may also be affected by other physical parameters such as: density; particle size (distribution) and humidity. For some physical hazards the outcome of the tests and hence the classification can also be dependent on the quantity of the sample and the packaging.

1.1.6 For these reasons, the above-mentioned parameters and circumstances should be taken into account when considering test results, particularly for classification for sectors other than transport.”

1.1.7 (new, former 1.1.2) In the first sentence, delete “of Tests and Criteria” and “of products”. Amend the beginning of the third sentence to read: “Where appropriate, the competent authority...”.

1.1.8 (new, former 1.1.3) Delete “or Divisions for transport” and replace “Competent Authority” with “competent authority” and “Competent Authorities” with “competent authorities”

1.1.9 Insert a new paragraph 1.1.9 to read as follows:

“1.1.9 The text and references throughout the Manual strive to be sector-neutral, but sometimes must be sector-specific. For example, Part IV is used for transport equipment, and Part V is used for sectors other than transport. Also, there is some sector-specificity within Parts I and II describing tests with packages as presented for transport. Explosives transport classifications to the Division level frequently apply only to a defined configuration, with the quantity and confinement (packaging) as prepared for transport. Sectors other than transport may build upon explosives transport classifications.”

1.2 Current section 1.2 becomes new section 1.3.

Insert a new section 1.2 to read as follows:

**“1.2 Hazard classes in the Model Regulations and in the GHS**

**1.2.1 Hazard classes in the Model Regulations**

1.2.1.1 Substances and articles subject to the Model Regulations are assigned to one of nine classes according to the hazard or the predominant hazard they present for transport. Some of these classes are subdivided into divisions addressing a more specific type of hazard within a given class. The numerical order of the classes and divisions does not reflect the degree of hazard.

1.2.1.2 In addition, for packing purposes, some dangerous goods are assigned to one of three packing groups in accordance with the degree of hazard they present:

Packing group I: high hazard

Packing group II: medium hazard

Packing group III: low hazard

The packing group to which a substance is assigned is indicated in the Dangerous Goods List in Chapter 3.2 of the Model Regulations. Articles are not assigned to packing groups.

1.2.1.3 Dangerous goods meeting the criteria of more than one hazard class or division and which are not listed in the Dangerous Goods List are assigned to a transport class and division and subsidiary hazard(s) on the basis of the precedence of hazards characteristics.

1.2.1.4 *Precedence of hazard characteristics for transport purposes*

1.2.1.4.1 The precedence of hazard characteristics table in 2.0.3.3 of Chapter 2.0 of the Model Regulations may be used as a guide in determining the class of a substance having more than one hazard, when it is not named in the Dangerous Goods List in Chapter 3.2 of the Model Regulations. For goods having multiple hazards, which are not specifically listed by name in the Dangerous Goods List, the most stringent packing group denoted to the respective hazard of the goods takes precedence over other packing groups, irrespective of the precedence of hazard characteristics table.

1.2.1.4.2 The precedence of hazard characteristics of the following goods is not dealt with in the Precedence of hazard table in Chapter 2.0 of the Model Regulations, since these primary characteristics always take precedence:

- Substances and articles of Class 1;
- Gases of Class 2;

- Liquid desensitized explosives of Class 3;
- Self-reactive substances and solid desensitized explosives of Division 4.1;
- Pyrophoric substances of Division 4.2;
- Substances of Division 5.2;
- Substances of Division 6.1 with a packing group I inhalation toxicity;
- Substances of Division 6.2; and
- Radioactive material of Class 7.

1.2.1.4.3 Self-reactive substances, type A to type G, should not be tested in the self-heating test N.4, as the test result will give a false positive result (i.e. temperature increase due to thermal decomposition rather than oxidative self-heating). Self-reactive substances of type G and organic peroxides of type G having properties of another hazard class (e.g. UN 3149) should be classified according to the requirements of that hazard class.

## **1.2.2 *Hazard classes in the GHS***

The GHS addresses classification of substances by types of chemical hazards (e.g. flammability, toxicity, corrosivity) grouped into physical, health and environmental hazards. Each GHS hazard class corresponds to a type of hazard, and it is sometimes specific to a certain aggregation state (solid, liquid or gaseous). Most of the GHS hazard classes are further subdivided into hazard categories reflecting the severity of the hazard, with Category 1 indicating the most severe hazard.

## **1.2.3 *Relationship between the Model Regulations and the GHS***

1.2.3.1 Since the GHS addresses other sectors in addition to transport (e.g. storage, supply and use), it includes hazards not considered relevant to transport, such as several non-acute health hazards. Due to the differences in scope between the GHS and the Model Regulations not all hazards addressed in the GHS have their counterparts in the Model Regulations, and vice versa. For instance, there is no specific hazard class in the GHS for radioactive material (Class 7 in transport) and some of the dangerous goods classified for transport in Class 9 are covered by other GHS hazard classes (e.g.: environmentally hazardous substances of Class 9 may fall under the GHS hazard class Hazardous to the aquatic environment).

1.2.3.2 In addition, while one transport class may cover several different types of hazards, GHS hazard classes usually address one type of hazard each. For instance, substances of Class 4 in transport belong to seven individual GHS hazard classes. Furthermore, while transport classes are identified by a number (1 to 9), GHS hazard classes are identified by a name reflecting the type of chemical hazard (e.g. “Flammable solids”). Moreover, the concept of precedence of hazards as defined in the Model Regulations (see 1.2.1.4) does not exist in the GHS.

1.2.3.3 The overarching correlation between GHS hazard classes and the transport classes addressed in the Model Regulations is indicated in Table 1.1. The table is indicative only and is not intended to be used as the sole basis in translating the classification of any substance or article between the GHS and the Model Regulations, or vice versa.

**Table 1.1: Correlation between hazard classes in the GHS and in the Model Regulations**

<b>Hazard classes in the GHS</b>	<b>Hazard classes in the Model Regulations</b>
Explosives, Divisions 1.1 to 1.6	Class 1, Divisions 1.1 to 1.6
Flammable gases, Category 1	Class 2, Division 2.1
Aerosols	Class 2, Division 2.1 and 2.2
Oxidizing gases	Class 2, Division 2.2 with subsidiary hazard 5.1
Gases under pressure	Class 2
Flammable liquids, category 1 to 3	Class 3
Flammable solids	Class 4, Division 4.1
Self-reactive substances and mixtures	Class 4, Division 4.1
Pyrophoric liquids	Class 4, Division 4.2
Pyrophoric solids	Class 4, Division 4.2
Self-heating substances and mixtures	Class 4, Division 4.2
Substances and mixtures which, in contact with water, emit flammable gases	Class 4, Division 4.3
Oxidizing liquids	Class 5, Division 5.1
Oxidizing solids	Class 5, Division 5.1
Organic peroxides	Class 5, Division 5.2
Corrosive to metals	Class 8
Desensitized explosives	Class 3 (liquids)
	Class 4, Division 4.1 (solids)
Acute toxicity, Categories 1, 2 and 3	Class 6, Division 6.1 (solids and liquids)
	Class 2, Division 2.3 (gases)
Skin corrosion, Category 1	Class 8
Hazardous to the aquatic environment, Acute 1 and Chronic 1 and 2	Class 9 (environmentally hazardous substances)

”

1.3 Delete current section 1.3 (“Precedence of hazards characteristics”).

Former heading of 1.2 becomes new 1.3. The text remains unchanged.

1.3.1 (new, former 1.2.1) Amend to read as follows:

“1.3.1 The Manual is divided into five parts:

Part I: Relating to explosives;

Part II: Relating to self-reactive substances, organic peroxides and polymerizing substances;

Part III: Relating to aerosols, desensitized explosives (relating to transport only), flammable liquids, flammable solids, pyrophoric liquids and solids, substances which in contact with water emit flammable gases, oxidizing liquids and solids, chemically unstable gases and gas mixtures, substances corrosive to metals, and substances and articles of transport Class 9 (ammonium nitrate fertilizers, lithium metal and lithium ion batteries) and solid ammonium nitrate based fertilizers;

Part IV: Test methods concerning transport equipment; and

Part V: Classification procedures, test methods and criteria relating to sectors other than transport.”

The last paragraph of current 1.2.1 (“Part III ...screening procedures” becomes new paragraph 1.3.2. Delete the first sentence (“Part III ...Model Regulations”) and “a number of “before “appendices”. Amend the end of the paragraph to read as follows: “... portable tanks for organic peroxides and self-reactive substances, on screening procedures, on flash compositions tests for the classification of fireworks, response descriptors and the ballistic energy test for cartridges, small arms.”.

1.3.3 (new, former 1.2.2) Replace (twice) “Table 1.1” with “Table 1.2”.

In the table, third row, under “Test Series”, replace “L-T” with “C, L-U”.

1.3.4 Former paragraph 1.2.3 becomes new paragraph 1.3.4. The text of the paragraph remains unchanged.

1.4.1 Amend the end of the paragraph to read as follows: “toxicity data (see Chapter 1.5 and Annex 4 of the GHS for guidance on the preparation of Safety Data Sheets).”.

1.5.1 In the second sentence, replace “here” with “below”. In the last sentence, after “those prescribed,” insert “the deviation should be described and”.

1.5.2 Amend the end of the first sentence and the beginning of the second sentence to read as follows: “...should be representative of the substances being classified. The contents of active substance(s)...”.

1.5.4 Amend the end of the first sentence to read: “expected circumstances, e.g. of transport or storage.”. In the second sentence replace “the transport conditions” with “these circumstances” and “anticipated transport conditions” with “anticipated conditions”.

1.6.1 In the third sentence replace “Table 1.2” with “Table 1.3” and “Table 1.3” with “Table 1.4”. In the fourth sentence, amend “self-reactive substances and organic peroxides” to “self-reactive substances, organic peroxides and polymerizing substances”. In the last but one sentence, delete “as only one test is given for each property”.

Current Table 1.2 becomes new Table 1.3, with the following changes:

Amend the title to read “Recommended tests in Part I”.

Add the following new rows in proper order:

7	(l)	7 (l)	1.6 article (or component) fragment impact tests
8	(e)	8 (e)	CanmetCERL Minimum Burning Pressure (MBP) test

Amend the end of note “a” under the table to read as follows: “... suitability for containment in portable tanks as an oxidizing substance.”.

Current Table 1.3 becomes new Table 1.4, with the following change: Amend the title to read “RECOMMENDED TESTS IN PART II”.

1.7.1 Amend the beginning of the first sentence to read: “Classifications for inclusion in the list of dangerous goods for transport in Chapter 3.2...”.

In the list under the introductory paragraph, replace “Substances and articles of Class 1” with “Explosive substances and articles” and delete “of Division 4.1” and “of Division 5.2”.

## Part I

Title In the title, delete “OF CLASS 1”.

Table of contents In the entry for 10.4, replace “OF CLASS 1” with “OF THE CLASS OF EXPLOSIVES”.

Add the following new entries:

“18.8 SERIES 8 TYPE (e) TEST PRESCRIPTION”.

“18.8.1 **Test 8 (e) \* CanmetCERL minimum burning pressure (MBP) test**”

## Section 10

10.1.1 In the second sentence, after “the most useful for providing” delete “competent authorities with” and “for transport” at the end.

10.1.2 Amend to read as follows:

“The GHS class of explosives covers all sectors. Class 1 is a subset of this class and comprises explosives as presented for transport. The class of explosives also includes unstable explosives which are those explosives which are forbidden for transport. Goods of class 1 are assigned to one of the six divisions, depending on the type of hazard they present (see Chapter 2.1, paragraph 2.1.1.4 of the Model Regulations and Chapter 2.1, paragraph 2.1.2 of the GHS) and, for some regulatory purposes (e.g. transport), to one of the thirteen compatibility groups that identify the kinds of explosives that are deemed to be compatible. The general scheme for classifying a substance or article which is to be considered for inclusion in the class of explosives is illustrated in Figure 10.1. The assessment is in two stages. In the first stage, the potential of a substance or article to explode is ascertained and its chemical and physical stability and sensitivity are also determined. In order to promote uniform assessments by classifiers, it is recommended that, using the flow chart in Figure 10.2, data from suitable tests is analysed systematically with respect to the appropriate test criteria. If the substance or article is provisionally accepted into the class of explosives, it is then necessary to proceed to the second stage and assign it to the correct division by use of the flow charts of Figures 10.3 and 10.5. With the exception of compatibility groups N and S, for which test data is necessary, assignment to a compatibility group, when appropriate, is usually made without reference to testing. In the case of compatibility group S, the tests may be waived (where appropriate by the competent authority) if classification by analogy is based on test results for a comparable article.”

10.1.3 Current paragraph 10.1.3 becomes new paragraph 10.1.4.

Insert the following new paragraph 10.1.3:

“10.1.3 Test Series 4 and 6 are performed as presented for transport. Explosives are unique in that the type of packaging and environment frequently have a decisive effect on the hazard and therefore on the assignment to a particular division (see Chapter 2.1 of the Model Regulations, introductory note 4). Additional considerations may therefore be necessary when transport classifications are used for other sectors.”

10.1.4 (new, former 10.1.3) Amend the end of the sentence to read as follows: “so that an appropriate classification can be assigned. When appropriate this is done by the competent authority.”.

10.2.1 At the end of the first sentence, replace “Class 1” with “the class of explosives”. In the second sentence delete “of Division 4.1” and “of Division 5.2”. In the third sentence, insert “when appropriate” before “in the opinion”.

In (a), delete “or a combination or mixture of substances”. Replace “combinations or mixtures” with “substances”.

In (b), delete “(see paragraph 2.1.1.5 of the Model Regulations)”.

In (c), delete “or a new combination or mixture of explosive substances”.

In (d), replace “risk” with “hazard” (twice).

Delete the last sentence following sub-paragraphs (a) to (d) (“The classification...for transport”).

10.2.2 Amend to read as follows:

“10.2.2 The classifier of a new product should document adequate information concerning the names and characteristics of all explosive substances in the product and all relevant tests which have been done. This information should be furnished to the competent authorities, if required.”

10.3 The amendment to the French version does not apply to the English text.

10.3.1.1 In the first sentence replace “product” by “substance or article”, “transport” by “classification”, and “Class 1” by “the class of explosives”.

Amend the second sentence to read as follows: “This is decided by determining whether a substance provisionally accepted into the class of explosives is either too insensitive for inclusion in this class or is accepted as an unstable explosive (and considered too dangerous for transport); or whether the article or packaged article are accepted as an unstable explosive (and considered too dangerous for transport).”.

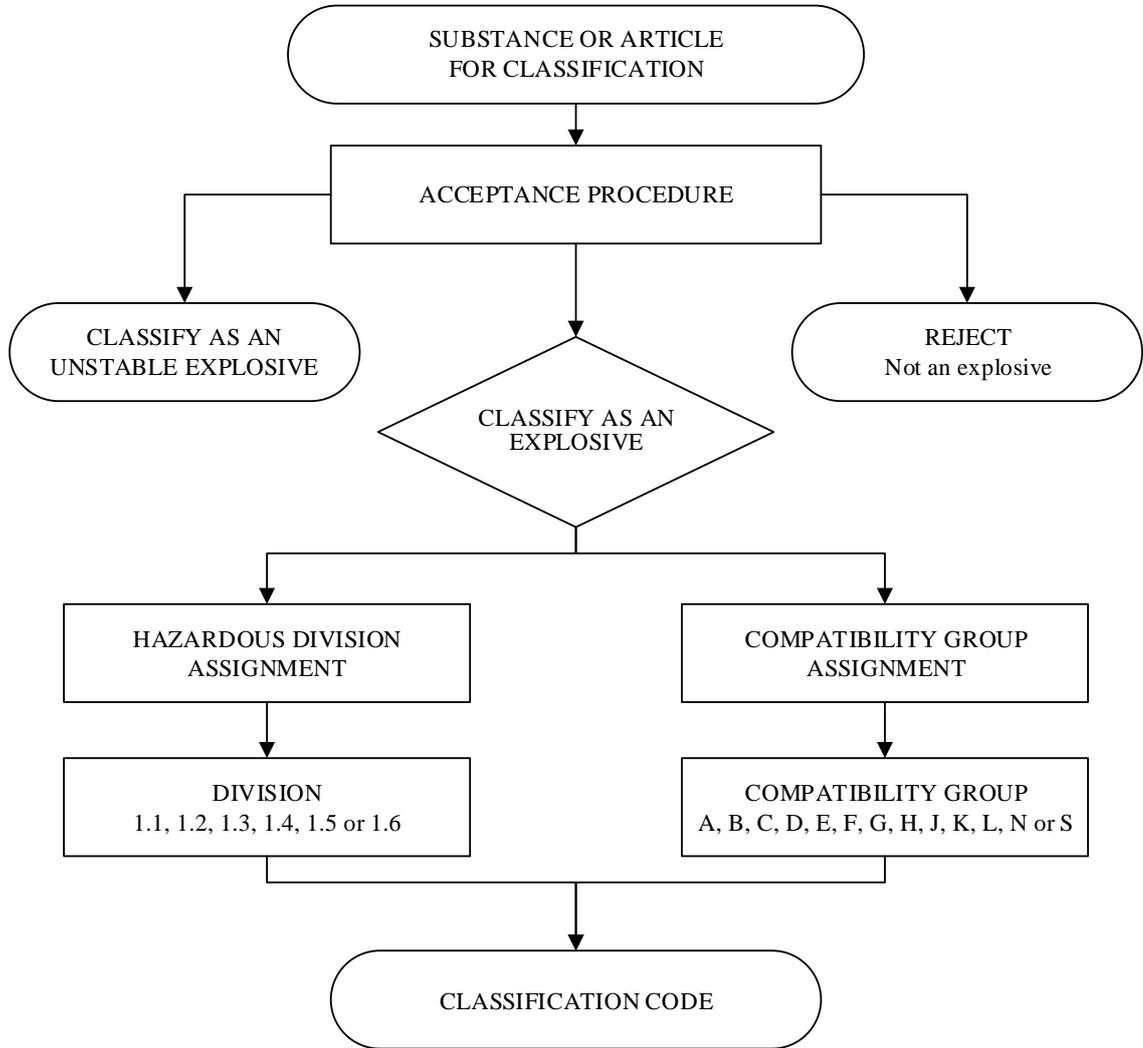
10.3.2.1 Replace “Class 1” with “the class of explosives”. Replace “four series, numbered 1 to 4,” by “four series (Test Series 1 to 4)”.

10.3.2.2 Amend the beginning of the sentence to read: “The question “Does it have explosive properties?” (box 5, Figure 10.2) is answered...”.

10.3.2.3 Amend the first sentence to read as follows: “Series 2 tests are used to answer the question “Is it too insensitive for acceptance into this class?” (box 7, Figure 10.2).”.

Figure 10.1 Replace the figure and its heading with the following:

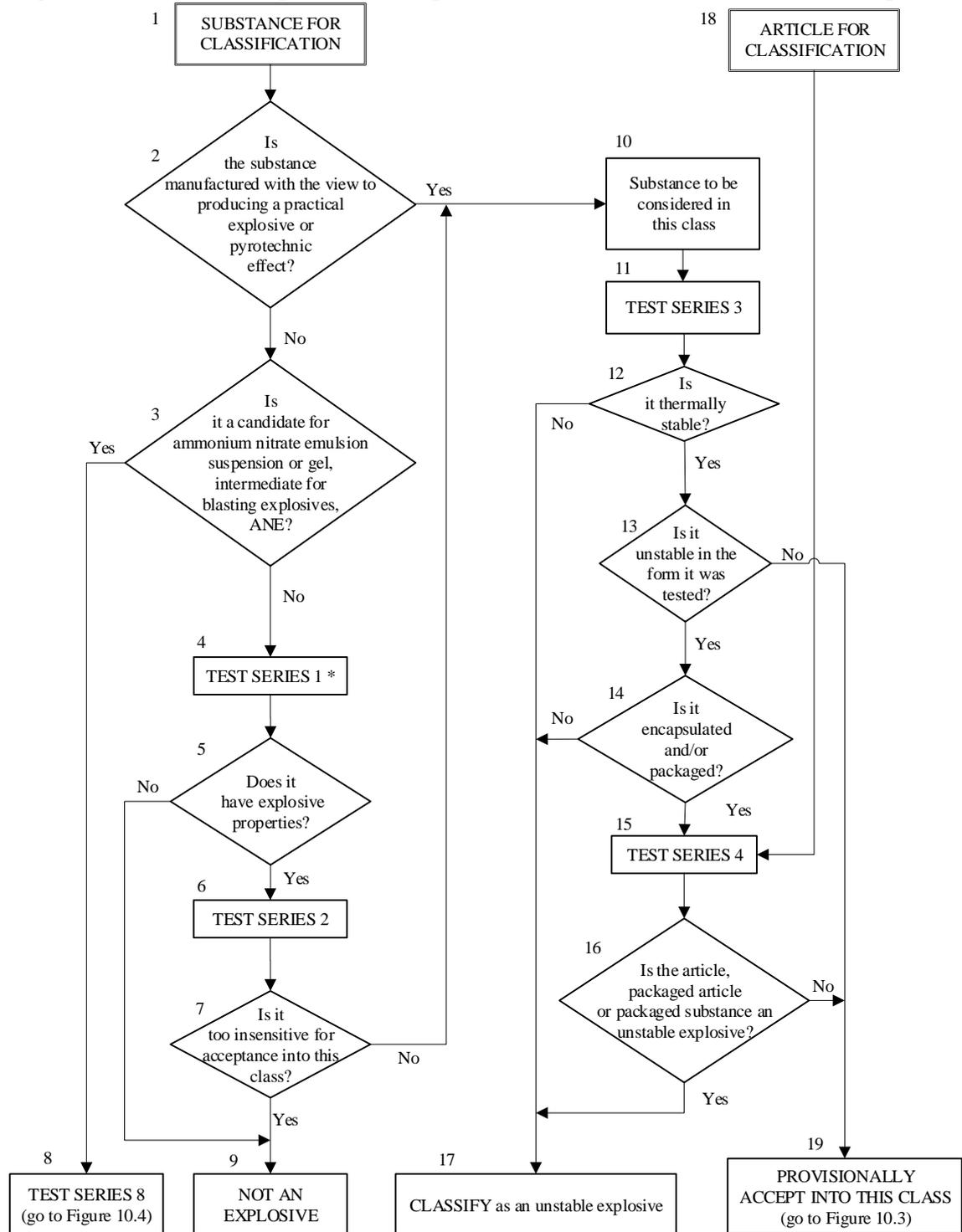
**“Figure 10.1: Overall scheme of the procedure for classifying a substance or article in the class of explosives**



”

Figure 10.2 Replace current figure 10.2 and its heading with the following:

**"Figure 10.2: Procedure for provisional acceptance of a substance or article in the class of explosives"**



10.3.2.4 Amend the first sentence to read: “Test series 3 is used to answer the questions “Is it thermally stable?” (box 12, Figure 10.2) and “Is it unstable in the form it was tested?” (box 13, Figure 10.2).”.

10.3.2.5 In the first sentence, replace “too dangerous for transport” with “an unstable explosive”.

10.3.3.3 In the second sentence, insert “, where appropriate,” after “authority”. Amend the beginning of the last sentence to read: “If it is suspected (e.g. by the competent authority where appropriate), that the product...”.

10.3.3.4 Amend to read as follows:

“10.3.3.4 Test series 1 indicates whether a substance has explosive properties. However, for a new substance not designed to have a practical explosive or pyrotechnic effect, it is more appropriate to start the testing procedure with test series 3. Test Series 3 involves relatively small sample sizes, which reduces the risk to test personnel. If the substance passes test series 3, as a practical matter the next step is the application of test series 2 which determine whether the substance is too insensitive for inclusion into the class of explosives. There is no real need to perform test series 1 at this point. Substances which fail test series 2 but pass test series 3 shall be subjected to the procedure for assignment to the appropriate division of explosives. It is important to note, however, that a substance which fails test series 2 may still be excluded from the class of explosives provided the substance is not designed to have a practical explosive or pyrotechnic effect, nor exhibits any hazardous effects in test series 6 of the assignment procedure as packaged.”

10.3.3.5 Insert “for testing purposes” after “control components,”.

10.4 In the title replace “Class 1” with “the class of explosives”.

10.4.1.1 Amend the beginning and the end of the first sentence to read as follows: “Unless classified as unstable, explosives are ... Model Regulations and 2.1.2 of the GHS).”

In the second sentence, replace the text between brackets with “(Figures 10.3 and 10.5)”, replace “and/or” with “and”, and “Class 1” with “this class”.

Amend the beginning and the end of the third sentence to read as follows: “A substance or article is assigned to ... to which it has been subjected.”.

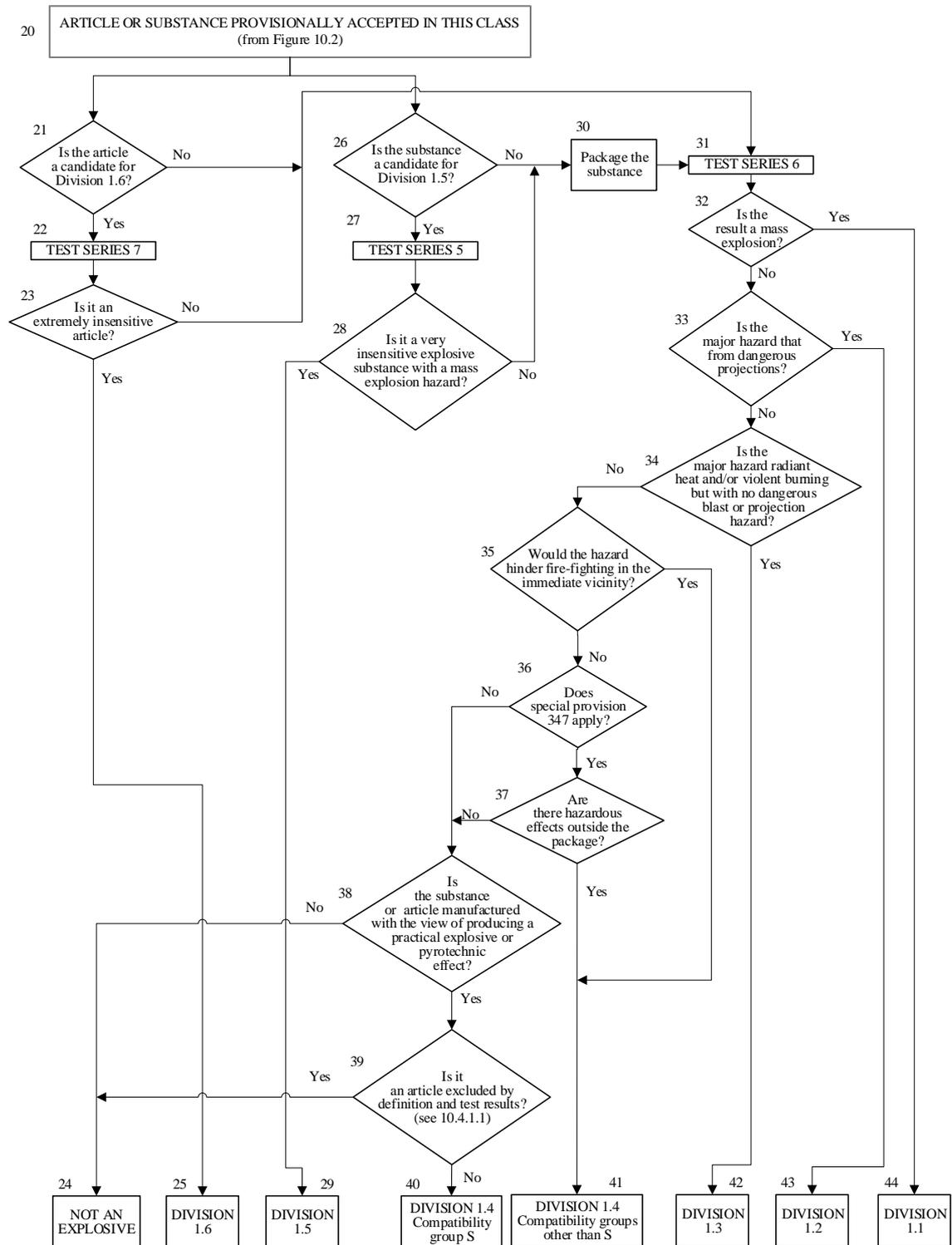
Amend the last sentence to read as follows:

“As indicated in box 39 of Figure 10.3, there is authority to exclude an article from the class of explosives by virtue of test results and the “explosives” definition (see paragraphs 2.1.1.1 (b) of the Model Regulations and 2.1.1.2 (b) of the GHS). Specific criteria by which articles may be excluded from the class of explosives may be found in paragraph 2.1.3.6.4 of the Model Regulations.”

10.4.2.1 In the first sentence replace “- numbered 5 to 7 -” by “(Test Series 5 to 7)”. In the last sentence, replace “national authority” with “classifier”.

10.4.2.2 Replace “(box 21, Figure 10.3)” with “(box 28, Figure 10.3)”.

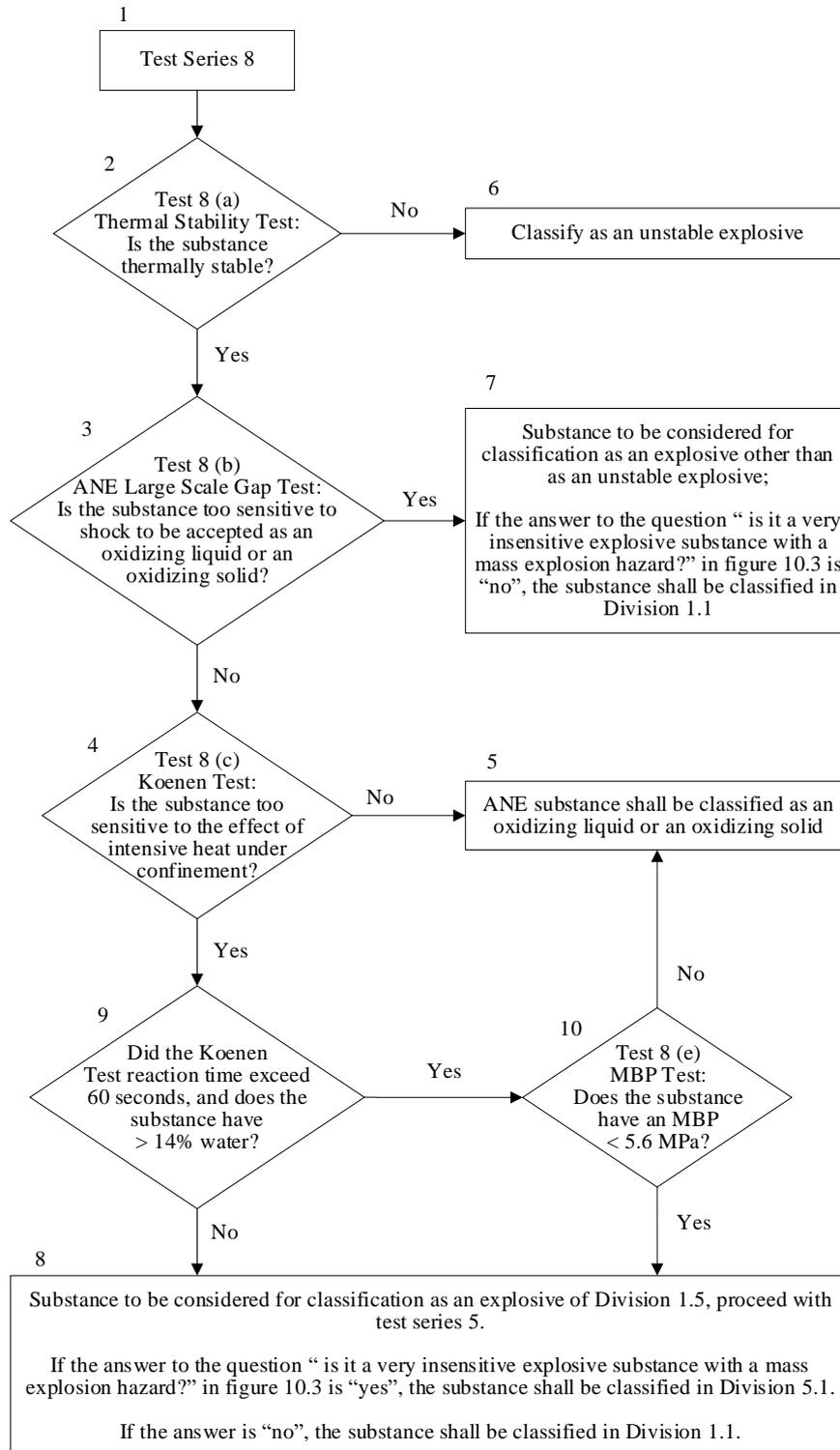
Figure 10.3 Replace the figure and its heading with the following:

**“Figure 10.3: Procedure for assignment to a division of the class of explosives**

”

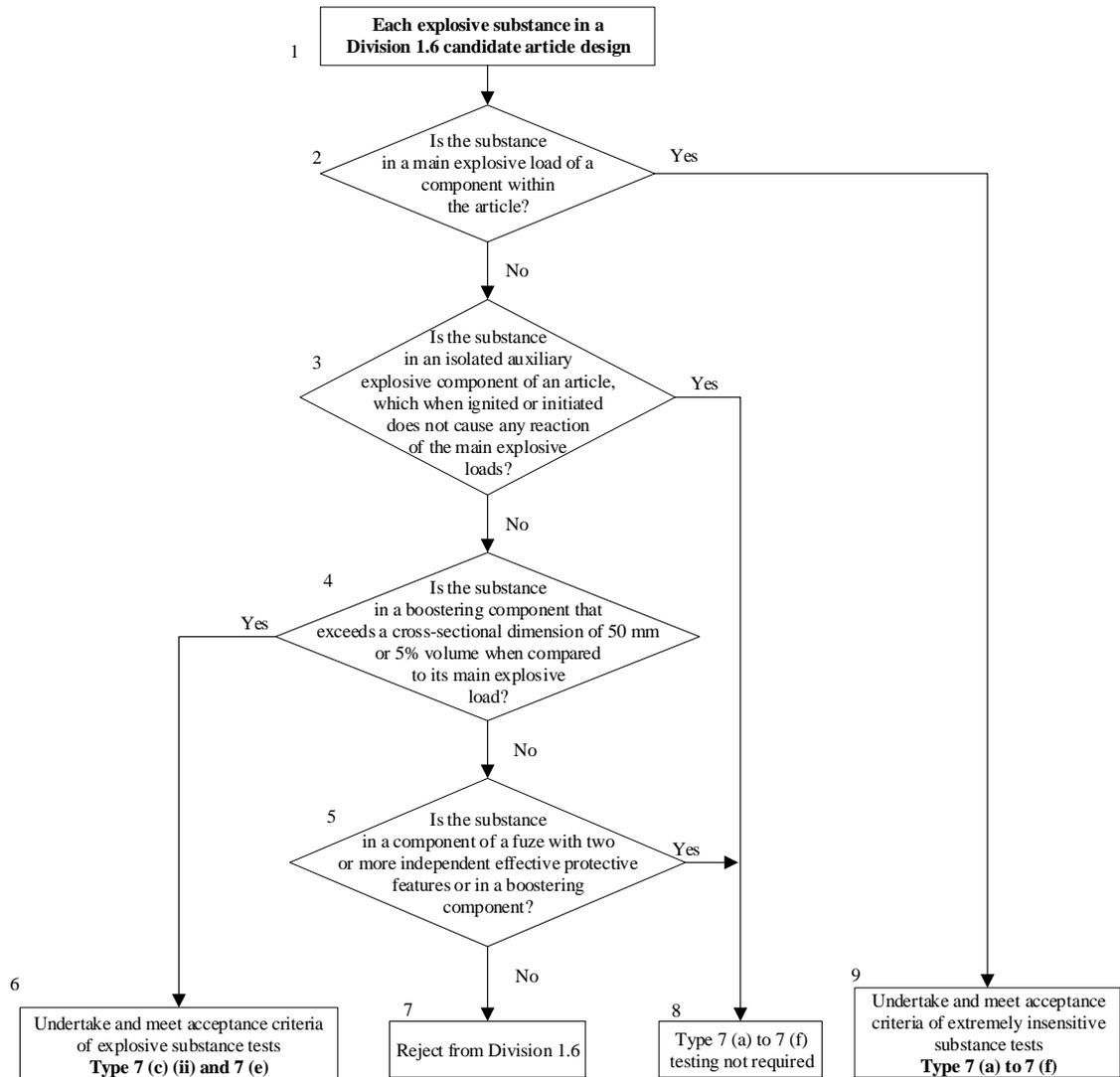
Figure 10.4 Replace current figure 10.4 with the following:

**“Figure 10.4: Procedure for ammonium nitrate emulsion, suspension or gel, intermediate for blasting explosives**



”

Figure 10.5 Replace the current figure with the following:



”

10.4.2.3 In the first sentence, insert “, as appropriate,” after “series 6 tests”. Replace “behaviour of a product if a load is involved” with “behaviour of the explosive if it is involved” and amend the text between parenthesis to read: “(boxes 32, 33, 34, 35, 36 and 37 of Figure 10.3)”.

In the second sentence, replace “a product” by “a substance or article in the transport configuration” and “should be excluded from Class 1 (boxes 35 and 36 of Figure 10.3)” by “can be excluded from the class of explosives (boxes 38 and 39 of Figure 10.3)”.

10.4.2.4 In the first sentence, delete “explosive” after “extremely insensitive”. Replace “(box 40, Figure 10.3)” with “(box 23, Figure 10.3)” and, after “any candidate for Division 1.6”, replace “should pass one of each” with “shall pass one of each”.

For Type 7 (g), replace “as presented for transport” with “as presented for classification;” and delete the words: “which is in the condition”.

10.4.2.5 In the first sentence, replace “Is the substance a candidate” by “Is it a candidate”. Replace “emulsion or suspension” with “emulsion, suspension”. Replace “(box 2 (a), Figure 10.2)” with “(box 3, Figure 10.2)”.

In Type 8 (c), add “and” after the semicolon.

Add a new entry at the end of the list to read as follows: “Type 8 (e): a test to determine the effect of intense localised thermal ignition under high confinement.”.

Amend the end of the last sentence to read as follows: “...of ANEs for containment in portable tanks as oxidizing substances.”.

10.4.3.3 In the second sentence, replace “most disadvantageous” with “most severe”. In the third sentence replace “are to be carried” with “are classified”.

In (a), replace “by the competent authority” with “, where appropriate by the competent authority,”.

10.4.3.4 In (a), replace “articles are carried” by “articles are classified” and “in the package (see also section 10.4.3.4.(d))” by “in the package (see also sub-paragraph 10.4.3.4 (d) below)”.

In (b), amend the end of the first sentence to read “...each type of 6 (a) test (see also sub-paragraph 10.4.3.4 (d) below)”.

In (b) (i) replace “detonation and/or ignition” with “initiation”.

10.4.3.6 Replace “should be used to establish that the explosive” by “are used to establish whether an explosive”. After “extremely insensitive” delete “detonating”. Replace “used to establish that the articles containing EIS(s)” by “are used to establish whether the articles predominantly containing EIS(s)”.

10.4.3.7 In the first sentence, replace “should be performed” with “are performed”.

In the second sentence replace “for transport” with “for classification” and “the competent authority” with “the classifier”.

Amend (a) to read as follows: “Complex articles may contain multiple substances and test types 7 (a) to (f) shall be completed for all main explosive load and boosting component substances, as appropriate, within the article to be classified in Division 1.6.”.

In (b), delete the comma after “boosting” and replace “Box 3” with “Box 9” and “Box 24” with “Box 21”.

In (c), replace “Box 4” with “Box 3”.

In (d), replace “Box 6” with “Box 4”, “Box 7” with “Box 6” and “Box 24” with “Box 21”.

In (e), replace “Box 8” with “Box 5” and “Box 24” with “Box 21”.

10.4.3.8 Amend the end of the first sentence to read as follows: “may be accepted as an oxidizing solid or liquid.”.

In the second sentence, replace “Class 1” with “the class of explosives”.

10.4.3.9 Delete the paragraph.

10.5.1 Replace “the Class 1” with “the class of explosives” and amend the end of the paragraph to read as follows: “assignment procedures to hexanitrostilbene (UN 0392) and musk xylene (UN 2956), are given in figures 10.6 (a) to (d) and 10.7 (a) to (d)”.

10.5.2 Replace “Figure 10.10” with “Figure 10.8”.

Figure 10.6 Insert the following new Figures 10.6 (a) to 10.6 (d):

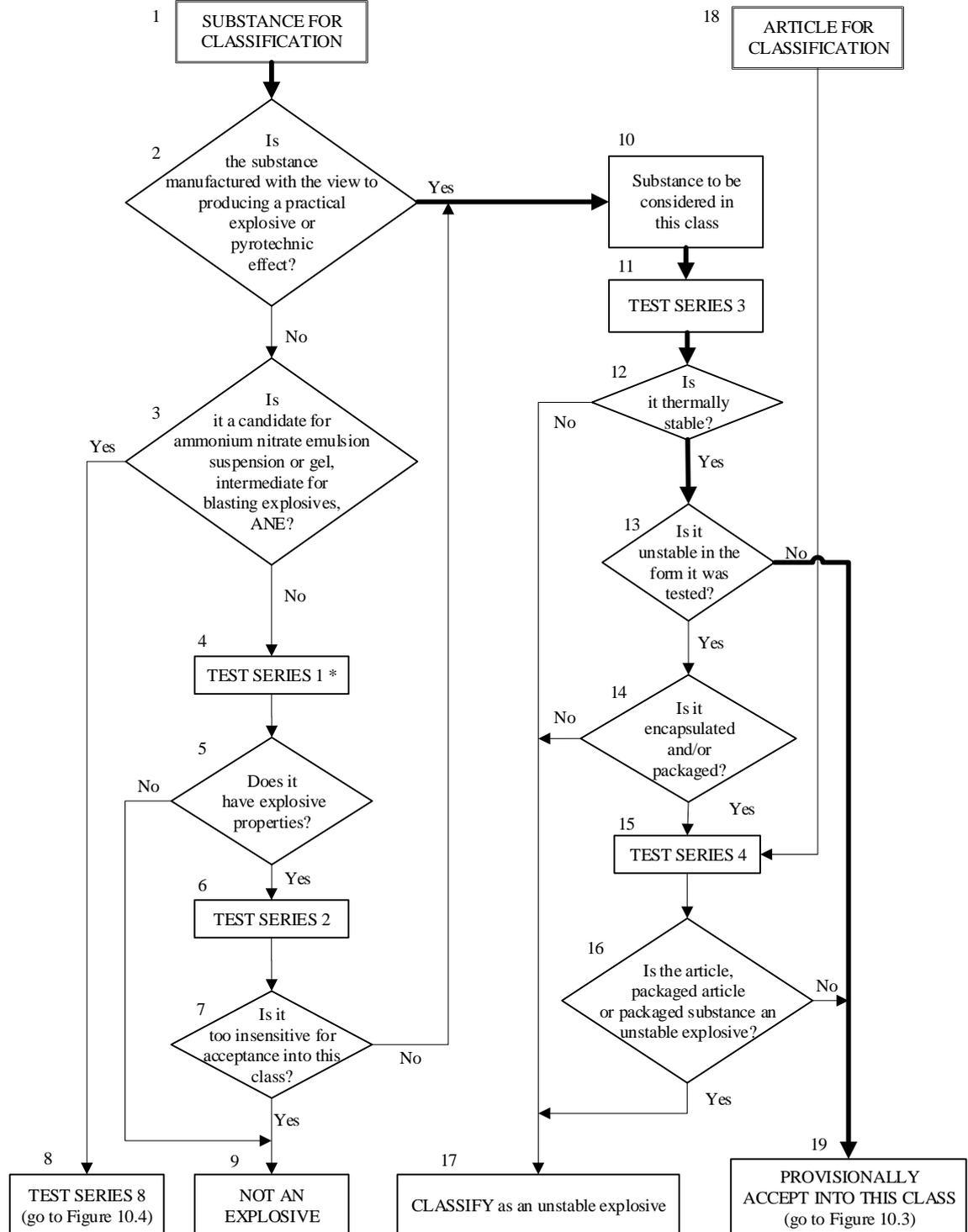
**“Figure 10.6 (a): Results from the application of the provisional acceptance procedure in the class of explosives (Figure 10.2) to hexanitrostilbene**

<b>1.</b>	<b>Name of substance:</b>	Hexanitrostilbene
<b>2.</b>	<b>General data</b>	
2.1	Composition:	Hexanitrostilbene
2.2	Molecular formula:	C <sub>14</sub> H <sub>6</sub> N <sub>6</sub> O <sub>12</sub>
2.3	Physical form:	Powder
2.4	Colour:	Yellow orange
2.5	Apparent density:	1700 kg/m <sup>3</sup>
2.6	Particle size:	0.1 – 0.3 mm
<b>3.</b>	<b>Box 2:</b>	Is the substance manufactured with the view to producing a practical explosive or pyrotechnic effect?
3.1	Answer:	Yes
3.2	Exit	Go to Box 10
<b>4.</b>	<b>Box 10:</b>	Substance to be considered in this class
<b>5.</b>	<b>Box 11:</b>	Test Series 3
5.1	Thermal stability:	75 °C/48 hour test (test 3 (c))
5.2	Sample conditions:	100 g of substance at 75 °C
5.3	Observations:	No ignition, explosion, self-heating or visible decomposition
5.4	Result:	"-", thermally stable
5.5	Impact sensitivity:	BAM fallhammer test (test 3 (a) (ii))
5.6	Sample conditions:	As received
5.7	Observations:	Limiting impact energy 5 J
5.8	Result:	"-", not unstable in the form it was tested
5.9	Friction sensitivity:	BAM friction test (test 3 (b) (i))
5.10	Sample conditions:	As received
5.11	Observations:	Limiting load > 240 N
5.12	Result:	"-", not unstable in the form it was tested
5.13	Ease of deflagration to detonation transition:	Small scale burning test (test 3 (d))
5.14	Sample conditions:	Ambient temperature
5.15	Observations:	Ignites and burns
5.16	Result:	"-", not unstable in the form it was tested
5.17	Exit:	Go to box 12

**“Figure 10.6 (a): Results from the application of the provisional acceptance procedure in the class of explosives (Figure 10.2) to hexanitrostilbene**

- |           |                            |   |
|-----------|----------------------------|---|
| <b>6.</b> | <b>Box 12:</b>             | Is it thermally stable?   |
| 6.1       | Answer from test 3(c):     | Yes   |
| 6.2       | Exit:                      | Go to box 13  |
| <b>7.</b> | <b>Box 13:</b>             | Is it unstable in the form it was tested?                               |
| 7.1       | Answer from Test Series 3: | No  |
| 7.2       | Exit:                      | Go to box 19  |
| <b>8.</b> | <b>Conclusion:</b>         | PROVISIONALLY ACCEPT INTO THIS CLASS                                    |
| 8.1       | Exit:                      | Apply procedure for assignment to a division of the class of explosives |
- ”

**“Figure 10.6 (b): Flow chart for the provisional acceptance of hexanitrostilbene in the class of explosives**



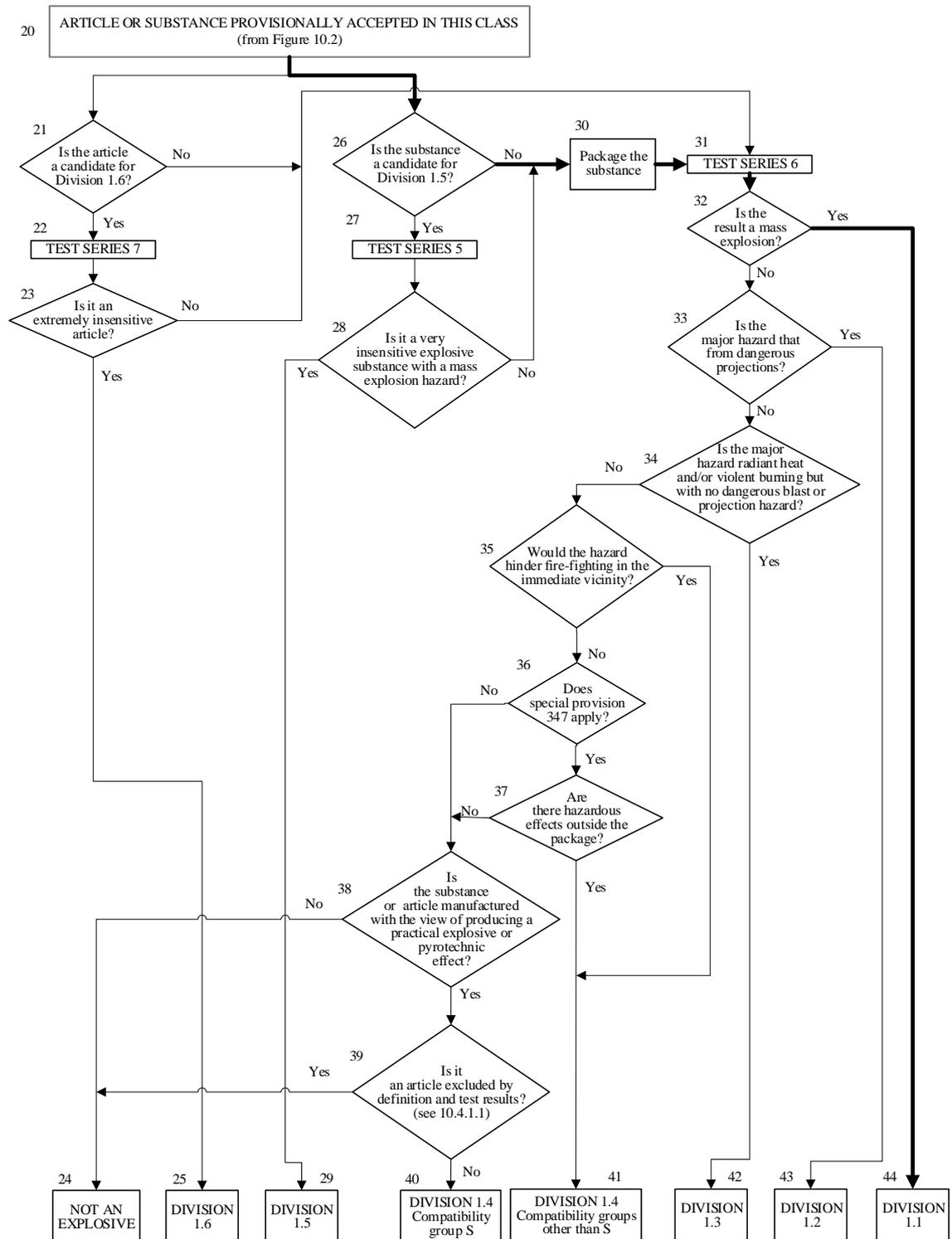
”

**“Figure 10.6 (c): Results from application of the procedure for assignment to a division of the class of explosives (Figure 10.3) to hexanitrostilbene**

<b>1.Box 26:</b>	Is the substance a candidate for Division 1.5?
1.1 Answer:	No
1.2 Result:	Package the substance (box 30)
1.3 Exit:	Go to box 31
<b>2. Box 31:</b>	Test Series 6
2.1 Effect of initiation in the package:	Test 6 (a) with detonator
2.2 Sample conditions:	Ambient temperature, 50 kg fibreboard drum
2.3 Observations:	Detonation, crater
2.4 Result:	Mass explosion
2.5 Effect of ignition between packages:	Test 6 (b) with detonator
2.6 Sample conditions:	Ambient temperature, 3 fibreboard drums
2.7 Observations:	Detonation, crater
2.8 Result:	Mass explosion
2.9 Effect of fire engulfment:	Test 6 (c) not required
<b>3. Box 32:</b>	Is the result a mass explosion?
3.1 Answer from Test Series 6:	Yes
3.2 Exit:	Go to box 44
<b>4. Conclusion:</b>	Assign to Division 1.1

”

“Figure 10.6 (d): Flow chart for assignment to a division of the class of explosives of hexanitrostilbene



”

Figure 10.7 (a) Current Figure 10.6 becomes Figure 10.7(a), as amended to read as follows:

**“Figure 10.7 (a): Results from the application of the provisional acceptance procedure in the class of explosives (Figure 10.2) to musk xylene**

- |           |                                       |  |
|-----------|---------------------------------------|--|
| <b>1.</b> | <b>Name of substance:</b>             | 5-tert-BUTYL-2,4,6-TRINITRO-m-XYLENE (MUSK XYLENE)   |
| <b>2.</b> | <b>General data</b>                   |  |
| 2.1       | Composition:                          | 99% tert-butyl-2,4,6-trinitro-m-xylene   |
| 2.2       | Molecular formula:                    | $C_{12}H_{15}N_3O_6$   |
| 2.3       | Physical form:                        | Fine crystalline powder  |
| 2.4       | Colour:                               | Pale yellow  |
| 2.5       | Apparent density:                     | 840 kg/m <sup>3</sup>  |
| 2.6       | Particle size:                        | < 1.7 mm   |
| <b>3.</b> | <b>Box 2:</b>                         | Is the substance manufactured with the view to producing a practical explosive or pyrotechnic effect?          |
| 3.1       | Answer:                               | No   |
| 3.2       | Exit:                                 | Go to Box 3  |
| <b>4.</b> | <b>Box 3:</b>                         | Is it a candidate for ammonium nitrate emulsion, suspension or gel, intermediate for blasting explosives, ANE? |
| 4.1       | Answer:                               | No   |
| 4.2       | Exit:                                 | Go to Box 4  |
| <b>5.</b> | <b>Box 4:</b>                         | Test Series 1  |
| 5.1       | Propagation of detonation:            | UN gap test (test 1(a))  |
| 5.2       | Sample conditions:                    | Ambient temperature  |
| 5.3       | Observations:                         | Fragmentation length 40 cm   |
| 5.4       | Result:                               | "+", propagation of detonation   |
| 5.5       | Effect of heating under confinement:  | Koenen test (test 1(b))  |
| 5.6       | Sample conditions:                    | Mass 22.6 g  |
| 5.7       | Observations:                         | Limiting diameter 5.0 mm<br>Fragmentation type "F" (time to reaction 52 s, duration of reaction 27 s)          |
| 5.8       | Result:                               | "+", shows some explosive effects on heating under confinement   |
| 5.9       | Effect of ignition under confinement: | Time/pressure test (test 1 (c) (i))  |
| 5.10      | Sample conditions:                    | Ambient temperature  |
| 5.11      | Observations:                         | No ignition  |
| 5.12      | Result:                               | "-", no effect on ignition under confinement   |
| 5.13      | Exit:                                 | Go to Box 5  |
| <b>6.</b> | <b>Box 5:</b>                         | Does it have explosive properties?   |

**“Figure 10.7 (a): Results from the application of the provisional acceptance procedure in the class of explosives (Figure 10.2) to musk xylene**

6.1	Answer from Test Series 1:	Yes
6.2	Exit:	Go to box 6
<b>7.</b>	<b>Box 6:</b>	Test Series 2
7.1	Sensitivity to shock:	UN gap test (test 2(a))
7.2	Sample conditions:	Ambient temperature
7.3	Observations:	No propagation
7.4	Result:	"-", not sensitive to shock
7.5	Effect of heating under confinement:	Koenen test (test 2(b))
7.6	Sample conditions:	Mass 22.6 g
7.7	Observations:	Limiting diameter 5.0 mm Fragmentation type "F" (time to reaction 52 s, duration of reaction 27 s)
7.8	Result:	"+", violent effect on heating under confinement
7.9	Effect of ignition under Confinement:	Time/pressure test (test 2 (c) (i))
7.10	Sample conditions:	Ambient temperature
7.11	Observations:	No ignition
7.12	Result:	"-", no effect on ignition under confinement
7.13	Exit:	Go to Box 7
<b>8.</b>	<b>Box 7:</b>	Is it too insensitive for acceptance into this class?
8.1	Answer from Test Series 2:	No
8.2	Conclusion:	Substance to be considered in this class (box 10)
8.3	Exit:	Go to Box 11
<b>9.</b>	<b>Box 11:</b>	Test Series 3
9.1	Thermal stability:	75 °C/48 hour test (test 3 (c))
9.2	Sample conditions:	100 g of substance at 75 °C
9.3	Observations:	No ignition, explosion, self-heating or visible decomposition
9.4	Result:	"-", thermally stable
9.5	Impact sensitivity:	BAM fallhammer test (test 3 (a) (ii))
9.6	Sample conditions:	as received
9.7	Observations:	Limiting impact energy 25 J
9.8	Result:	"-", not unstable in the form it was tested
9.9	Friction sensitivity:	BAM friction test (test 3 (b) (i))
9.10	Sample conditions:	as received
9.11	Observations:	Limiting load > 360 N

**“Figure 10.7 (a): Results from the application of the provisional acceptance procedure in the class of explosives (Figure 10.2) to musk xylene**

9.12	Result:	"-", not unstable in the form it was tested
9.13	Ease of deflagration to detonation transition:	Small scale burning test (test 3 (d))
9.14	Sample conditions:	Ambient temperature
9.15	Observations:	Ignites and burns slowly
9.16	Result:	"-", not unstable in the form it was tested
9.17	Exit:	Go to box 12
<b>10.</b>	<b>Box 12:</b>	Is it thermally stable?
10.1	Answer from test 3(c):	Yes
10.2	Exit:	Go to box 13
<b>11.</b>	<b>Box 13:</b>	Is it unstable in the form it was tested?
11.1	Answer from Test Series 3:	No
11.2	Exit:	Go to box 19
<b>12.</b>	<b>Conclusion:</b>	PROVISIONALLY ACCEPT INTO THIS CLASS
12.1	Exit:	Apply procedure for assignment to a division of the class of explosives

”

Figure 10.7 (b) Renumber current Figure 10.7 as 10.7 (b) as amended to read as follows:

**“Figure 10.7 (b): Flow chart for the provisional acceptance of musk xylene in the class of explosives**

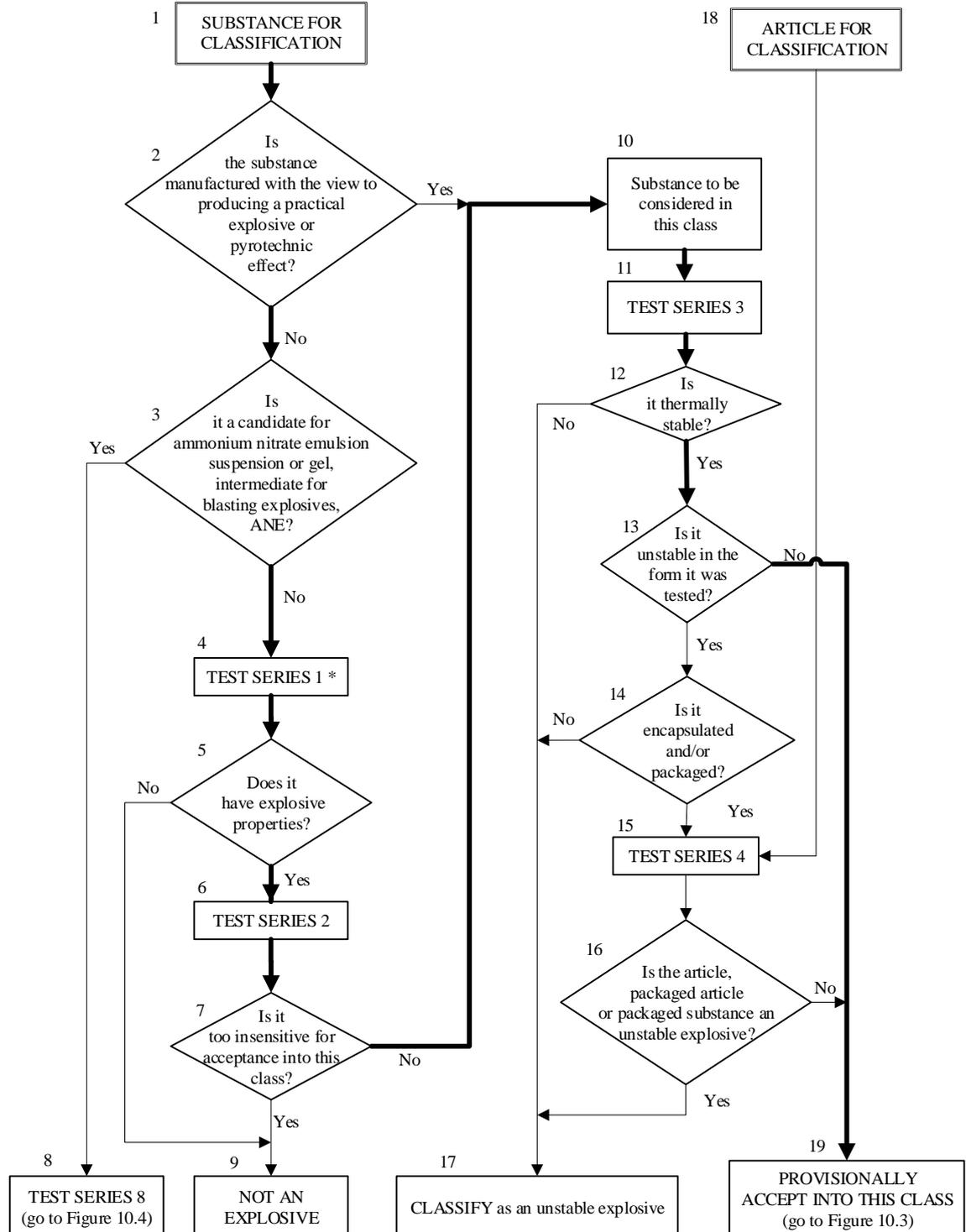


Figure 10.7 (c) Renumber current figure 10.8 as 10.7(c) and amend to read follows:

**“Figure 10.7 (c): Results from the application of the procedure for assignment to a division of the class of explosives (Figure 10.3) of musk xylene**

- |  |  |
|--|--|
| <b>1. Box 26:</b>                        | Is the substance a candidate for Division 1.5?   |
| 1.1 Answer:                              | No   |
| 1.2 Result:                              | Package the substance (box 30)   |
| 1.3 Exit:                                | Go to box 31   |
| <b>2. Box 31:</b>                        | Test Series 6  |
| 2.1 Effect of initiation in the package: | Test 6 (a) with detonator  |
| 2.2 Sample conditions:                   | Ambient temperature, 50 kg fibreboard drum   |
| 2.3 Observations:                        | Only localised decomposition around detonator  |
| 2.4 Result:                              | No significant reaction  |
| 2.5 Effect on ignition in the package:   | Test 6 (a) with igniter  |
| 2.6 Sample conditions:                   | Ambient temperature, 50 Kg fibreboard drum   |
| 2.7 Observations:                        | Only localised decomposition around igniter  |
| 2.8 Result:                              | No significant reaction  |
| 2.9 Effect of propagation:               | Type 6 (b) test not required as no effect outside package between packages in 6 (a) test |
| 2.10 Effect of fire engulfment:          | Test 6 (c)   |
| 2.11 Sample conditions:                  | 3 × 50 kg fibreboard drums mounted on steel frame above wooden crib fire                 |
| 2.12 Observations:                       | Only show burning with black smoke occurred  |
| 2.13 Result:                             | No effects which would hinder fire fighting  |
| 2.14 Exit:                               | Go to box 32   |
| <b>3. Box 32:</b>                        | Is the result a mass explosion?  |
| 3.1 Answer from Test Series 6:           | No   |
| 3.2 Exit:                                | Go to box 33   |
| <b>4. Box 33:</b>                        | Is the major hazard that from dangerous projections?                                     |
| 4.1 Answer from Test Series 6:           | No   |
| 4.2 Exit:                                | Go to box 34   |

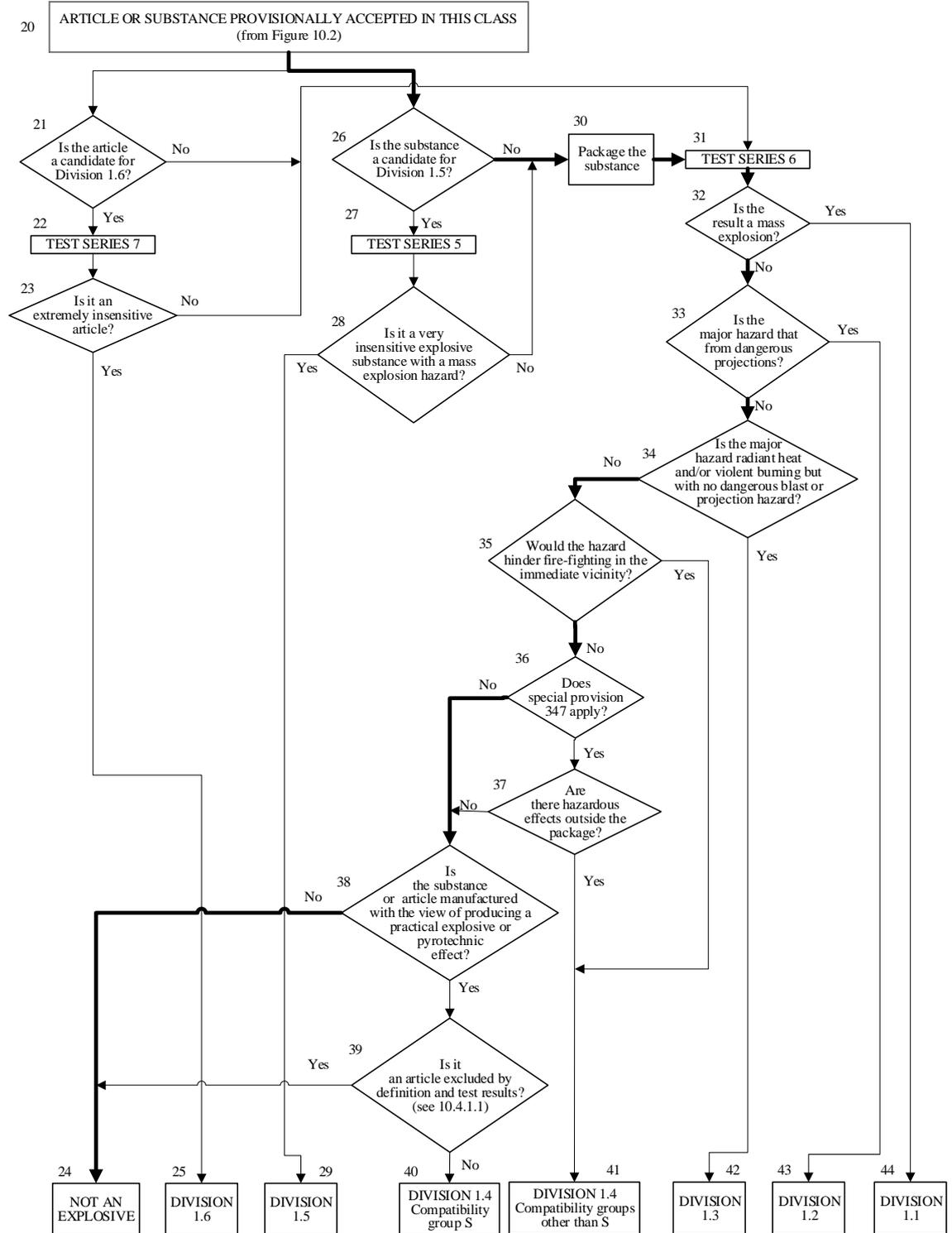
**“Figure 10.7 (c): Results from the application of the procedure for assignment to a division of the class of explosives (Figure 10.3) of musk xylene**

- 5. Box 34:** Is the major hazard radiant heat and/or violent burning but with no dangerous blast or projection hazard?
- 5.1 Answer from Tests Series 6: No  
5.2 Exit: Go to box 35
- 6. Box 35:** Would the hazard hinder fire-fighting in the immediate vicinity?
- 6.1 Answer from Test Series 6: No  
6.2 Exit: Go to box 36
- 7. Box 36:** Does special provision 347 apply?
- 7.1 Answer: No  
7.2 Exit: Go to box 38
- 8. Box 38:** Is the substance or article manufactured with the view of producing a practical explosive or pyrotechnic effect?
- 8.1 Answer: No  
8.2 Exit: Go to box 24
- 9. Conclusion:** NOT AN EXPLOSIVE  
9.1 Exit: Consider for another class/division

”

Figure 10.7 (d) Renumber current Figure 10.9 as 10.7(d), and amend to read as follows:

**“Figure 10.7 (d): Procedure for exemption of musk xylene from the class of explosives**



”

Figure 10.8            Current Figure 10.10 becomes Figure 10.8.

## Section 11

11.5.1.2.2    In the fourth sentence, delete “dibutyl phthalate or”.

## Section 12

12.5.1.2.2    In the fourth sentence, delete “dibutyl phthalate or”.

## Section 16

16.5.1.4 (c)    Replace “gave a "+" result” by “gave evidence of a mass explosion”.

## Section 18

18.1            Amend the end of the first paragraph to read as follows” by “comprising the series 8 (a), 8 (b), and 8 (c), or if the substance failed the 8(c) and had a time to reaction in 8 (c) longer than 60 seconds and a water content greater than 14%, the series 8 (a), 8 (b), and 8 (e). The test types are:”.

In the list, after the item for “Type 8 (c)” add the following item:

“Type 8 (e): a test to determine the effect of pressure on combustion.”

Table 18.1    Add a new entry as follows:

8 (e)	CanmetCERL Minimum Burning Pressure (MBP) test <sup>a</sup>	18.8
-------	---	------

18.6.1.2.2    In the fourth sentence, delete “dibutyl phthalate or”.

18.6.1.4        Amend to read as follows:

“The result is considered “+” if three negative (-) results cannot be achieved within a maximum of five tests. In such a case, the ANE candidate may either be assigned to the class of explosives or, if the time to reaction exceeds 60 seconds and the substance has greater than 14% water, it can be subjected to Test 8 (e) (as described in 18.8) to determine whether it may be classified in Division 5.1.”

New 18.8        Add a new section 18.8 as follows:

“18.8            **Series 8 Type (e) test prescription**

**18.8.1        *Test 8(e): CanmetCERL minimum burning pressure (MBP) Test***

18.8.1.1        *Introduction*

This test is used to determine the sensitiveness of a candidate ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosive, to the effect of intense localised thermal ignition under high confinement. This test can be performed in case of a positive (“+”) result in Test 8(c) when the time to reaction in this test has exceeded 60 seconds and the substance has a water content greater than 14%.

18.8.1.2        *Apparatus and materials*

18.8.1.2.1 The samples should be loaded in small cylindrical steel pipes (so-called test cells) having a nominal length of 7.6 cm and an internal diameter of at least 1.6 cm. Each test cell should have a 3-mm wide slit machined along the axis to allow combustion gases to escape during the tests (Figure 18.8.1). The interior of each test cell should be painted with high-temperature non-conductive paint. Introduction of the sample into the cell should be done with caution to avoid causing crystallization of the sample and introducing air voids in the sample. Once the ignition wire has been introduced in the sample (see 18.8.1.2.2), the ends of the cell are closed off with No. 0 neoprene, or similar, stoppers which must be reamed at their inside face to accommodate the splice connectors of the ignition wire assembly.

18.8.1.2.2 Ignition is provided by a Ni/Cr wire having a nominal diameter of 0.51 mm (nominal resistance of  $5.5 \Omega \text{ m}^{-1}$  at  $20^\circ\text{C}$ ) and a length of 7 cm. Both ends of the ignition wire should be spliced onto 50 cm lengths of 14 AWG (American Wire Gage) (1.628 mm) or larger solid core bare copper wire using appropriate butt-end splice connectors. The ignition wire should be introduced in the sample, along the axis of the test cell. The stoppers are then inserted in place.

18.8.1.2.3 The above test cell should be introduced in a pressure vessel so that the axis of the cell is held horizontal with the slit on top (Figure 18.8.2). A minimum volume of 4 litres and an operating pressure resistance of 20.8 MPa (or 3000 psig) are recommended for this pressure vessel. The vessel must be equipped with two insulated rigid feedthrough electrodes capable of carrying an electric current up to 20 A and sealed so as to have a pressure rating equivalent to that of the vessel itself. The vessel should also be equipped with an inlet and an outlet. The inlet should be used to pressurize the vessel to a predetermined initial pressure before the test. For convenience, it is recommended that the vessel also be equipped with a 0-25 MPa pressure transducer.

18.8.1.2.4 A gas manifold capable of pressurizing the pressure vessel to a chosen initial pressure using cylinders of argon. For convenience, this manifold should be equipped with a needle valve that can be used as a bleed valve to adjust the initial pressure in the vessel.

18.8.1.2.5 A power supply capable of delivering a constant current up to 20 A. The current can be monitored by measuring the voltage across a shunt resistor (few  $\text{m}\Omega$ ) connected in series with the ignition wire.

18.8.1.2.6 An oscilloscope or PC-based data acquisition system capable of acquiring the pressure transducer signal and the ignition wire current. Minimum acquisition rate should be 100 Hz for time periods up to 5 minutes.

18.8.1.2.7 A multi-meter capable of measuring electrical resistance in the range  $0.1 \Omega$  to  $10 \text{ M}\Omega$ .

### 18.8.1.3 *Procedure*

18.8.1.3.1 A test cell prepared as in 18.8.1.2.1 and 18.8.1.2.2 is introduced in the pressure vessel with its axis being horizontal. The bare copper wires from the cell are connected to the vessel's electrodes inside the vessel and the vessel is closed.

18.8.1.3.2 Using the multi-meter (see 18.8.1.2.7) the operator should check that there is no electrical contact between each electrode and the body of the pressure vessel.

18.8.1.3.3 The vessel outlet is closed while the vessel inlet is opened. The vessel is then pressurized approximately to the required initial pressure for the test. If this is the first test with a given substance, this pressure should be an educated guess as the expected MBP, based on the formulation of the sample. The inlet is then closed and the vessel is left pressurized for several minutes in order to check that the system has no leak. Once this is established, the pressure is adjusted to the required initial value and the vessel inlet is closed.

18.8.1.3.4 The data acquisition (or oscilloscope) is then started and a 10.5 A current or higher is allowed to flow through the ignition wire. The current should remain on until the sample ignites and melts the ignition wire or for a maximum of 100 seconds.

18.8.1.3.5 If the sample burns completely (combustion front reaching wall of the test cell; small amount of sample can be left on the stoppers), the result is deemed to be a 'go', and the pressure should be decreased for the next test. Otherwise the result is deemed to be a 'no-go' and the pressure should be increased for the next test (Figure 18.8.3). The pressure record from the transducer can also be used as evidence of sustained combustion or not (Figure 18.8.4).

18.8.1.3.6 Steps 18.8.1.3.1 to 18.8.1.3.5 are repeated while gradually decreasing the magnitude of the pressure increments (or decrements) until the MBP has been determined to the desired degree of precision (see typical examples below). A minimum of 12 tests using this 'up-and-down' methodology should be performed. The MBP should be quoted as the mean between the initial pressure of the highest 'no-go' event and that of the lowest 'go' event.

#### 18.8.1.4 *Test criteria and method of assessing results*

18.8.1.4.1 The result is considered positive ("+") and the substance should not be classified in Division 5.1 if the MBP is less than 5.6 MPa (800 psig).

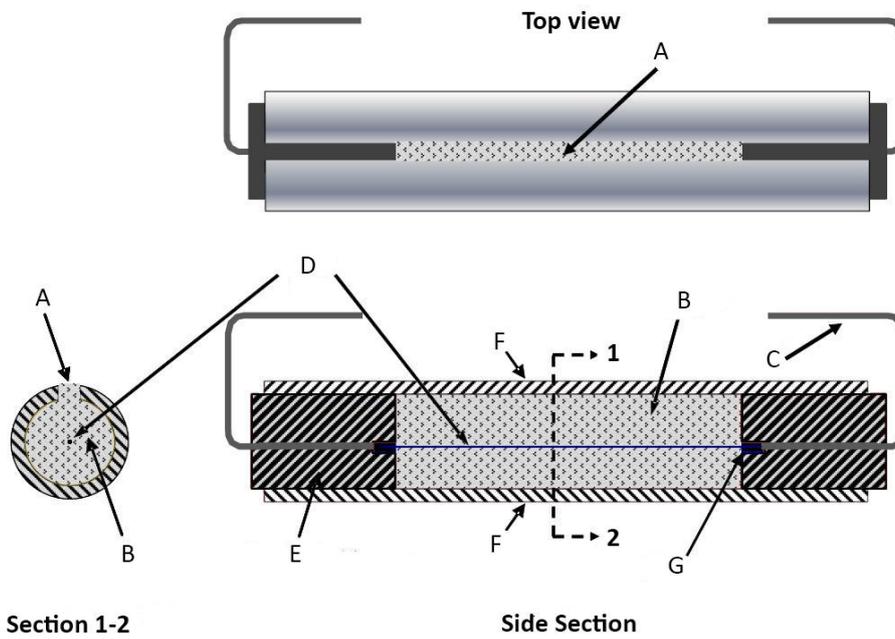
#### 18.8.1.5 *Examples of results*

	<b>Substances</b>	<b>MBP/MPa (psig)*</b>	<b>Result</b>
1.	72.5 ammonium nitrate/6.1 sodium perchlorate/8.1 water/5.3 oil+wax/5.0 aluminum/3.0 glass $\mu$ S**	0.93 (120)	+
2.	69.4 ammonium nitrate/5.7 sodium nitrate/6.4 sodium perchlorate/7.8 water/5.5 oil+wax/5.0 Aluminum/0.2plastic $\mu$ S**	1.58 (215)	+
3.	72.1 ammonium nitrate/11.2 sodium nitrate/11.2 water/5.5 oil+wax	3.03 (425)	+
4.	69.3 ammonium nitrate/10.5 sodium nitrate/14.7 water/5.5 oil+wax	4.17 (590)	+
5.	83.0 ammonium nitrate/11.7 water/5.3 oil+wax	4.48 (635)	+
6.	66.9 ammonium nitrate/10.4 sodium nitrate/17.2 water/5.5 oil+wax	5.72 (815)	-
7.	79.9 ammonium nitrate/14.6 water/5.5 oil+wax	6.82 (975)	-
8.	77.2 ammonium nitrate/17.4 water/5.4 oil+wax	8.18 (1170)	-
9.	69.8 ammonium nitrate/24.8 water/5.4 oil+wax	14.24 (2050)	-

\* The pressure in MPa units is absolute while the parenthetical pressure in psi units is gauge.

\*\*  $\mu$ S refers to micro-spheres

Figure 18.8.1: Test cell for CanmetCERL MBP test



(A) Slit	(D) Ni/Cr wire	(G) Splice
(B) Explosive	(E) Rubber plug	
(C) Copper conductor	(F) Steel pipe	

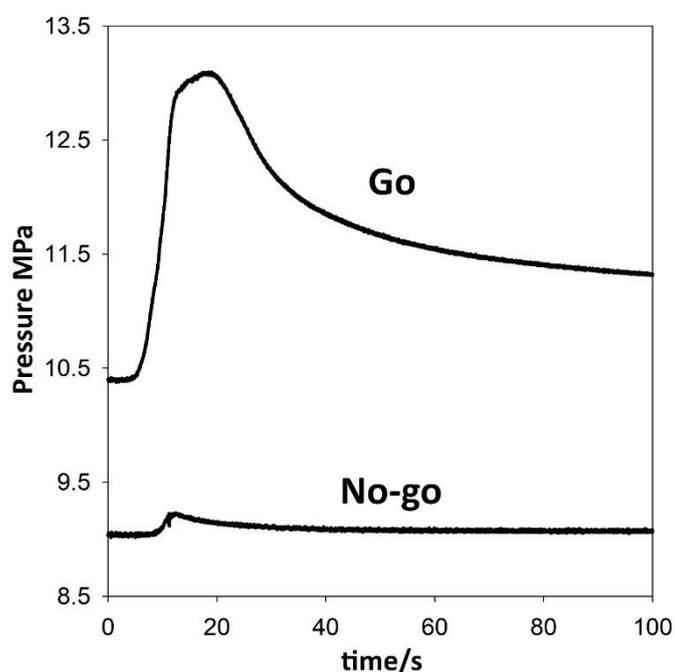
Figure 18.8.2: Test cell mounted horizontally under the cover of the pressure vessel (copper conductors connected to vessel's fixed electrodes)



Figure 18.8.3: Typical aspect of the test cell after a ‘go’ (left) and ‘no-go’ (right) event



Figure 18.8.4: Typical pressure records for ‘Go’ and ‘No-go’ events



”

## Part II

Title Replace “SELF-REACTIVE SUBSTANCES OF DIVISIONS 4.1 AND ORGANIC PEROXIDES OF DIVISION 5.2” with “SELF-REACTIVE SUBSTANCES, ORGANIC PEROXIDES AND POLYMERIZING SUBSTANCES”.

Table of contents Amend the entries hereafter as follows:

New 20.4.4 Insert a new entry as follows: “20.4.4 Classification of polymerizing substances for transport”.

20.4.4 Renumber “20.4.4” to “20.4.5”.

20.4.5 Renumber “20.4.5” to “20.4.6”.

- 21.4.2 Delete this entry.
- 21.4.3 Renumber “21.4.3” to “21.4.2”.
- 21.4.4 Renumber “21.4.4” to “21.4.3”.
- 26.4.5 Delete this entry.

## Section 20

20.1.1 In the first sentence, replace “of Division 4.1 and” by a comma and replace “of Division 5.2 (see respectively sub-section 2.4.2.3 and section 2.5.3 of the Model Regulations)” by “and the determination of the self-accelerating polymerization temperature (SAPT) for polymerizing substances”.

Amend the second sentence to read as follows: “For self-reactive substances and organic peroxides it includes a description of the procedures, test methods and criteria considered to be the most suitable to arrive at a proper classification of these substances.”.

In the third sentence, delete “(Division 4.1)”, replace “(Division 5.2) and” by a comma and replace “(see also 2.4.2.3.3 and 2.5.3.3 in the Model Regulations)” by “of this Manual, sub-sections 2.4.2.3 and 2.5.3 of the Model Regulations and Chapters 2.8 and 2.15 of the GHS”.

20.1.2 Amend the end of the first sentence to read: “... according to their hazards.”

Amend the last sentence to read: “The classification tests should be performed in the second stage.”

20.2.1 In the first sentence, delete the words “offered for transport”.

In (a), replace “according to the criteria of Class 1” by “(see Part I)”.

In (b), delete “according to the classification procedure for Division 5.1” and replace “defined” by “described”.

In the note to (b):

- First sentence: delete “meeting the criteria of Division 5.1” and “above”.
- Second sentence: at the end add “For GHS purposes type G should be considered in this respect as well.”.
- Third sentence: replace “a substance of Division 5.1” by “an oxidizing substance”.

In (c), replace “according to the criteria of Division 5.2” by “(see 20.2.2)”.

In (e), at the end, replace the full stop (.) by “; or”

Insert a new indent (f), reading “They are polymerizing substances according to 2.4.2.5 of the Model Regulations.”.

20.2.2 Delete “offered for transport” and “classification” in the first sentence.

20.2.3 In the first sentence delete “, in the opinion of the competent authority,”

In (a), replace “paragraph 2.4.2.3.1.1 of the Model Regulations” by “20.2.1”.

In (c), replace “paragraph 2.5.1 of the Model Regulations” by “20.2.2”

20.2.4 In the first sentence, insert “in the dangerous goods list of Chapter 3.2 of the Model Regulations” after “entry”.

20.2.5 Delete and renumber current 20.2.6 to 20.2.5.

20.2.5 (new, former 20.2.6) In the first sentence amend “(except Type G) should” to read “(Type A to Type G) should” and replace the rest of the sentence with “not be tested in the self-heating test N.4, as the test result will give a false positive result (i.e. temperature increase due to thermal decomposition rather than oxidative self-heating).”.

20.2.6 Insert a new paragraph 20.2.6 reading:

“20.2.6 Substances capable of polymerization should be subjected to the classification procedures for polymerizing substances in Chapter 2.4, section 2.4.2.5 of the Model Regulations, unless:

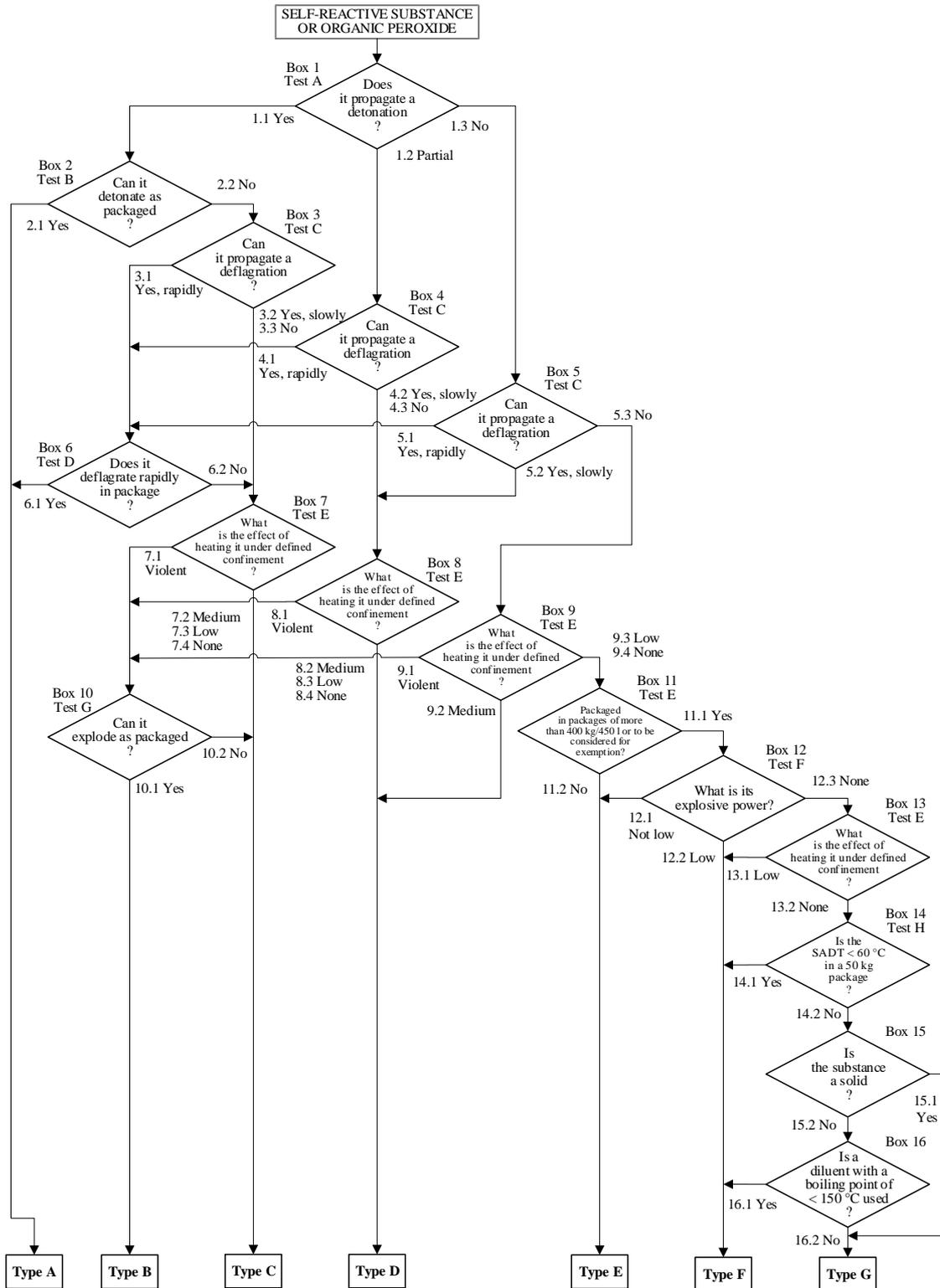
- (a) Their self-accelerating polymerization temperature (SAPT) is greater than 75 °C under the conditions (with or without chemical stabilization as offered for transport) and in the packaging, IBC or portable tank in which the substance or mixture is to be transported; or
- (b) They exhibit a heat of reaction of less than or equal to 300 J/g; or
- (c) They meet any other criteria for inclusion in transport classes 1 to 8.

A mixture meeting the criteria of a polymerizing substance shall be classified as a polymerizing substance of Division 4.1 for transport.

**NOTE:** *If a polymerizing substance meets the criteria for inclusion in transport classes 1 to 8, the SAPT shall be evaluated (e.g., calculated or measured) to determine if temperature control is needed (see paragraph 2.4.2.5.2 of the Model Regulations).*”

20.3.3.2 Replace “Class 1” by “for the class of explosives”.

Figure 20.1 (a): Renumber to 20.1 and replace the figure with the following:



Add the following note to new figure 20.1:

**“NOTE: For transport:**

- Type A: *not accepted for transport in that packaging;*
- Type B: *accepted for transport in packages of not more than 25 kg net mass with an “Explosive” subsidiary hazard label;*
- Type C: *accepted for transport in packages of not more than 50 kg net mass;*
- Type D: *accepted for transport in packages of not more than 50 kg net mass;*
- Type E: *accepted for transport in packages of not more than 400 kg/450 litres;*
- Type F: *may be considered for transport in IBCs or tanks;*
- Type G: *shall be considered for exemption.”*

Figure 20.1 (b) Delete.

20.4.1.1 Delete “(see also paragraphs 2.4.2.3.3 and 2.5.3.3 of the Model Regulations)” in the first sentence. At the end of the third sentence replace “the hazard” by “their hazards”. In the fifth line delete “of Division 4.1” and “of Divisions 5.2”.

20.4.1.3 At the end of the first sentence, delete: “as used in transport (see sub-section 2.5.3.4 of the Model Regulations)”.

In (a), delete “during transport” at the end.

20.4.1.4 Insert a new paragraph 20.4.1.4 reading:

“20.4.1.4 The self-accelerating polymerization temperature (SAPT) means the lowest temperature at which self-accelerating polymerization may occur with a substance in the packaging, IBC or portable tank as offered for transport. The SAPT shall be evaluated (e.g., calculated or measured) to determine if a substance should be subjected to temperature control.”

Re-number old 20.4.1.4 to 20.4.1.5 and old 20.4.1.5 to 20.4.1.6.

20.4.1.5 (new, former 20.4.1.4): Insert a footnote “1” at the end of the sentence to read as follows:

*“<sup>1</sup> Liquid means a substance which at 50 °C has a vapour pressure of not more than 300 kPa (3 bar), which is not completely gaseous at 20 °C and at a pressure of 101.3 kPa, and which has a melting point or initial melting point of 20 °C or less at a pressure of 101.3 kPa. A viscous substance for which a specific melting point cannot be determined shall be subjected to the ASTM D 4359-90 test; or to the test for determining fluidity (penetrometer test) prescribed in section 2.3.4 of Annex A of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).”*

20.4.2 Replace the first sentence by “Self-reactive substances are classified in one of the seven categories “Types A to G” according to the following principles:<sup>2</sup>” and insert a footnote “2” to read as follows: “<sup>2</sup> For transport, these principles should be applied to the classification of self-reactive substances not listed in the Table of paragraph 2.4.2.3.2.3 of the Model Regulations.”.

Amend (a) to read as follows: “Any self-reactive substance which, as packaged, can detonate or deflagrate rapidly will be defined as self-reactive substance Type A;”.

In (b), insert “self-reactive” between “Any” and “substance” and delete “for transport”. After “that package,” replace the rest of the paragraph with “will be defined as self-reactive substance Type B;”.

Amend (c), to read as follows: “Any self-reactive substance possessing explosive properties when the substance as packaged cannot detonate or deflagrate rapidly, or undergo a thermal explosion will be defined as self-reactive substance Type C;”.

In (d), insert “self-reactive” between “Any” and “substance”. Amend the last part (after indent iii) to read: “will be defined as self-reactive substance Type D;”.

In (e), replace the text after “under confinement” by “... will be defined as self-reactive substance Type E;”.

In (f), amend the end to read “... or no explosive power will be defined as self-reactive substance Type F;”.

In (g), delete “should be exempted from classification as a self-reactive substance of Division 4.1” and replace “the formulation” by “it”. Amend the end of the paragraph to read “...50 kg package) and, for liquid mixtures, a diluent having a boiling point greater than or equal to 150 °C is used for desensitization will be defined as self-reactive substance Type G. If the mixture is not thermally stable or a diluent having a boiling point less than 150 °C is used for desensitization, the mixture shall be defined as self-reactive Type F.”.

20.4.3 Replace the first sentence by “Organic peroxides are classified in one of the seven categories “Types A to G” according to the following principles:<sup>3</sup>” and insert a footnote “3” reading: “<sup>3</sup> For transport, these principles should be applied to the classification of organic peroxides not listed in the Table of paragraph 2.5.3.2.4 of the Model Regulations.”.

At the start of indents (a) through (g) delete “formulation”.

Amend (a) to read as follows: “Any organic peroxide which, as packaged, can detonate or deflagrate rapidly will be defined as organic peroxide Type A;”.

Amend (b) to read as follows: “Any organic peroxide possessing explosive properties and which, as packaged will be defined as organic peroxide Type B;”.

Amend (c) to read as follows: “Any organic peroxide possessing explosive properties when the substance as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion will be defined as organic peroxide Type C;”.

In (d), at the start, delete “formulation. Amend the last part (after indent iii) to read: “will be defined as organic peroxide Type D;”.

Amend (e) to read as follows: ” Any organic peroxide which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement will be defined as organic peroxide Type E;”.

Amend (f) to read as follows: “Any organic peroxide which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power will be defined as organic peroxide Type F;”.

In (g), first sentence, delete “formulation”, delete “should be exempted from Division 5.2” and replace “the formulation” by “it”. Amend the end of the paragraph to read: “...50 kg package) and, for liquid mixtures, a diluent having a boiling point greater than or equal to 150 °C is used for desensitization will be defined as organic peroxide Type G. If the mixture is not thermally stable or a diluent having a boiling point less than 150 °C is used for desensitization, it shall be defined as organic peroxide Type F.”.

Insert a new paragraph 20.4.4, to read as follows:

**“20.4.4 Classification of polymerizing substances for transport**

20.4.4.1 Polymerizing substances are substances which, without stabilization, are liable to undergo a strongly exothermic reaction resulting in the formation of larger molecules or resulting in the formation of polymers under conditions normally encountered in transport. Such substances are considered to be polymerizing substances of Division 4.1 for transport when:

- (a) Their self-accelerating polymerization temperature (SAPT) is 75 °C or less under the conditions (with or without chemical stabilization as offered for transport) and in the packaging, IBC or portable tank in which the substance or mixture is to be transported; and
- (b) They exhibit a heat of reaction of more than 300 J/g; and
- (c) They do not meet any other criteria for inclusion in classes 1 to 8.

20.4.4.2 Based on their SAPT and physical state, polymerizing substances are classified for transport purposes as:

- (a) Polymerizing substance, solid, stabilized
- (b) Polymerizing substance, liquid, stabilized
- (c) Polymerizing substance, solid, stabilized, temperature controlled
- (d) Polymerizing substance, liquid, stabilized, temperature controlled”

Renumber subsequent paragraphs accordingly (i.e., to 20.4.5(x) and 20.4.6(x)).

In renumbered paragraphs 20.4.5.4, 20.4.5.6 and 20.4.5.9 delete “for transport”.

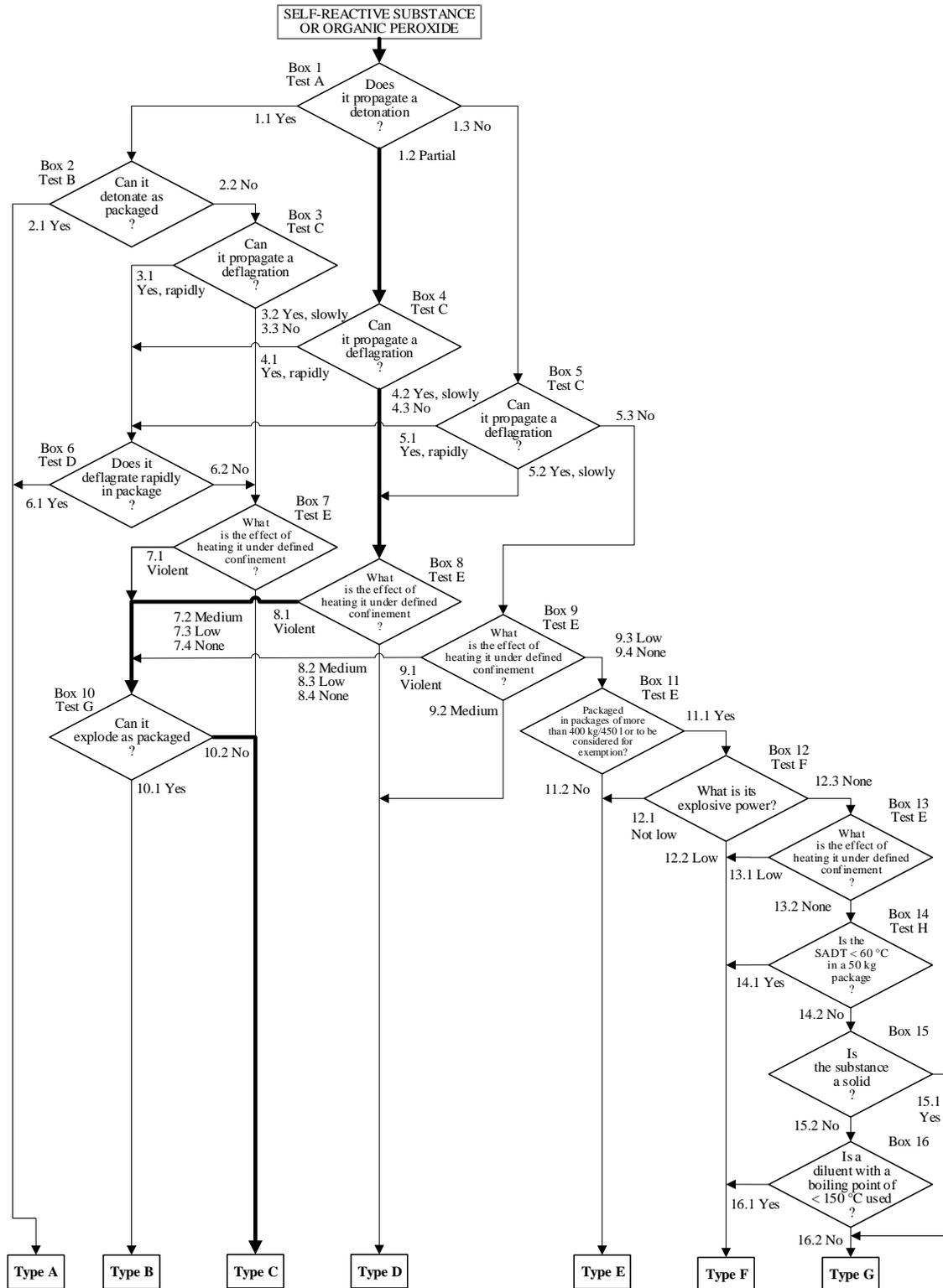
In new paragraph number 20.4.5.8 replace “transport” by “containment”.

Add to the end of renumbered paragraph 20.4.5.10 “and for the determination of the SAPT”.

20.5.2 Replace “transported” by “classified”.

Figure 20.2 Amend the question in line 3 to read “Does it propagate...”. Amend the question in line 4 to read “Can it propagate...”. In Line 6, replace “the substance” by “it” and delete “for transport”.

Replace the current figure 20.3 with the following:



## Section 21

- 21.2.1 In the second sentence, replace “transport” by “containment”.
- Table 21.1 Replace “21.4.3” by “21.4.2” and “21.4.4” by “21.4.3”.
- 21.2.2 In the paragraph after indent (b), first sentence, delete “For transport in packages excluding IBCs,”. In the second sentence replace “transport” by “containment”.
- 21.3.2 Delete “during transport”.
- 21.3.3 Replace “to be transported under” by “likely to encounter”.
- 21.4.2 Delete entire sub-section and renumber sections 21.4.3 and 21.4.4 (and related references) accordingly.

## Section 22

- 22.1 Delete “for transport” in the first sentence.
- 22.2 Delete “for transport” in the first sentence.
- 22.3.1 Insert “substances in” between “applied to” and “packages”; delete “of substance” and replace “transport” by “classification”.
- 22.4.1.1 At the end of the first sentence, delete “as for transport”.
- 22.4.1.3 In the first sentence, replace “transport” by “classification”.

## Section 23

- 23.4.2.3.2 At the end of the last sentence replace “transport” by “the package”.

## Section 24

- 24.1 At the end of the first sentence, delete “for transport”.
- 24.3.1 Insert “substances in” before “packages” and delete “of substance”. Replace “transport” by “classification”.
- 24.4.1.1 At the end of the first sentence, delete “as for transport”.
- 24.4.1.3 Replace “transport” by “classification” in the first sentence.

## Section 25

- 25.4.1.2.2 In the fourth sentence, delete “dibutyl phthalate or”.
- 25.4.1.3.1 Footnote 1: In the second sentence, replace “transport” by “packing”.
- 25.4.1.3.4 In footnote 2, replace “remained” by “remaining”.
- 25.4.2.2.2 In the fourth sentence replace “dibutyl phthalate” by “silicone oil, apparent density  $0.96 \pm 0.02$  at 20 °C and heat capacity  $1.46 \pm 0.02$  J/g at 25 °C,”.
- 25.4.3.3.1 In the second sentence replace “dibutyl phthalate” by “silicone oil, apparent density  $0.96 \pm 0.02$  at 20 °C and heat capacity  $1.46 \pm 0.02$  J/g at 25 °C” and replace “the temperature of the dibutyl phthalate” by “its temperature”. In the third sentence replace “dibutyl phthalate” by “oil”.

## Section 26

- 26.1.1 In the second sentence replace “transport” by “containment” and delete “of Division 4.1” and “of Division 5.2”.
- 26.4.5 Delete entire sub-section.

## Section 27

- 27.1.1 In the first sentence, delete “for transport”.
- 27.2.1 Delete “for transport”.
- 27.3.1 Replace “packages of substance” by “substances in packages” and “transport” by “classification”.
- 27.4.1.3 In the first sentence replace “transport” by “classification”.
- 27.4.2 In the title amend “g.2” to “G.2”.

## Section 28

- 28.1 In the first sentence insert “and the self-accelerating polymerization temperature (SAPT)” after “(SADT)”.

At the end of the second sentence, delete “as used in transport”.

Insert a new third sentence reading “The SAPT is defined as the lowest temperature at which self-accelerating polymerization may occur with a substance in the packaging.”.

Amend the beginning of the fourth sentence to read “The SADT and SAPT are measures of the...” and replace “decomposition” by “reaction”.

- 28.2.1 Delete “at transport temperatures”.

At the end of the paragraph insert “or a polymerizing substance”.

Table 28.1 In footnotes a, b and c amend “transported” to “contained”.

- 28.2.2 In the last sentence after the table insert “or SAPT” after “SADT” and delete “for transport”.

28.2.3 Amend to read “When temperature control is necessary (see Table 28.2) the control and emergency temperatures should be derived from the SADT or SAPT using Table 28.3.”

Renumber current table 28.2 to 28.3

Insert a new table 28.2 to read as follows:

**“Table 28.2: Criteria for temperature control**

<b>Type of substance</b>	<b>Criterion for temperature control</b>
Self-reactive substance	SADT $\leq$ 55 °C
Organic peroxide Type B and C	SADT $\leq$ 50 °C
Organic peroxide Type D showing medium effect when heated under confinement <sup>a</sup>	SADT $\leq$ 50 °C
Organic peroxides Type D showing low or no effect when heated under confinement <sup>a</sup>	SADT $\leq$ 45 °C
Organic peroxides Type E and F	SADT $\leq$ 45 °C
Polymerizing substance in packaging or IBC	SAPT $\leq$ 50 °C
Polymerizing substance in portable tank	SAPT $\leq$ 45 °C

<sup>a</sup> *As determined by test series E as prescribed in this Manual of Tests and Criteria, Part II*”

Table 28.3 (new, former 28.2) Replace “SADT” by “SADT/SAPT” in the table and in the note to the table (10 times). In the row for portable tanks replace “< 50 °C” by “ $\leq$  45 °C”. In footnote a, delete “for transport”.

28.2.4 Delete “of Division 4.1” and replace “transported” by “contained”.

28.2.5 Insert a new paragraph 28.2.5 to read as follows:

“If a substance is being tested to determine whether it is a polymerizing substance, a test of series H, or a suitable alternative method, should be performed to determine if its SAPT would be less than or equal to 75 °C in its packaging, IBC or portable tank.”

Current paragraph 28.2.5 becomes new 28.2.6.

28.3.1 Amend the beginning of the sentence to read “For organic peroxides and self-reactive substances the preliminary...”.

28.3.2 In the first sentence, delete “to be transported” and in the second sentence delete “transport in”.

28.3.4 Replace “SADT” by “SADT or SAPT”.

28.3.5 In the first sentence, replace “SADT” by “SADT or SAPT” and delete “offered for transport”.

28.3.6 In the second sentence replace “dibutyl phthalate” by “silicone oil, apparent density  $0.96 \pm 0.02$  at 20 °C and heat capacity  $1.46 \pm 0.02$  J/g at 25 °C”.

In the fourth sentence, replace “SADT” by “SADT or SAPT”.

28.4.1.1 In the first sentence correct “auto-accelerative” to “self-accelerating”. In the second sentence replace “220 litres” by “225 litres”. In the third sentence insert “or polymerization” between “decomposition” and “reaction”.

28.4.1.2.5 In the last sentence replace “SADT” by “SADT or SAPT”.

28.4.1.3.4 In the second sentence replace “self-accelerating decomposition temperature (SADT)” by “SADT or SAPT”. In the third sentence replace “SADT” by “SADT or SAPT” (twice). Insert a new last sentence reading “If the substance is being tested to determine if it meets the SAPT criterion for a polymerizing substance, perform sufficient tests to determine if the SAPT in the packaging as used is 75 °C or less.”.

- 28.4.1.4.1 Replace “SADT” by “SADT or SAPT” (twice).
- 28.4.1.5 In the table heading replace “SADT” by “SADT/SAPT”.
- 28.4.2.1.1 In the second sentence replace “SADT” by “SADT or SAPT”.
- 28.4.2.2.2 In the last sentence replace “SADT” by “SADT or SAPT”.
- 28.4.2.3.1 In indent (a), replace “dibutyl phthalate or with a suitable oil” by “silicone oil, apparent density  $0.96 \pm 0.02$  at 20 °C and heat capacity  $1.46 \pm 0.02$  J/g at 25 °C, or another suitable oil”.
- 28.4.2.4.6 In the penultimate sentence, replace “SADT” by “SADT or SAPT”.
- 28.4.2.5 In the table heading, replace “SADT” by “SADT/SAPT”.
- Figure 28.4.2.2 In the legend for letter “D”, replace “Self-accelerating decomposition temperature (SADT)” by “SADT or SAPT”. Insert “or SAPT” at the end of the title of the figure.
- 28.4.3.1.1 In the second sentence, replace “SADT” by “SADT or SAPT”.
- 28.4.3.2.1 In the last sentence, replace “SADT” by “SADT or SAPT”.
- 28.4.3.4.3 In the penultimate sentence, replace “SADT” by “SADT or SAPT”.
- 28.4.3.5 In the table heading, replace “SADT” by “SADT/SAPT”.
- Figure 28.4.3.2 In the legend for letter “D”, replace “Self-accelerating decomposition temperature (SADT)” by “SADT or SAPT” and insert “or SAPT” at the end of the title of the figure.
- 28.4.4.1.1 At the end of the first sentence, delete “as for transport”. In the last sentence replace “SADT” by “SADT or SAPT”.
- 28.4.4.1.2 At the end of the sentence, delete “offered for transport”.
- 28.4.4.2.6 At the end of the first sentence, delete “offered for transport”.
- 28.4.4.3.4 In the second sentence replace “SADT” by “SADT or SAPT” (twice). Insert a new last sentence reading “If the substance is being tested to determine if it meets the SAPT criterion for a polymerizing substance, perform sufficient tests to determine if the SAPT in the packaging as used is 75 °C or less.”
- 28.4.4.4.1 Replace “SADT” by “SADT or SAPT” (twice).
- 28.4.4.5 In the table heading replace “SADT” by “SADT/SAPT”.

### **Part III**

- Title Replace “CLASS 2, CLASS 3, CLASS 4, DIVISION 5.1, CLASS 8 AND CLASS 9” with “VARIOUS HAZARD CLASSES”.
- Table of contents Amend the entries hereafter as follows, renumbering where appropriate:
- 31 Replace “FLAMMABLE AEROSOLS OF CLASS 2” by “THE FLAMMABILITY OF AEROSOLS”.
- 32 Delete “OF CLASS 3”.
- 33 Replace “CLASS 4” by “FLAMMABLE SOLIDS, SOLID DESENSITIZED EXPLOSIVES, SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION AND SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES”.

- 33.2 Delete this entry.
- 33.2.1.3 Replace “readily combustible” by “flammable”.
- 33.2.1.4 Replace “readily combustible” by “flammable”.
- 33.2.2 Delete this entry.
- 33.2.3 Delete “OF DIVISION 4.1”.
- 33.3 Delete this entry.
- 33.3.1 Add “(PYROPHORIC AND SELF-HEATING SUBSTANCES)” at the end.
- 33.3.1.3 Delete “for substances liable to spontaneous combustion”.
- 33.4 Delete this entry.
- 34 Delete “OF DIVISION 5.1”
- 36 Delete “*for classification procedures, test methods and criteria relating to Class 7*”
- 37 Replace “OF CLASS 8” by “CORROSIVE TO METALS”.
- 37.4.1.1 Amend the end of the sentence to read as follows: “... liquid as a substance corrosive to metal”.
- 38 Insert “SUBSTANCES AND ARTICLES OF TRANSPORT” before “CLASS 9”.

### Section 30

30.1.1 In (a), replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapter 2.3 of the GHS);”.

In (b), delete “of Class 3”, replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapters 2.6 and 2.17 of the GHS);”.

In (c), delete “of Division 4.1”, replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapters 2.7 and 2.17 of the GHS);”.

In (d), delete “of Division 4.2”, replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapters 2.9, 2.10 and 2.11 of the GHS);”.

In (e), delete “of Division 4.3”, replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapter 2.12 of the GHS);”.

In (f), delete “of Division 5.1”, replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapters 2.13 and 2.14 of the GHS);”.

In (g), delete “properties of” and “of Class 8”, replace “Manual and” by “Manual,” and amend the end of the sentence to read “... Model Regulations and Chapters 2.16 of the GHS);”.

In (h), delete “of Class 9” and insert “and section 39” after “sub-section 38.2”.

30.1.2 Delete the first sentence. Amend the beginning of the second sentence to read: “Section 36 is reserved, to allow...” and delete “for Classes 6 and 7 respectively” at the end of the sentence.

30.2 Amend the end of the first sentence to read: "...undertaken on a new substance or article."

### Section 31

Title Amend the end of the title to read: "... RELATING TO THE FLAMMABILITY OF AEROSOLS".

31.1.1 Amend the end of the first sentence to read as follows: "of aerosols as either flammable (Division 2.1/Category 1 or 2) or non-flammable (Division 2.2/Category 3)."

In the second sentence, insert: "Chapter 2.3 of the GHS," after "Regulations,".

31.1.2 Replace "relative hazard of flammable aerosols" by "flammability hazards of aerosols".

31.1.3 In the definition for "*Aerosols or aerosol dispensers*", delete "meeting the requirements of section 6.2.4 of the Model Regulations," at the beginning of the sentence and insert at the end: "(for transport purposes the receptacles need to meet the requirements of section 6.2.4 of the Model Regulations)".

In note 2 under the definition of "*Flammable components*", after "Model Regulations", insert "and section 2.7.1 of the GHS" and delete: "of Division 4.1".

31.2.1 In the first sentence, delete: "offered for transport" and insert a full stop (.) after "Model Regulations". Insert a new second sentence, to read as follows: "Aerosols for supply and use shall be subjected to the classification scheme as set out in section 2.3.2 of the GHS." In the remainder of the original first sentence, replace "and for flammability" by "For flammability, aerosols". Delete the last sentence.

In the note, replace "*Aerosol dispensers*" by "*Aerosols*" and insert "(Category 1)" at the end of the note.

31.3.1 In the first sentence, insert "non-flammable," after "classified as".

In (a), insert "(Divisions 2.1/Category 1)" after "extremely flammable" and insert a colon (:) after "if". The remainder of the text becomes a new sub-indent (i) with the following amendments: replace "the product" by "it" and insert "or" after "30 kJ/g". Insert a new sub-indent (ii) to read as follows:

"(ii) it meets the criteria for extreme flammability in 31.3.2 for spray aerosols or in 31.3.4 for foam aerosols; and"

Insert a new indent (b) to read as follows:

"(b) The aerosol is classified as flammable (Division 2.1/Category 2) if it meets the criteria for flammability in 31.3.2 for spray aerosols or in 31.3.4 for foam aerosols; and"

Re-number indent (b) to become indent (c). Insert: "(Divisions 2.2/Category 3)" after "non-flammable".

31.3.2 In the first sentence, delete: "be made taking into", insert "for" after "account", delete "on the basis of", insert "(see section 31.4 of this Manual)." after "distance test" and delete "as follows:" and indents (a) and (b).

31.3.4 Delete all text of indents (a) and (b).

31.3.5 Replace "criteria" by "procedure". The second amendment to the French version does not apply to the English text.

31.4.4.2 In the first sentence, delete: “as flammable, extremely flammable or non flammable”. Replace indents (a) to (d) by the following table:

<b>Criteria</b>	<b>UN Model Regulations Division</b>	<b>GHS Category</b>
Ignition occurs at a distance of 75 cm or more, regardless of the heat of combustion	2.1	1
Ignition occurs at a distance of less than 75 cm, with a chemical heat of combustion equal to or more than 20 kJ/g	2.1	2
Ignition occurs at a distance equal or greater than 15 cm but less than 75 cm, with a chemical heat of combustion less than 20 kJ/g	2.1	2
No ignition occurs in the ignition distance test and the chemical heat of combustion is less than 20 kJ/g	Perform enclosed space ignition test described in section 31.5	

31.5.4.4 At the beginning of the first sentence, amend “An aerosol” to read “Spray aerosols” and amend the end to read “(this Manual) shall be classified according to the following criteria:

<b>Criteria</b>	<b>UN Model Regulations Division</b>	<b>GHS category</b>
Time equivalent is less than or equal to 300 s/m <sup>3</sup> or the deflagration density is less than or equal to 300 g/m <sup>3</sup>	2.1	2
Time equivalent is more than 300 s/m <sup>3</sup> and the deflagration density is more than 300 g/m <sup>3</sup>	2.2	3

“

31.6.4.2 Amend to read: “Foam aerosols shall be classified according to the following criteria:

<b>Criteria</b>	<b>UN Model Regulations Division</b>	<b>GHS Category</b>
Flame height is 20 cm or more and the flame duration is 2 s or more	2.1	1
Flame height is 4 cm or more and the flame duration is 7 s or more	2.1	1
Flame height is 4 cm or more and the flame duration is 2 s or more	2.1	2
Flame height is 4 cm or less or the flame duration is 2 s or less (if any)	2.2	3

“

## Section 32

Title Delete “OF CLASS 3” from the title.

32.1 In the first sentence, replace “of Class 3 (see Chapter 2.3 of the Model Regulations)” by “(Class 3/Categories 1 to 4)”. In the second sentence, after “Model

Regulations” insert “, Chapter 2.6 of the GHS”. Add a new last sentence reading “Note 2 to paragraph 2.1.2.2 of the GHS should also be taken into consideration.”.

32.2.2 In the first sentence, replace “listed in this class” by “classified”. Amend the second sentence to read “... than 35 °C and not more than 60 °C may be regarded as non-flammable for some regulatory purposes (e.g. transport) if they do not sustain combustion (i.e. negative results have been obtained in the sustainability test L.2 in sub-section 32.5.2 of this Manual).”

32.2.3 Amend the first sentence to read as follows: “Flammable liquids listed by name in the dangerous goods list of Chapter 3.2 of the Model Regulations should be regarded as chemically pure.”.

In the third sentence, after “... open-cup test, may be”, replace “offered for transport as commercial products” by “classified as “generic” or “not otherwise specified” flammable liquids”.

In the fourth sentence, after “packing group III” insert: “/Category 3” and after “packing group II” insert “/Category 2”.

32.2.4 In the second sentence, delete “of substances”.

32.2.5 Delete “for the purposes of the Model Regulations” and replace “have passed” by “yield a negative when submitted to”.

32.3.1.1 Amend the end of the sentence to read “... hazard grouping of a flammable liquid.”.

32.3.1.2 Delete “in the hazard grouping shown”.

32.3.1.3 In the first sentence, replace “hazard group” by “packing group” (twice).

The amendment to the second sentence of the French version does not apply to the English text.

In the third sentence, replace “hazard grouping” by “packing group” and “for the” by “for such a”.

Table 32.1 Replace the current table by the following table and note:

Criteria	Model Regulations Packing group	GHS Category
Flash point < 23 °C and initial boiling point ≤ 35 °C	I	1
Flash point < 23 °C and initial boiling point > 35 °C	II	2
Flash point ≥ 23 °C and ≤ 60 °C and initial boiling point > 35 °C	III	3
Flash point > 60 °C and ≤ 93 °C	<i>Not applicable</i>	4

**NOTE:** the criterion of initial boiling point > 35 °C for packing group III/Category 3 is currently not used in the GHS.

32.3.2.1 Amend the first sentence to read as follows: “This sub-section presents the Model Regulations scheme for the classification of liquid desensitized explosives as flammable liquids (see paragraph 2.3.1.4 of the Model Regulations and note 2 to paragraph 2.1.1 of the GHS”. In the second sentence, between “liquid mixture” and “to suppress”, insert “in order”.

32.3.2.2 Delete current paragraph 32.3.2.2 and renumber subsequent two paragraphs to 32.3.2.2 and 32.3.2.3 respectively.

32.3.2.2 (new, former 32.3.2.3) In the first sentence, replace “is assigned to Class 1” by “meets the criteria for classification as explosive”, amend “exempted from Class 1” to read “exempted from this class”, amend “another class or division” to read “another hazard class”, delete “or division” just before “at the highest concentration” and, at the end of the first sentence, amend “Class 1” to read “the class of explosives”. In the second sentence, after “non-dangerous” insert “for some regulatory purposes (e.g. transport)” and amend the paragraph number to read “2.1.3.6.3”.

32.3.2.3 (new, former 32.3.2.4) Delete “the Globally Harmonized System of Classification and Labelling of Chemicals”, remove the brackets around “GHS” and replace “referred to” by “given in”.

32.4.1 Amend the beginning of the title to read: “Tests for non-viscous ...”.

32.4.2 Amend the beginning of the title to read: “Tests for viscous ...”.

32.4.2.1 In the first sentence, replace “substances of Class 3” by “liquids”, and insert before “by reference to”: “as per sub-section 2.3.2.2 of the Model Regulations”.

32.4.2.2 Delete “the ISO method”.

32.5.1.1 At the end of the paragraph, delete “with a flash point less than 23 °C”.

32.5.1.4 At the end of the paragraph, replace “32.3.1.6 and 32.3.1.7)” by “2.3.2.2 of the Model Regulations) or may not be subject to the Model Regulations (see 2.3.2.5 of the Model Regulations)”.

32.5.2.2.1 Amend the fifth sentence to read as follows: “Essential diagrams for a suitable apparatus are given in figures 32.5.2.1 and 32.5.2.2.”.

## Section 33

Title Replace “CLASS 4” by “FLAMMABLE SOLIDS, SOLID DESENSITIZED EXPLOSIVES, SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION AND SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES”.

33.1 At the end of the paragraph, replace “substances (except self-reactive substances of Division 4.1, see Part II) and articles of Class 4” by “flammable solids, solid desensitized explosives, substances liable to spontaneous combustion and substances which, in contact with water, emit flammable gases”.

33.2 (current) Delete 33.2 and renumber subsequent paragraphs and references accordingly.

33.2.1.1 (new, former 33.2.1.1.1) In the first sentence delete “of Division 4.1” and insert “and Chapter 2.7 of the GHS” after “Model Regulations”. In the second sentence insert “paragraph 2.7.2 of the GHS,” after “Model Regulations,” and delete “here” at the end of the sentence.

33.2.1.2 (new, former 33.2.1.1.2) At the end of the paragraph replace “Division 4.1” by “the class of flammable solids”.

33.2.1.3 (new, former 33.2.1.1.3) Delete “and in the Model Regulations” and “for transport”.

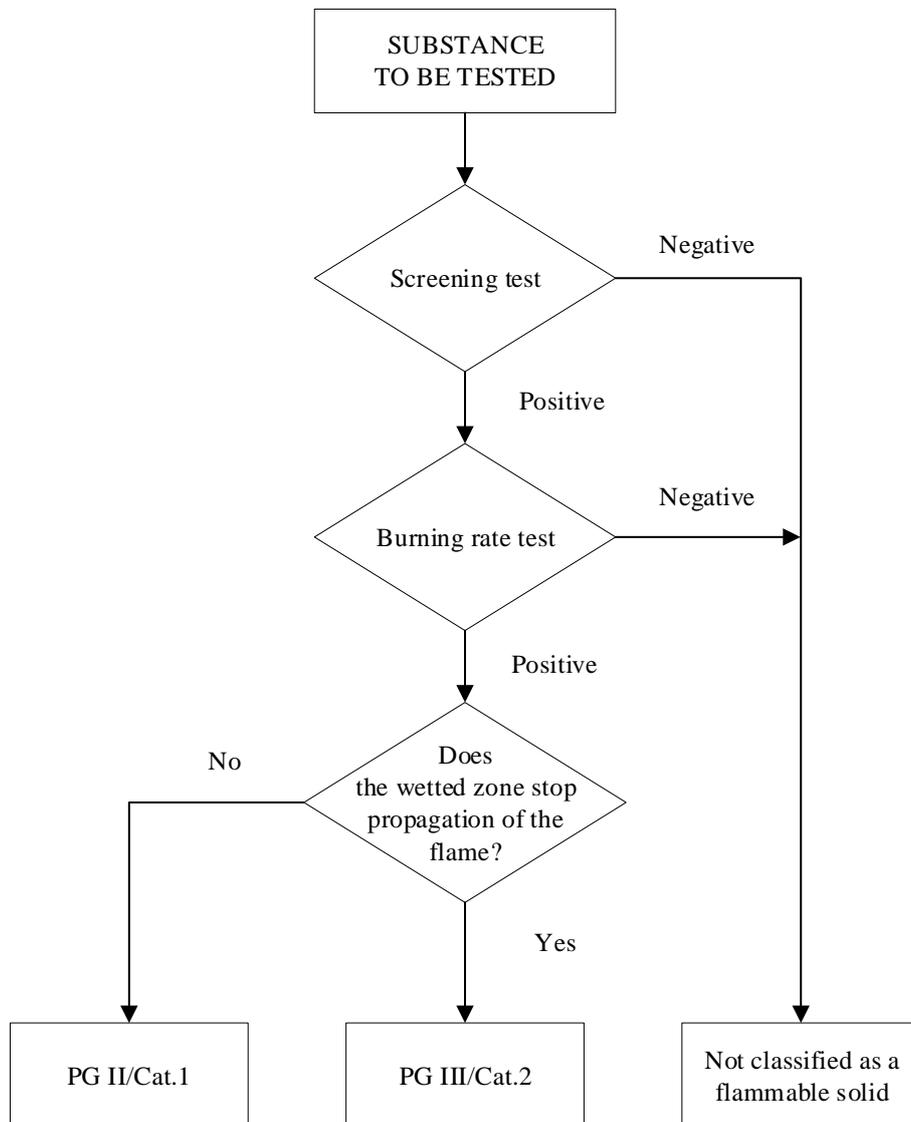
33.2.2.1 (new, former 33.2.1.2.1) In the first sentence, delete “offered for transport”, replace “subjected to the classification procedures as set out” by “classified according to the criteria” and insert “and paragraph 2.7.2 of the GHS” after “Model Regulations”. In the second sentence delete “or articles”. Delete the third sentence.

33.2.3 (new, former 33.2.1.3) Replace “readily combustible” by “flammable”.

33.2.3.2 (new, former 33.2.1.3.2) At the end of the second sentence delete “of Division 4.1”. In the fourth sentence replace “readily combustible” by “flammable”, delete “of Division 4.1” and after “packing group II or III” insert “Category 1 or 2”.

Fig. 33.2.3 (new, former 33.2.1.3) Replace the figure and it’s heading by the following:

**Figure 33.2.3: Flow chart for the classification of flammable solids, except metal powders**



33.2.4 (new, former 33.2.1.4) In the title replace “readily combustible” by “flammable”.

33.2.4.4.1 (new, former 33.2.1.4.4.1) In the first sentence replace “in Division 4.1” by “as flammable solids”.

33.2.4.4.2 (new, former 33.2.1.4.4.2) Insert after “packing group II” “/Category 1” (twice).

- 33.2.4.4.3 (new, former 33.2.1.4.4.3) Insert after “packing group III” “/Category 2” (twice).
- 33.2.4.5 (new, former 33.2.1.4.5) In the column “Result” change “4.1” to “a flammable solid” (three times).
- 33.2.2 (current) Delete and renumber subsequent paragraphs and references accordingly.
- 33.3 (new, former 33.2.3) Delete “OF DIVISION 4.1”.
- 33.3.1 (new, former 33.2.3.1) Amend the first sentence to read as follows: “This sub-section presents the Model Regulations scheme for the classification of desensitized explosives as flammable solids of Division 4.1 (see sub-section 2.4.2.4 of the Model Regulations and note 2 to paragraph 2.1.1.1 of the GHS.”. In the second sentence, after “solid mixture”, insert “in order”.
- 33.3.2 (new, former 33.2.3.2) Delete this paragraph and renumber the two subsequent paragraphs to 33.2.3.2 and 33.2.3.3 respectively.
- 33.3.2 (new, former 33.2.3.3) In the first sentence, replace “is assigned to Class 1” by “meets the criteria for classification in the class of explosives”, amend “exempted from Class 1” to read “exempted from this class”, amend “another class or division” to read “another hazard class”, delete “or division” just before “at the highest concentration” and, at the end of the first sentence, amend “Class 1” to read “the class of explosives”. In the second sentence, after “non-dangerous” insert “for some regulatory purposes (e.g. transport)” and amend the paragraph number to read “2.1.3.6.3”.
- 33.3.3 (new, former 33.2.3.4) Delete “the Globally Harmonized System of Classification and Labelling of Chemicals”, remove the brackets around “GHS” and replace “referred to” by “given in”.
- 33.3 (current) Delete and renumber subsequent paragraphs and references accordingly.
- 33.4 (new, former 33.3.1) Add “(pyrophoric and self-heating substances)” at the end.
- 33.4.1.1 (new, former 33.3.1.1.1) Amend the first sentence to read as follows: “This sub-section presents the scheme for the classification of substances liable to spontaneous combustion i.e. pyrophoric liquids and solids and self-heating substances (see section 2.4.3 of the Model Regulations and Chapters 2.9, 2.10 and 2.11 of the GHS.”.
- In the second sentence, replace “sub-sections 2.4.3.2 and 2.4.3.3 of the Model Regulations” by “these references” and delete “here” towards the end of the sentence”.
- 33.4.1.2 (new, former 33.3.1.1.2) In (a), amend the beginning to read “Liquid or solid substances which, even in...”.
- In (b), second sentence, replace “These substances” by “They”.
- 33.4.1.3 (new, former 33.3.1.1.3) Delete “for transport”.
- 33.4.2.1 (new, former 33.3.1.2.1) Amend the first sentence to read as follows: “Substances offered for transport should be subjected to the classification procedures as set out in sub-sections 2.4.3.2 and 2.4.3.3 of the Model Regulations and Chapters 2.9, 2.10 and 2.11 of the GHS.”. Delete the second sentence.
- 33.4.3 (new, former 33.3.1.3) In the title, delete “for substances liable to spontaneous combustion”.

33.4.3.1 (new, former 33.3.1.3.1) In the second sentence, delete “here.”. In the third sentence delete “of Division 4.2”. In the last sentence, after “Packing group 1” insert “/Category 1”.

33.4.3.2 (new, former 33.3.1.3.2) In the third sentence, delete “here”. In the fourth sentence delete “of Division 4.2”. In the last sentence, after “Packing group 1” insert “/Category 1”.

33.4.3.3.1 (new, former 33.3.1.3.3.1) At the end of the fourth sentence, replace “assigned to Division 4.2” by “classified as a self-heating substance”. In the fifth sentence, after “packing group II” replace “of Division 4.2” by “/Category 1”. In the last sentence, delete “here”.

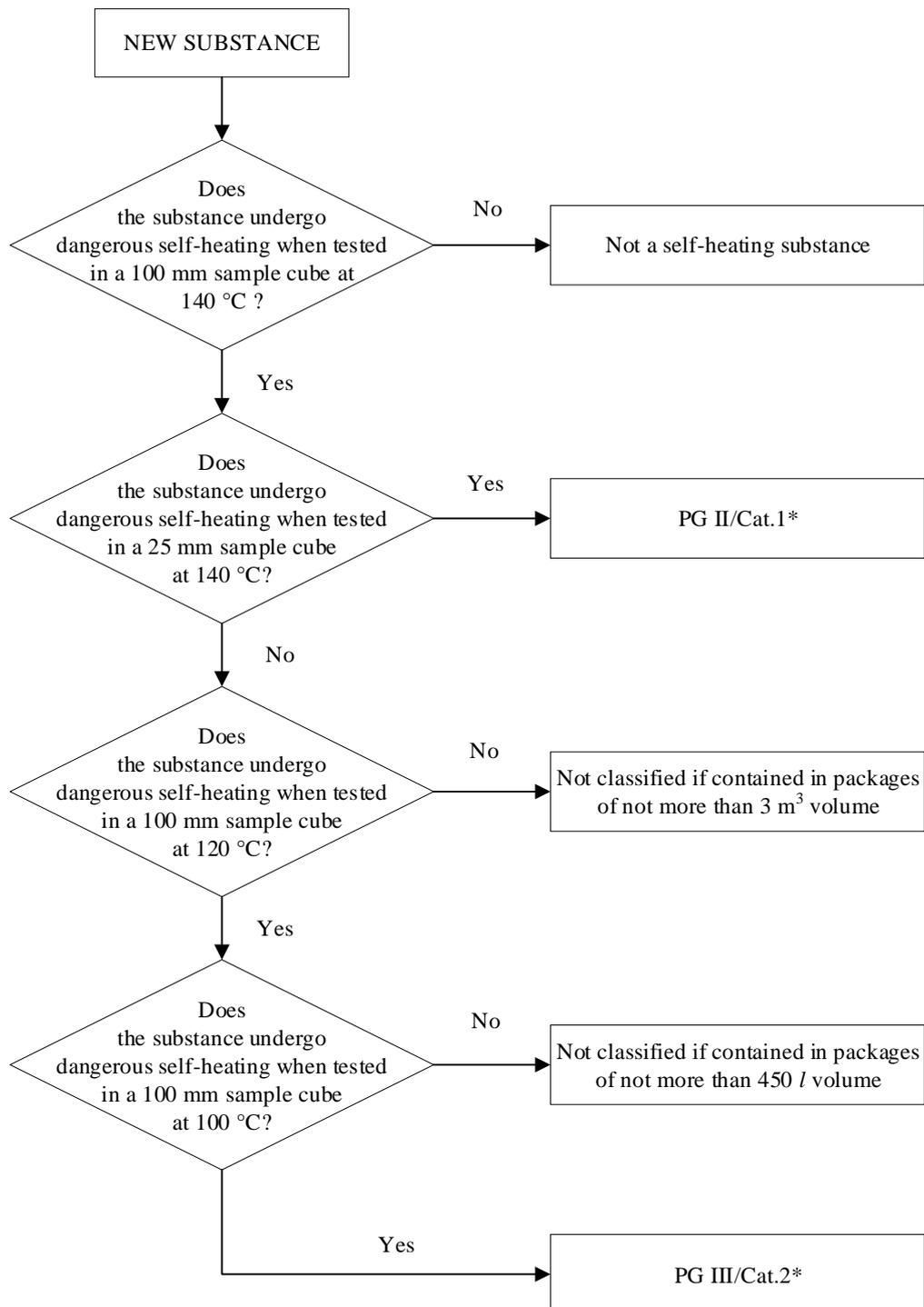
33.4.3.3.2 (new, former 33.3.1.3.3.2) At the end of the paragraph, delete “of Division 4.2”.

33.4.3.3.3 (new, former 33.3.1.3.3.3) At the end of the paragraph, insert “/Category 1”.

33.4.3.3.4 (new, former 33.3.1.3.3.4) In both indents (a) and (b), replace “transported” by “contained”. In the last sentence, delete “of Divisions 4.2” (twice) and insert “/Category 2” after “packing group III”.

33.4.3.3.5 (new, former 33.3.1.3.3.5) Delete the whole paragraph.

Fig. 33.4.3.3.1 (new, former 33.3.1.3.3.1) Replace the figure by the following:



In the footnote, replace “in Division 4.2” by “as self-heating substances”.

33.4.4.4 (new, former 33.3.1.4.4) Amend the end of the sentence to read as follows: “should be classified as a pyrophoric solid of packing group I/Category 1.”.

33.4.4.5 (new, former 33.3.1.4.5) In the column “Results” replace “PGI of 4.2” by “a pyrophoric solid” (three times).

33.4.5.4 (new, former 33.3.1.5.4) Amend the end of the sentence to read as follows: “should be classified as a pyrophoric liquid of packing group I/Category 1.”.

33.4.5.5 (new, former 33.3.1.5.5) In the column “Results” replace “Not 4.2” by “Not a pyrophoric liquid” (twice) and “4.2” by “Pyrophoric liquid” (four times).

33.4.6.3 (new, former 33.3.1.6.3) In the tenth sentence, insert “/category 1” after “packing group II”. In (a) and (b), replace “transported” by “contained”.

33.4.6.4.2 (new, former 33.3.1.6.4.2) In the first sentence replace “in Division 4.2” by “as a self-heating substance”. In (b) and (c), replace “transported” by “contained”.

33.4.6.4.3 (new, former 33.3.1.6.4.3) After “Packing group II” insert “/Category 1”.

33.4.6.4.4 (new, former 33.3.1.6.4.4) After “Packing group III” insert “/Category 2”. In both indents (a) and (b), replace “transported” by “contained”.

33.4.6.5 (new, former 33.3.1.6.5) In the column “Results” replace “Not 4.2” by “Not self-heating”, “P.G. II of 4.2” by “Self-heating PG II/Cat 1” and “P.G. III of 4.2” by “Self-heating PG III/Cat 2”. The note applicable to “packing group III/category 2” remains unchanged.

33.4 (current) Delete and renumber subsequent paragraphs and references accordingly.

33.5.1.1 (new, former 33.4.1.1.1) In the first sentence delete “United Nations”, delete “of Division 4.3” and after “Model Regulations” insert “and Chapter 2.12 of the GHS”. In the second sentence, replace “sub-sections 2.4.4.2 and 2.4.4.3 of the Model Regulations” by “these references” and delete “here” towards the end of the sentence”.

33.5.1.3 (new, former 33.4.1.1.3) Towards the end of the paragraph, delete “for transport”.

33.5.2.1 (new, former 33.4.1.2.1) Amend the first sentence to read as follows: “New substances should be subjected to the classification procedures as set out in sub-sections 2.4.4.2 and 2.4.4.3 of the Model Regulations and Chapter 2.12 of the GHS.”. Delete the second sentence.

33.5.3.1 (new, former 33.4.1.3.1) At the end of the fourth sentence, replace “assigned to Division 4.3” by “classified as a substance which, in contact with water, emits flammable gases”. Towards the end of the sixth sentence, delete “here”. In the last sentence, delete “of Division 4.3” and insert “/Category 1, 2 or 3” after “packing group I, II or III”.

33.5.4.3.5 (new, former 33.4.1.4.3.5) In the penultimate sentence insert “/category” after “packing group” and replace “Division 4.3” by “this hazard class”.

33.5.4.4.1 (new, former 33.4.1.4.4.1) Replace “Division 4.3” by “this hazard class”.

33.5.4.4.2 (new, former 33.4.1.4.4.2) After “Packing group I” insert “/Category 1”.

33.5.4.4.3 (new, former 33.4.1.4.4.3) After “Packing group II” insert “/Category 2” and after “packing group I” insert “/Category 1”.

33.5.4.4.4 (new, former 33.4.1.4.4.4) After “Packing group III” insert “/Category 3” and after “packing groups I or II” insert “/Categories 1 or 2”.

33.5.4.5 (new, former 33.4.1.4.5) In the column “Results”, replace “Not 4.3” by “Not classified in this hazard class”.

## Section 34

Title In the title, replace “SUBSTANCES OF DIVISION 5.1” by “SOLIDS AND LIQUIDS”.

34.1.1 Amend the first sentence to read as follows “This section presents the scheme for the classification of oxidizing solids and liquids (see section 2.5.2 of the Model Regulations and Chapters 2.13 and 2.14 of the GHS.”. In the second sentence replace “paragraphs 2.5.2.2 and 2.5.2.3 of the Model Regulations and” by “these references” and delete “here”.

34.2.1 Amend the first sentence to read as follows: “New substances should be classified according to the criteria unless it is impracticable (e.g. because of the physical properties) to perform the tests.”. Delete the last sentence.

34.3 In the first sentence, delete “outlined here”, replace “substances” by “solids and liquids”, delete “for transport” and replace “competent authority” by “classifier”.

34.3.1 In the first sentence delete the first occurrence of “substance”. Delete the second sentence. In the (old) third sentence delete “of Division 5.1”, insert “/Category 1, 2, or 3” before “should be assigned” and insert a full stop (.) after “test result”. Start the thus created new sentence with: “For transport, in case of solids representing more than one hazard characteristic” and remove the brackets around the remainder of the new sentence. In the sentence starting with “As the particle...” replace “substance” by “solid”.

34.3.2 In the first sentence delete the first occurrence of “substance”. In the second sentence delete “given here”. In the third sentence, delete “of Division 5.1”, replace “packing group I, II or III” by “packing group I, II or III /Category 1, 2 or 3” and insert a full stop (.) after “test result”.

Amend the thus created new sentence to read as follows: “For transport, in case of liquids representing more than one hazard characteristic see also **Precedence of hazards characteristics** in section 2.0.3 of the Model Regulations.”.

34.4 In the title replace “substances” by “solids and liquids”.

34.4.1.1 In the last sentence after “packing group I or II” insert “/Category 1 or 2”.

34.4.1.2.3 Amend to read:

“34.4.1.2.3 An ignition source is required comprising an inert metal wire connected to an electrical power source capable of maintaining the power dissipation specified below. The electrical resistance depends on the wire material. It is recommended to use a nickel/chromium or Aluchrom wire as follows:

- (a) Length = 30 cm ± 1 cm;
- (b) Diameter below or equal to 1 mm;
- (c) Electrical power dissipated in the wire = 150 W ± 7 W.

The wire should be shaped as in Figure 34.4.1.1.”

34.4.1.2.6 In the first sentence delete “, in the form in which it will be transported,”.

34.4.1.3.1 In the first sentence replace “in which it will be transported (see 34.4.1.2.6)” by “as determined in paragraph 34.4.1.2.6”.

34.4.1.3.3 In the last sentence insert “/category” after “packing group” and replace “in Division 5.1” by “as an oxidizing solid”.

34.4.1.4.2 Replace:

- “Packing group I” by “Packing group I/Category 1”;
- “Packing group II” by “Packing group II/Category 2”;
- “Packing group III” by “Packing group III/Category 3”;
- “packing groups I and II” by “packing groups I and II/categories 1 and 2”;  
and
- “Division 5.1” by “an oxidizing solid”.

Amend the beginning of the last sentence to read: “For the assignment of precedence of hazards for transport purposes in the case of substances having other hazards...”.

34.4.1.5 In the column ‘Results’ and in footnotes “a”, “b” and “c”, replace:

- “PG I” by “PG I/cat. 1”;
- “PG II” by “PG II/cat 2”;
- “PG III” by “PG III/cat. 3”;
- “Not 5.1” by “Not an oxidizing solid”; and
- “Not currently classified” by “Not currently classified as an oxidizing solid”.

34.4.2.1 In footnote “2” to this paragraph, at the end of the first sentence amend “the oxidizing” to “their oxidizing” and delete “of the substance”.

34.4.2.3.1 Insert a new second sentence to read as follows: “A leakage test should be conducted on an empty vessel beforehand.”.

Modify the new third sentence to read as follows: “ $2.50 \pm 0.01$  g of the liquid to be tested is mixed with  $2.50 \pm 0.01$  g of dried cellulose in a glass beaker using a glass stirring rod or any other appropriate non-metallic mixing tool (e.g. porcelain, agate...) for at least two minutes. The time for mixing should be tracked by a timer and kept uniform for all mixtures.”.

Modify the sentence starting with “It is important” to read as follows: “It is important that the coil is not distorted during the packing process and should be covered completely by the mixture after loading.”.

Modify the sentence starting with “The charged vessel” to read as follows: “The charged vessel is transferred bursting disc uppermost to the firing support stand, which should be located in a suitable, armoured fume cupboard or firing cell.”.

Modify the end of the current paragraph to read as follows: “... firing plug and  $10 \pm 0.5$  A applied. The electric power is set before loading the vessel and should remain fixed for each test sequence or until any breakage of the wire occurs. The time between the start of mixing and switching the power on should be as short as possible and be kept constant for each test series.”.

34.4.2.4.2 Replace:

- “Packing group I” by “Packing group I/Category 1”;
- “Packing group II” by “Packing group II/Category 2”;
- “Packing group III” by “Packing group III/Category 3”;
- “packing groups I and II” by “packing groups I and II/categories 1 and 2”;  
and

- “Division 5.1” by “an oxidizing solid”.

Amend the beginning of the last sentence to read: “For the assignment of precedence of hazards for transport purposes in the case of substances having additional hazards...”.

34.4.2.5 In the column ‘Results’, replace:

- “PG I” by “PG I/cat. 1”;
- “PG II” by “PG II/cat 2”;
- “PG III” by “PG III/cat. 3” ; and
- “Not Div. 5.1” by “Not an oxidizing liquid”.

In the footnote “b” insert “transport” before “Class 8” and insert at the end of the note “(see section 2.0.3 of the Model Regulations)”.

34.4.3 In this whole sub-section amend “Packing Group(s)” to read “packing group(s)”.

34.4.3.1 In the last sentence of the first paragraph, after “packing group III”, insert “/Category 3” and after “packing group I or II”, insert “/Categories 1 or 2”.

34.4.3.2.1 In the first sentence replace “75% ± 0.5” by “75% ±1.0”.

In the second sentence replace “impact on the burning behavior of the reference piles” by “affect the burning behaviour of the reference mixtures”.

In the first item of the list replace “75% ± 0.5” by “75% ±1.0”.

In the last item of the list replace “and thereof” by “of which”.

34.4.3.2.2 In the last sentence insert after “packing group III” “/Category 3”.

34.4.3.2.3 In the last sentence insert after “packing group III” “/Category 3”.

34.4.3.2.4 In (b), replace “below 1 mm” by “below or equal to 1 mm”.

34.4.3.4 In the table, replace “packing group I” by “P.G. I/Cat. 1”, “packing group II” by “P.G. II/Cat. 2” and “packing group III” by “P.G. III/Cat. 3”.

34.4.3.5.3 Amend the beginning of the second sentence of the first paragraph to read as follows: “For the purpose of this test it is defined”.

Amend the end of the first paragraph to read as follows: “The total mass loss is the difference in mass before ignition and at the end of the combustion, defined as the time after which the rate of mass loss rate is less than 1 g per minute.”.

In the second paragraph, insert the following new sentence at the beginning: “Five valid tests should be performed with each reference and test substance mixture.”.

In the fourth sentence of the second paragraph, replace “0.95” by “0.90”.

Remove the next sentence.

In the last sentence of the second paragraph, replace “10%” by “20%”.

34.4.3.5.4 In the first sentence delete “transport”.

Replace:

- “packing groups” by “packing groups/categories”;
- “Packing group I” by “Packing group I/Category 1”;

- “Packing group II” by “Packing group II/Category 2”;
- “Packing group III” by “Packing group III/Category 3”;
- “packing groups I and II” by “packing groups I and II/categories 1 and 2”;  
and
- “Division 5.1” by “an oxidizing solid”.

Amend the beginning of the last sentence to read: “For the assignment of precedence of hazards for transport purposes in the case of substances having other hazards...”.

Delete the rest of the current paragraph (“In GHS terminology ... and cellulose.”).

34.4.3.6 Amend the heading of column three to read “Results”. In this same column: amend “I” to read “PG I/cat. 1” (three times); amend “II” to read “PG II/cat. 2” (four times); amend “III” to read “PG III/cat. 3” (twice) and amend “5.1” to read “an oxidizing solid” (three times).

In note “a” insert “/cat. 2” at the end.

In note “b” insert “/cat. 3” at the end.

## Section 36

Amend to read “Reserved”.

## Section 37

Title In the title replace “OF CLASS 8” by “CORROSIVE TO METALS”.

37.1.1 In the first sentence delete “United Nations”, amend “classification of corrosive substances of Class 8” to read “classification of substances corrosive to metal” and after “Model Regulations” insert “and Chapter 2.16 of the GHS”.

Convert the rest of the text to a new paragraph 37.1.2, with the following amendment:

New 37.1.2 Insert “or 435” after “404” and insert after “Model Regulations” “and Chapter 3.2 of the GHS”.

37.1.3 Insert a new paragraph to read as follows:

“37.1.3 In assigning the packing group to a substance or mixture in accordance with Chapter 2.8, paragraph 2.8.2.2 of the Model Regulations, account shall be taken of human experience in instances of accidental exposure. In the absence of human experience, the grouping shall be based on data obtained from experiments with OECD test guidelines 404 or 435. A substance or mixture which is determined not to be corrosive in accordance with OECD test guideline 430 or 431 may be considered not to be corrosive to skin for the purposes of classification without further testing.”

37.2.1 Amend the first sentence to read as follows: “New substances shall be subjected to the classification procedures as set out in paragraph 2.8.2.5 (c) (ii) of the Model Regulations and paragraph 2.16.2 of the GHS”. In the second sentence at the end delete “with existing entries”. Delete the third sentence.

37.3 Delete “for transport” at the end of the paragraph.

37.4.1.1 Amend the end of the sentence to read as follows: "... liquid as a substance corrosive to metal, packing group III/category 1".

## Section 38

Title In the title insert "SUBSTANCES AND ARTICLES OF TRANSPORT" before "CLASS 9".

38.1 At the end of the paragraph insert "transport" before "Class 9".

38.2.1.1 Insert "transport" before "Class 9".

38.2.3.1 Insert "transport" before "Class 9".

38.2.3.2 Insert "transport" before "Class 9".

38.2.3.3 Delete. Current 38.2.3.4 becomes 38.2.3.3.

38.3.5 (f) Amend sub-paragraph (ii) to read as follows:

“(ii) Mass of cell or battery;”

Amend sub-paragraph (v) to read as follows:

“(v) Cell or battery model number or, alternatively, if the test summary is established for a product containing a cell or battery, the product model number.”

## Part IV

Title The amendment to the French version does not apply to the English text.

## Section 41

41.2 At the beginning of the paragraph, replace "variations in container design" by "variations in portable tank or MEGC design".

41.3.1 In the introductory sentence and in (a) and (b), replace "container-under-test" by "prototype".

41.3.3.2 In (a), first sentence, after "of 3000 Hz", add ", and a resonant frequency of at least five times the sampling frequency".

In (c), replace the second sentence ("The data acquisition system...") by "Aliasing must not exceed 1%, which may require the incorporation of an anti-aliasing filter into the data acquisition system;"

41.3.4.1 In the introductory sentence and in paragraph (a), replace "container-under-test" by "prototype".

41.3.4.2 Replace "container" by "prototype".

41.3.4.3 In the first and third sentence, replace "container under test" by "prototype". In the second sentence, replace "container" by "portable tank or MEGC".

41.3.4.5 In the first sentence, replace "container-under-test" by "prototype". In the second sentence, replace "container" by "portable tank or MEGC".

41.3.5.1 (b)(i) For "ωn", after "natural frequency", replace "(in radians)" by "(radians/second)".

- 41.3.7 In the title, delete “for portable tanks with frame length of 20 feet”.
- 41.3.7.1 In the introductory sentence, replace “tank container-under-test” by “prototype” and “containers” by “portable tanks or MEGCs”.
- 41.3.7.2 The first amendment to the French version does not apply to the English text. In the third sentence, replace “tank containers” by “prototype designs”.
- 41.3.8 (b), (c) Replace “Container” by “Prototype”.
- 41.3.8 (f) Replace “container” by “the prototype”.

## Section 51

- 51.4.5.1 Replace the current paragraph and sub-paragraphs (a) to (c) with the following:  
“51.4.5.1 A compilation for the test results and classification data for more than 200 industrial nitrocellulose products is given in Appendix 11.”

## Appendices

Table of contents Add the following two new entries:

“Appendix 10 STABILITY TESTS FOR NITROCELLULOSE MIXTURES”

“Appendix 11 COMPILATION OF CLASSIFICATION RESULTS ON INDUSTRIAL NITROCELLULOSE FOR THE PURPOSES OF SUPPLY AND USE ACCORDING TO GHS CHAPTER 2.17, WHICH CAN BE USED FOR THE CLASSIFICATION OF INDUSTRIAL NITROCELLULOSE PRODUCTS”

## New Appendix 10

Insert a new appendix 10 to read as follows:

### “APPENDIX 10

#### STABILITY TESTS FOR NITROCELLULOSE MIXTURES

##### 1. Introduction

1.1 The Bergmann Junk test and the methyl violet paper test are used to determine whether nitrocellulose mixtures are considered to be stable for transport.

1.2 The methyl violet paper test is a qualitative test and determines the stability of a nitrocellulose mixture by examining the colour change of reagent paper over a period of time.

1.3 The Bergmann-Junk test is a quantitative stability test applicable to all types of nitrocellulose mixtures (NC). The test measures the quantity of NO gas per g NC given off by nitrocellulose heated for two hours at 132°C determined by titration with alkali. The expression “NO gas” comprises all types of NO-gas formed during the heating for 2 hours at 132°C. The Bergmann Junk test method allows a reliable and reproducible quantitative assessment of chemical stability. Thus this test is the preferred method.

## 2. Bergmann-Junk test

### 2.1 Introduction

The Bergmann-Junk test is a quantitative stability test applicable to all types of nitrocellulose (NC). The test measures the quantity of NO gas per g of NC given off by 1 (one) or 2 (two) gram(s) of nitrocellulose heated for two hours at  $132^{\circ}\text{C} \pm 1^{\circ}\text{C}$  (*Plasticised NC: 3 (three) grams are heated for 1 hour*) as determined by titration with alkali.

### 2.2 Apparatus and materials

2.2.1 Analytical balance, precision 10 mg or better.

2.2.2 Bergman-Junk tube made of clear glass, approximately 17.5 mm inner diameter, 19.5 mm, outer diameter, and 270 mm to 350 mm long fitted with a condensing chamber. Several different types of suitable condensing chambers are commercially available. (for examples see figures A10.1 and A10.2).

2.2.3 Stability bath: Oil or suitable fluid bath or metal block capable of maintaining the temperature of the stability tubes at  $132^{\circ}\text{C} \pm 1^{\circ}\text{C}$  or better. The temperature of the bath should be monitored with a calibrated thermometer or thermocouple (precision  $0.1^{\circ}\text{C}$ ) which is located in one of the test wells.

2.2.4 The following apparatus is required:

- 10 cm<sup>3</sup> semi-automatic pipette or equivalent.
- 250 cm<sup>3</sup> conical flash with wide neck.
- 50 cm<sup>3</sup> test tube.
- Titration burette 10 ml to 25 ml; or automated potentiometric titration apparatus with pH-electrode and calibrated class A burette

2.2.5 Sodium hydroxide (NaOH) solution 0.01 mol/l, specification 0.009998 to 0.01002 mol/l for manual titration with a standard burette, or 0.1 mol/l for the titration with an automated potentiometric titration apparatus with pH-electrode and calibrated class A burette, with factor determined to obtain the exact molarity of the sodium hydroxide solution.

2.2.6 Suitable pH indicator e.g. methyl orange, methyl red, methyl red/methylene blue or R8 B3 coloured indicating fluid (Tacchiro). Solution composed of 1% alcohol mixed with 8 g of methyl red and 3 g of purple methyl (if manual titration is used).

2.2.7 Fully deionized or distilled water with a conductivity  $< 1 \mu\text{S}/\text{cm}$  (micro Siemens /cm).

### 2.3 Procedure

2.3.1 Weigh 1 (one) or 2 (two) gram(s) of dry nitrocellulose to an accuracy of 0.01 g. (*Weigh 3 (three) grams of plasticised NC to an accuracy of 0.01 g*). The moisture content of the sample must be below 1 % after the drying process and at the time, when it is introduced in the tube. (Drying conditions must be chosen, which avoid a decomposition of the nitrocellulose, e.g.  $50^{\circ}\text{C}$  in a vacuum oven) With the help of a funnel introduce this into the tube which must be dry and clean. Wipe the ground section thoroughly and adjust the condensing chamber making sure that the above is well greased with silicone grease; it may also not be greased.

2.3.2 Measure out 15 ml to 50 ml of distilled water, depending on the condenser type, in a test tube and pour into the bulbs of the condenser. Ensure that no water enters the stability tube.

2.3.3 Make sure that the stability bath has reached a temperature of  $132^{\circ}\text{C} \pm 1^{\circ}\text{C}$  and then insert each tube into one of the apertures in the bath. The depth of immersion of the tube will vary depending on the type of stability bath used but must be between 110 mm and 220 mm. Make a note of the time at which the experiment begins.

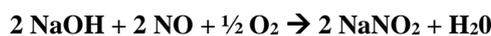
2.3.4 Maintain the tubes at a temperature of  $132^{\circ}\text{C} \pm 1^{\circ}\text{C}$  for two hours unless pronounced fuming is observed. If fuming occurs, the test shall be stopped immediately and the duration of the heating period noted.

2.3.5 After two hours at  $132^{\circ}\text{C}$  (*1 hour for plasticised NC*) remove the tube from the bath, place it in its stand and allow to cool behind a safety screen. During this time some water may be drawn into the lower tube. After 30 min cooling transfer the contents of the condensing chamber into the lower tube and rinse the condensing chamber with distilled water.

2.3.6 Transfer the contents of the lower tube into the conical flask and rinse with distilled water. The total amount of liquid should not be more than 175 ml.

2.3.7 Titrate with  $c_{\text{NaOH}} = 0.01$  mol/l sodium hydroxide solution until the color of the indicator changes.

2.3.8 *Calculations*



$$V_{\text{NO}} = \frac{c_{\text{NaOH}} \times C_{\text{NaOH}} \times V_{\text{NO,m}}}{m_{\text{NC}}} = \frac{C_{\text{NaOH}} \times 0.224}{m_{\text{NC}}} = C_{\text{NaOH}} \times 0.224$$

where:

$V_{\text{NO}}$  = volume of the evolved nitrogen oxide in  $\text{cm}^3/\text{g}$  nitrocellulose

$c_{\text{NaOH}}$  = concentration of sodium hydroxide solution = 0.01 mol/l

$C_{\text{NaOH}}$  = consumption of sodium hydroxide solution in ml.

$V_{\text{NO,m}}$  = molar volume of NO gas = 22.4 l/mol

$m_{\text{NC}}$  = mass of nitrocellulose in g

If a sodium hydroxide solution with  $c_{\text{NaOH}} =$  concentration of sodium hydroxide solution = 0.1 mol/l is used, the formula is:

$$V_{\text{NO}} = C_{\text{NaOH}} \times 2.24$$

The formula is based on the assumption that nitrogen oxide evolves as NO and that NO is an ideal gas; according on the ideal gas law, 1 mol of gas occupies a volume of 22.4 l.

The total absence of acidity in the water is verified by a mock test; otherwise the value determined by the mock test is subtracted.

Also aliquot portions of the water containing the NO gas may be used, resulting in different factors in the formula.

## 2.4 *Test criteria and method of assessing results*

2.4.1 The test result is considered "+" and the substance is classified as unstable if the quantity of NO gas given off is more than 2.5 ml/g of NC. If the quantity of NO gas given off is less than or equal to 2.5 ml/g, of NC the result is "-" and the substance is classified as stable.

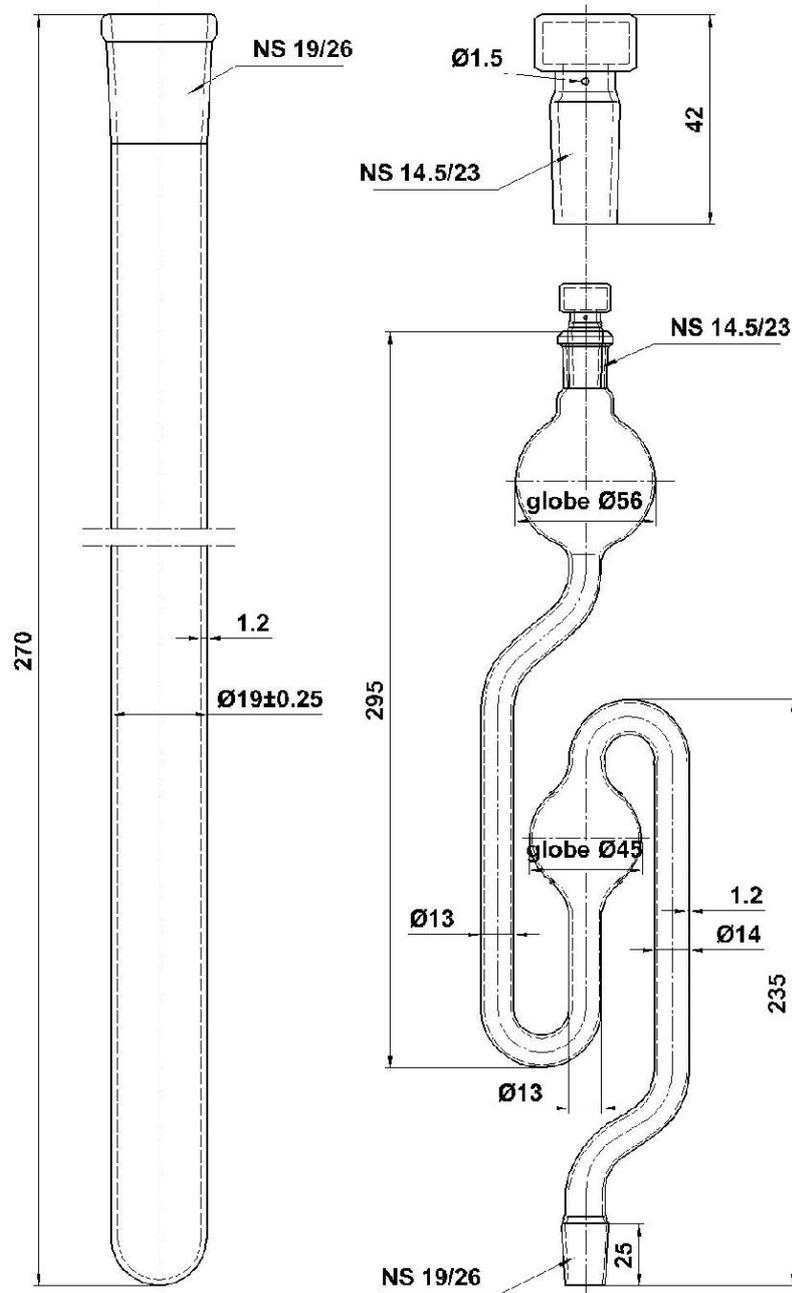
## 2.5 Examples of results

Quantity of NO gas/g of NC	Result
2.6 ml	+
2.5 ml	-

Figure A10.1: Condensing chamber for Bergmann Junk test example 1



Figure A10.2: Condensing chamber for Bergmann Junk test example 2



### 3. Methyl violet paper test (134.5°C heat test)

#### 3.1 Introduction

The stability of nitrocellulose is tested by examining the colour change of reagent paper over a period of time.

## 3.2 *Apparatus and materials*

### 3.2.1 *Apparatus*

The following equipment shall be used in the apparatus for 134.5°C heat test (methyl violet paper test):

- (a) Analytical balance, precision 0.01 g or better.
- (b) Stability bath: Water-ethylene glycol bath, oil bath, or metal block oven capable of maintaining the temperature of the stability tubes at  $134.5 \pm 0.5^\circ\text{C}$ . Temperature of bath has to be monitored with a calibrated thermometer or thermocouple (precision  $0.1^\circ\text{C}$ ) which is located in a test tube filled with inert material (e.g., sand); the test tube is placed in one of the thermowells. The inner diameter of each thermowell in the apparatus shall be  $19 \pm 0.5$  mm. Depth of immersion of the stability test tubes shall be such that no more than 6 to 7 mm of the tubes project above the bath.
- (c) Stability test tubes made of clear glass, approximately 15 mm inner diameter; 18 mm outer diameter; and 290 mm length.
- (d) Powder funnel; metal or conductive plastic funnel with a long tube (to prevent electrostatic charging).
- (e) Corks, each containing one breather hole 4 mm in diameter (or notch of equivalent area).

### 3.2.2 *Materials*

3.2.2.1 A sample of dry nitrocellulose weighing  $2.50 \pm 0.01$  g. The moisture content of the sample must be below 1% after the drying process and at the time, when it is introduced in the tube. Drying conditions must be chosen, which avoid a decomposition of the nitrocellulose, e.g.  $50^\circ\text{C}$  in a vacuum oven.

3.2.2.2 Standardized reagent methyl violet test papers approximately  $70 \pm 1.0$  mm long and  $20 \pm 0.6$  mm wide (see 6.16) or methyl violet test papers prepared and tested using the following method:

#### 3.2.2.2.1 Preparation of the indicator solution

To prepare 100 ml of indicator solution (note: if different amount of solution is required, it can be prepared while maintaining these proportions): 0.250 g of basic rosaniline (equivalent to CAS number 632-99-5) is weighed into a porcelain dish, and about 10 ml of reagent grade acetic acid is added. The dish is heated on a water bath until all excess of acid is removed. In a 100 ml graduate cylinder, 0.168 g of crystal violet (equivalent to CAS number 548-62-9) is dissolved in 30 ml of high purity water and 5.0 g (4 ml) of reagent grade glycerine is added. The content of the porcelain dish is added to the cylinder using ethanol (minimum 95% v/v) and adjusted to produce 100 ml of solution. The solution is mixed thoroughly.

#### 3.2.2.2.2 Preparation of the methyl violet paper

Sheets of paper are prepared by cutting filter papers (equivalent to Whatman 597, typically  $580 \text{ mm} \times 580 \text{ mm}$  with approximately  $8.5 \text{ mg/cm}^2$ ) into square parts that will fit into a low edge dish large enough to fit the cut sheet (typically cut in 4 square parts about  $290 \text{ mm} \times 290 \text{ mm}$ ). In a fume-hood, the methyl violet solution is poured into the low edge dish. Separately, each cut sheet of paper is dipped completely into the solution for about 30 seconds. The strip is removed from the solution and the wet sheet of paper rotated

vertically until the solution stops dripping (excess alcohol will evaporate in about 1 minute). The strip is hung up overnight to dry in a room free from deleterious fumes. When dry, the strips are cut in the size of  $70 \pm 1.0$  mm long and  $20 \pm 0.6$  mm wide. Once certified, they are kept in tightly closed amber glass bottles or opaque plastic bottles with a maximum of 200 papers per bottle. The bottle shall be kept closed, stored at room temperature, and out of direct light at all times except to briefly extract indicator papers.

#### 3.2.2.2.3 Certification of the methyl violet paper

3.2.2.2.3.1 A minimum of one paper from each 200 max bottle is tested for the content in water and shall be 7.5 to 15% water content by oven drying. If required, the paper may be rehydrated by keeping the paper in a controlled humidity chamber controlled at 60 to 80% relative humidity until the correct water content is obtained.

3.2.2.2.3.2 To confirm that the reactivity of the methyl violet paper is acceptable, a minimum of 1 paper from each 200 max bottle shall be tested using nitrogen dioxide gas of known concentration in air between 1500 and 2500 ppm (v/v). The gas may be obtained already diluted and certified or obtained by dilution using pure nitrogen dioxide. The gas concentration shall be known with an accuracy of  $\pm 2.5\%$ .

3.2.2.2.3.3 Based on the concentration of the nitrogen dioxide gas, the required flowrate for an end-point centered at 55 min is given by:

Flowrate (ml/min) =  $83636 / \text{Gas concentration in ppm (v/v) of nitrogen dioxide gas}$ .

3.2.2.2.3.4 The flowrate shall be maintained within  $\pm 1.5$  ml/min of the calculated value during the certification of the paper. The paper is tested using the standard gas and a cylindrical flow cell of about 30 ml containing one paper (the flow cell diameter is similar to the methyl violet paper width). The end-point is obtained when the paper is completely salmon pink after  $55 \pm 7$  min.

3.2.2.2.3.5 Only the batches that meet those 2 criteria (water content and reaction time) will be considered certified methyl violet paper. The paper shall be stored at room temperature and in the shade. The maximum shelf-life of the indicator papers in a sealed bottle is 5 years. Once the bottle is open, the shelf-life of the bottle's contents is reduced to 1 year. After 1 year, the water content of the paper shall be verified and adjusted, if necessary. The bottle containing the verified indicator papers shall be given another 1 year of shelf-life. Under no circumstances shall the indicator paper shelf-life be extended beyond 5 years after manufacture.

### 3.3 Procedure

3.3.1 Sample and interior of test tubes shall not be touched by bare hands. The test is to be performed in duplicate; with further repetition of test if the two results of the duplicate measurement differ by more than 5 min.

3.3.2 Two portions of  $2.5 \pm 0.01$  g each of dry nitrocellulose sample are transferred into the stability test tubes, preferably by a powder funnel. Each tube is tapped gently in order to settle the material, and any material adhering to the sides of the tubes is brushed down. If the nitrocellulose occupies a greater length than 5 cm, it has to be compressed to that length by means of a flat headed rod. Into each tube a piece of the test paper is placed vertically so that the lower end of the paper is 25 mm above the specimen. Then a cork is placed in each tube. The two tubes are placed in the bath and maintained at a temperature of  $134.5 \pm 0.5^\circ\text{C}$ .

### 3.4 Test criteria and method of assessing results

3.4.1 In order to determine the test time, the test papers are examined after the first 20 min in the bath, and thereafter at 5 min intervals. For each examination of test papers, the

tubes are lifted half way out of the bath to monitor test paper colour change, and quickly replaced.

3.4.2 When the test paper in any tube has changed colour completely to salmon pink, the test is considered complete.

3.4.3 The test time is then recorded (for example, if the violet paper is not completely changed in 25 min, but is completely changed in 30 min, the time of the test is recorded as 30 min). The test is discontinued when the salmon pink end point is attained in any of the papers.

3.4.4 The test result is considered "+" and the substance is classified as unstable if the test paper completely changes colour in less than 30 min. If the colour change exceeds 30 min the result is "-" and the substance is classified as stable.

### 3.5 *Examples of results*

Time	Result
25 min	+
35 min	-

”

## **New Appendix 11**

Insert the following new Appendix 11:

### **“APPENDIX 11**

#### **COMPILATION OF CLASSIFICATION RESULTS ON INDUSTRIAL NITROCELLULOSE FOR THE PURPOSES OF SUPPLY AND USE ACCORDING TO GHS CHAPTER 2.17, WHICH CAN BE USED FOR THE CLASSIFICATION OF INDUSTRIAL NITROCELLULOSE PRODUCTS.**

Requirements for the use of the test results for the classification of industrial nitrocellulose products:

1. The test results in this Appendix can only be used for the classification of industrial nitrocellulose products packed in fibre board boxes (4G) or fibre drums (1G) according to packing instruction P406. They cannot be used for nitrocellulose products in other pressure resistant packaging like steel drums.
2. The test results in this Appendix can only be used for industrial nitrocellulose products which fulfil the test requirements of the Bergmann Junk test for the thermal stability demonstrated by the fact that the quantity of nitrous vapours given off is not more than 2.5 ml/g NO during the test at 132 °C. The Bergman-Junk stability test is described in Appendix 10.

#### **Test results**

3. All industrial nitrocellulose products worldwide can be made comparable based upon their nitrogen content and their Norm-viscosities (according to ISO 14446). This method has been used for presenting the results of the tests in the following tables. It should be noted that Norm-viscosities are also used as found in the publications of the storage group classifications, whereby the storage group classification refers to the storage of industrial nitrocellulose in warehouses.

4. According to their nitrogen content three types of industrial nitrocellulose products have been defined:

- (a) E-grades as ester soluble products with nitrogen content from 11.8 to 12.3 %;
- (b) M-grades as medium soluble grades with nitrogen content of 11.3 to 11.8 %;
- (c) A-grades as alcohol soluble grades with a nitrogen content of 10.7 to 11.3 %.

The testing results have been grouped accordingly into 3 separate tables (A11.1 to A11.3).

5. The first column of the tables provides the types of the industrial nitrocellulose, which are identified according to ISO 14446 by a combination of two elements:

- (a) A 1- or 2-digit number, which indicates the concentration of the nitrocellulose solution that is required for a viscosity of  $400 \pm 25$  mPa.s; and
- (b) A letter which identifies the solvent in which the nitrocellulose product is soluble.
  - (i) E stands for ester soluble;
  - (ii) M stands for medium soluble;
  - (iii) A stands for alcohol soluble.

For example for the nitrocellulose type 4E in the first table, with a concentration of 4%, a viscosity of  $400 \pm 25$  mPa.s is achieved.

The viscosities are measured in a solvent mixture of 95% acetone/5% water with a Höppler viscometer. Historically industrial nitrocellulose types have been developed for a number of Norm-viscosities only and not for all Norm-viscosities. As it is technically possible to produce products with all Norm-viscosities, all relevant Norm-viscosities were entered in the tables, but some cells in the tables therefore remain empty.

6. The results of the tests are presented per phlegmatizer content for the phlegmatizers Isopropanol (IPA), Ethanol (ETH), Butanol (BUT) and Water and NC-chips with plasticiser.

**Compilation of category classifications for NC-Norm grades according to GHS chapter 2.17 desensitized explosives\***

**Table A11.1: Part ester soluble E-grades with a nitrogen content of 11.8 to 12.3 %**

NC-type	IPA 35%	IPA 30%	ETH 35%	ETH 30%	BUT 35%	BUT 30%	Water 35%	NC-Chips with 20% Plasticizer
3E								
4E	1 (330)	1 (760 )	3	3	1 (530)	1 (540)		1 (1115)
5E								
6E	2		3		1 (390)			1 (1115)
7E	2	1 (430 )	3	3	1 (320)	1 (420)		1 (1115)
8E	2		3		2	1 (420)		1 (1115)
9E	2	1 (330)	3	3	2	1 (420)		1 (1115)
10E	2		3		2			1 (1115)
11E								
12E	3	2	4	3	2	1 (330)	4	1 (1115)
13E	3		4		2			1 (1115)
14E								
15E	3	2	4	3	2	2		1 (1115)
16E								
17E								
18E	3		4		3			1 (1115)
19E								
20E	3	3	4	3	3			1 (1115)
21E					3	3		1 (1115)
22E	3	3	4	3	3	3	4	1 (1115)
23E	3	3	4		3		4	1 (1115)
24E	3	3	4	3	3	3		1 (1115)
25E	3	3	4	3	3	3	4	1 (1115)
26E								
27E	3	3	4	3	3	3		1 (1115)
28E	3	3	4		3			
29E								
30E					3	3		
31E	3		4					1 (1115)
32E	3	3	4	3	3	3		1 (1115)
33E								
34E	4	3	4	3	3			1 (1115)
35E								
36E								
37E								
38E								

\* Source: Tests conducted by BAM from 1981 to 2011.

**Table A11.2: Part medium soluble M-grades with a nitrogen content of 11.3 to 11.8 %**

NC-Type	IPA 35%	IPA 30%	ETH 35%	ETH 30%	BUT 35%	BUT 30%	Water 35%	NC-Chips with 20% Plasticizer
12M					3			
13M								
14M	3	3	4	3				1 (1115)
15M					3	2		
16M								
17M	3	3	4	3	3			1 (1115)
18M	3	3	4	3	3			1 (1115)
19M								
20M								
21M	3	3	4	4	3			1 (1115)
22M								
23M								
24M					3	3		
25M					3	3		
26M								
27M	4	3	4	4	3	3	4	1 (1115)
28M								
29M								
30M					3	3		
31M								
32M					3	3		
33M								
34M	4	3	4	4	4			1 (1115)

**Table A11.3: Part Alcohol-soluble A-grades with a Nitrogen content of 10.7 to 11.3 %**

NC-Type	IPA 35%	IPA 30%	ETH 35%	ETH 30%	BUT 35%	BUT 30%	Water 35%	NC-Chips with 20% Plasticizer
7A								
8A								
9A	4	3	4	3	3			1 (1115)
10A								
11A								
12A								
13A								
14A								
15A	4	3	4	3	4	2		1 (1115)
16A								
17A								
18A								
19A								
20A								
21A								
22A								
23A	4	3	4	4	4			1 (1115)
24A					4	3		
25A					4	3		
26A								
27A	4	3	4	4	4	3		1 (1115)
28A								
29A								
30A	4	3	4	4	4	3	4	1 (1115)
31A	4	3	4	4				1 (1115)
32A	4	3	4	4	4	3		
33A		3	4					1 (1115)
34A								
35A								

”

\_\_\_\_\_