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**Issues relating to the Globally Harmonized System
of Classification and Labelling of Chemicals:
Use of the Manual of Tests and Criteria in the
context of the GHS**

Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals

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Item 2 (a) of the provisional agenda

**Classification criteria and related hazard
communication:
Work of the Sub-Committee of Experts on the
Transport of Dangerous Goods (TDG) on matters of
interest to the GHS Sub-Committee**

Use of the Manual of Tests and Criteria in the context of the GHS : Part I (section 10)

Transmitted by the Chairman of the Working Group on Explosives

This document takes account of the amendments to the 6th revised edition of the Manual of Tests and Criteria agreed by the Working Group so far (see ST/SG/AC.10/C.3/102 paragraphs 95 to 97 and ST/SG/AC.10/C.4/66 paragraph 8).

Revision of sections 20 to 28 of the Manual is ongoing.

PART I

**CLASSIFICATION PROCEDURES,
TEST METHODS AND CRITERIA
RELATING TO EXPLOSIVES
~~OF CLASS 1~~**

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NOTE 1: The country or organization of origin of each test method is indicated in brackets after each test name.

NOTE 2: The test method recommended for use with each test type is indicated in **bold** and by an asterisk (see subsection 1.6 of the General Introduction).

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SECTION 10

INTRODUCTION TO PART I

10.1 Purpose

10.1.1 Part I of the Manual presents the United Nations scheme for the classification of explosives. It includes a description of the procedures and test criteria considered to be the most useful for providing ~~competent authorities with~~ the necessary information to arrive at a proper classification of explosive substances and articles ~~for transport~~. It should be used in conjunction with the classification flow charts in figures 10.1, 10.2, 10.3, 10.4 and 10.5, the general conditions for testing in sub-section 1.5 and the appropriate test prescriptions in sections 11 to 18 of this Manual.

10.1.2 ~~Goods of Class 1~~ Explosives, other than unstable explosives, are assigned to one of 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 ~~which~~ that identify the kinds of explosives ~~substances and articles~~ 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 ~~Class 1~~ 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 ~~should be~~ is ascertained and its chemical and physical stability and sensitivity, ~~both chemically and physically, shown to be acceptable~~ are also determined. In order to promote uniform assessments by competent authorities, 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 ~~Class 1~~, it is then necessary to proceed to the second stage and assign it to the correct division by use of the flow charts ~~of~~ in 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 by the competent authority if classification by analogy is based on test results for a comparable article.

10.1.3 The test procedures allow assessment of the hazard of explosive substances and articles so that an appropriate classification ~~for transport~~ can be ~~made~~ assigned. ~~When appropriate this is done~~ by the competent authority.

10.2 Scope

10.2.1 New products which are considered as having explosive properties or are intended to function as explosives should first be considered for inclusion in the class of explosives ~~Class 1~~. For substances such as self-reactive substances ~~of Division 4.1~~ or organic peroxides ~~of Division 5.2~~, refer to Part II of this Manual. In this context a new product is one which, ~~when appropriate~~ in the opinion of the competent authority, involves any of the following:

- (a) A new substance ~~or a combination or mixture of substances~~, intended to function as an explosive or pyrotechnic, which is considered to be significantly different from other ~~combinations or mixtures~~ substances already classified;
- (b) A new substance or article, not intended for explosive use, which has, or is suspected of having, explosive properties ~~(see paragraph 2.1.1.5 of the Model Regulations)~~;
- (c) A new design of article containing an explosive substance or an article containing a new explosive substance ~~or a new combination or mixture of explosive substances~~; or
- (d) A new design of package for an explosive substance or article including a new type of inner packaging or a new arrangement of articles (a relatively minor change to an inner or outer packaging can be critical and can convert a lesser ~~risk hazard~~ into a mass explosion ~~risk hazard~~).

~~The classification procedure should be undertaken before a new product is offered for transport.~~

10.2.2 The producer, or other applicant for the classification of a new product, should provide adequate information concerning the names and characteristics of all explosive substances in the product and should furnish the results of all relevant tests which have been done.

10.3 Acceptance procedure

10.3.1 *General description*

10.3.1.1 The acceptance procedure is used to determine whether or not a product as offered for transport is a candidate for the class of explosives ~~Class 1~~. This is decided by determining whether a substance provisionally accepted into the class of explosives ~~for Class 1~~ is either too insensitive for inclusion in this class ~~Class 1~~ or is accepted as an unstable explosive (and considered too dangerous for transport); or whether article(s) or packaged article(s) are accepted as an unstable explosive (and considered too dangerous for transport).

10.3.2 *Test types*

10.3.2.1 The test methods used for deciding provisional acceptance into the class of explosives ~~Class 1~~ are grouped into four series (~~Test series numbered~~ 1 to 4), and designed to provide the information necessary to answer the questions in Figure 10.2.

10.3.2.2 The question "~~Does Is it have an~~ explosive ~~substance~~ properties?" (box 45, Figure 10.2) is answered on the basis of national and international definitions of an explosive substance and the results of three types of Series 1 tests to assess possible explosive effects. The three types of test used are:

- Type 1 (a): a shock test with defined booster and confinement to determine the ability of the substance to propagate a detonation;
- Type 1 (b): a test to determine the effect of heating under confinement; and
- Type 1 (c): a test to determine the effect of ignition under confinement.

10.3.2.3 Series 2 tests are used to answer the question "Is ~~the substance~~ it too insensitive for acceptance into this class ~~1~~?" (box 67, Figure 10.2). In general the basic apparatus used is the same as that for Test Series 1 but with less stringent criteria, e.g. in the case of gap tests, the gap used is greater than zero. The following three types of test are used:

- Type 2 (a): a shock test with defined initiation system and confinement to determine sensitivity to shock;
- Type 2 (b): a test to determine the effect of heating under confinement; and
- Type 2 (c): a test to determine the effect of ignition under confinement.

Figure 10.1: OVERALL SCHEME OF THE PROCEDURE FOR CLASSIFYING A SUBSTANCE OR ARTICLE IN CLASS 1

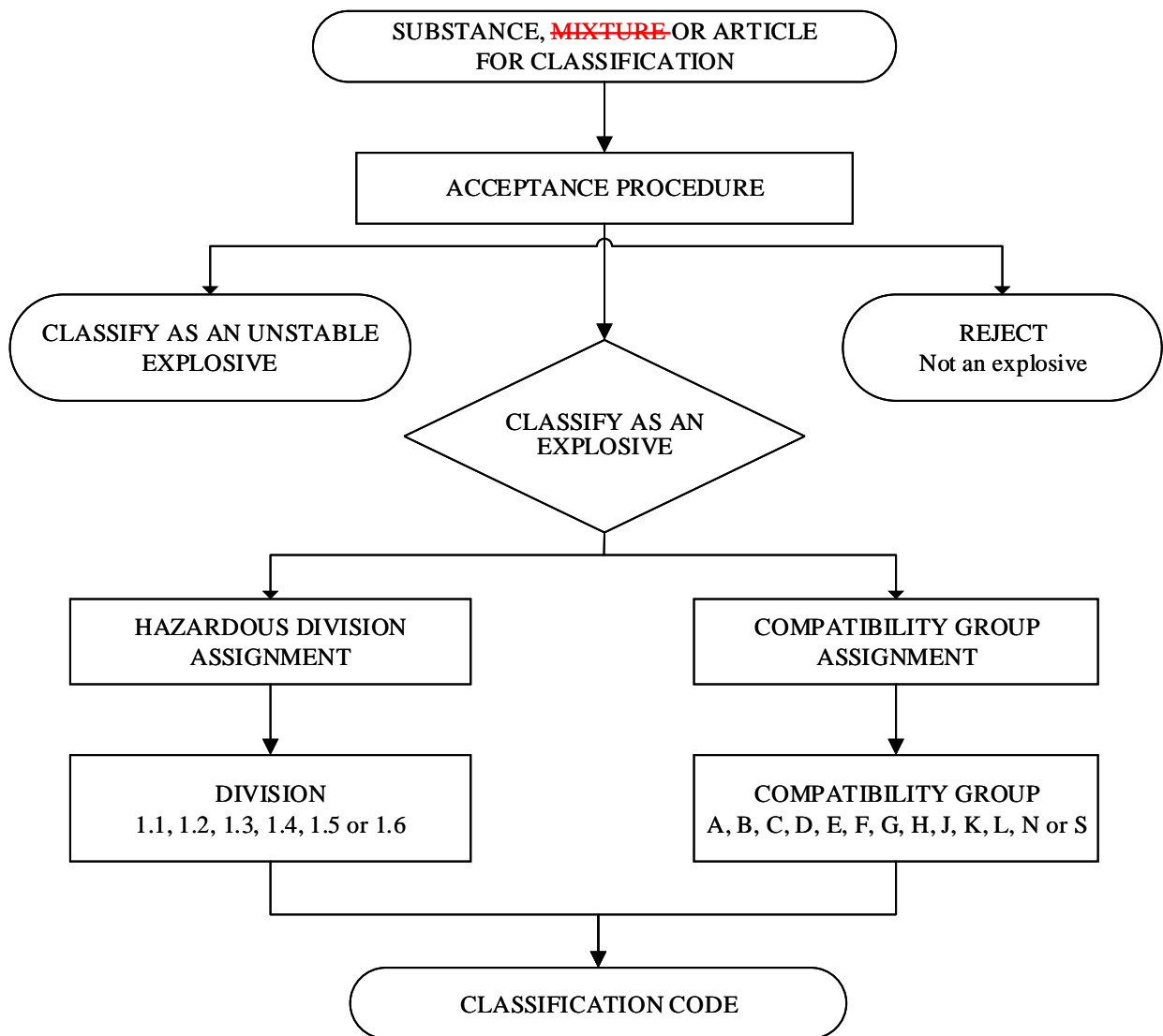
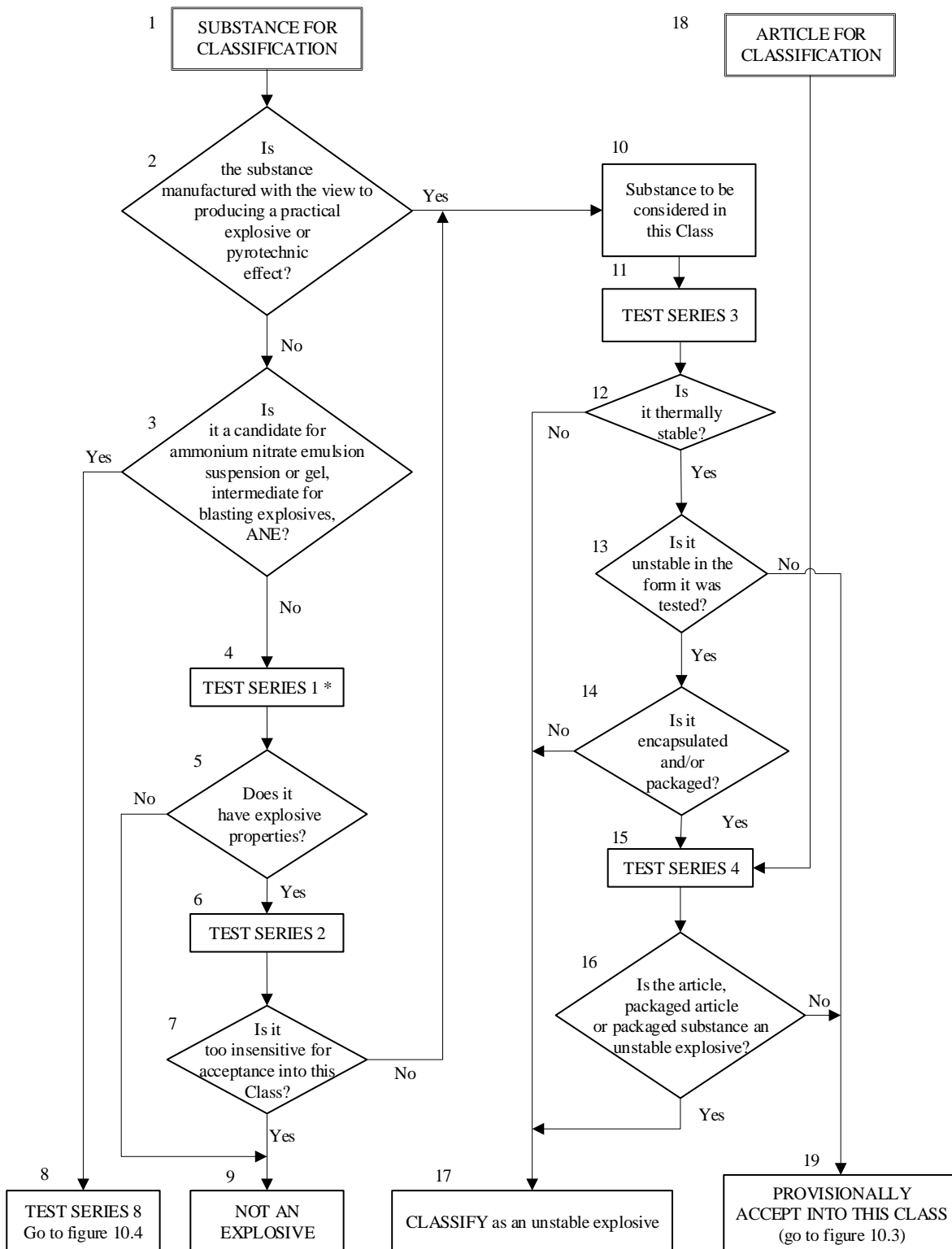


Figure 10.2: PROCEDURE FOR PROVISIONAL ACCEPTANCE OF A SUBSTANCE OR ARTICLE IN THE CLASS OF EXPLOSIVES¹



¹/ For classification purposes, start with test series 2

10.3.2.4 Test series 3 is used to answer the questions "Is ~~it the substance~~ thermally stable?" (box 12+10, Figure 10.2) and "Is ~~it unstable the substance too dangerous for transport~~ in the form ~~in which~~ it was tested?" (box 13+11, Figure 10.2). This involves tests for determining the sensitiveness of the substance to mechanical stimuli (impact and friction), and to heat and flame. The following four types of test are used:

- Type 3 (a): a falling weight test to determine sensitiveness to impact;
- Type 3 (b): a friction, or impacted friction, test to determine sensitiveness to friction;
- Type 3 (c): an elevated temperature test to determine thermal stability; and
- Type 3 (d): an ignition test to determine the response of a substance to fire.

10.3.2.5 Series 4 tests are intended to answer the question "Is the article, packaged article or packaged substance ~~an unstable explosive too dangerous for transport?~~" (box 16, Figure 10.2). Conditions which may occur during transport include high temperature and high relative humidity, low temperature, vibration, bumping and dropping. The two types of test to be carried out are:

- Type 4 (a): a test of thermal stability for articles; and
- Type 4 (b): a test to determine the hazard from dropping.

10.3.3 *Application of the test methods*

10.3.3.1 The numbering of test series 1 to 4 relates to the sequence of assessing the results rather than the order in which the tests are conducted. ***It may be important for the safety of experimenters that certain preliminary tests, using small amounts of material, be conducted first before proceeding to experiment with larger quantities.*** The results of these preliminary tests may also be used in the classification procedure.

10.3.3.2 The acceptance procedure for substances designed to have a practical explosive or pyrotechnic effect starts with the application of test series 3 to determine if the substance is too sensitive for transport in the form in which it is tested. If the substance passes all tests, the procedure for the assignment to the appropriate division is applied. If the substance fails any of the tests, it is forbidden for transport in the form tested. A substance which fails test type 3 (c) may be altered and resubmitted to test type 3(c). A substance which fails test types 3 (a), 3 (b) or 3 (d) may be encapsulated or packaged to reduce sensitiveness to external stimuli and submitted to test type 4(b).

10.3.3.3 All articles as presented for transport (packaged or unpackaged) should be subjected to test series 4. However, if there is sufficient information to indicate that the article would not be too dangerous for transport, the competent authority may decide to waive all or part of these tests for the article. If the product passes all the required tests in test series 4, the procedure for assignment to the appropriate division is applied. If the product fails any of the required tests, it is forbidden for transport in the form tested, but it may be modified or repackaged and resubmitted to test series 4. If the competent authority suspects that the product may be subject to stimuli other than those specified in test series 4 resulting in potentially dangerous effects, additional information or tests may be required (see note under paragraph 2.1.3.3.1 of the Model Regulations).

10.3.3.4 ~~Although~~ Test series 1 indicates whether a substance, ~~not designed to have an explosive effect,~~ has ~~in fact potentially~~ explosive properties. However, for a new substance not designed to have a practical explosive or pyrotechnic effect, ~~again~~ it is more appropriate to start the testing procedure with test series 3. ~~These tests~~ Test Series 3 involves relatively small sample sizes, which reduces the risk to test personnel. ~~If test series 3 indicates that a substance is too sensitive for transport in the form in which it is tested, then the procedures for reducing its sensitiveness to external stimuli, outlined in 10.3.3.2, should be applied.~~ If ~~test series 3 indicates that~~ the substance passes test series 3 is ~~not too sensitive for transport,~~ as a practical matter the next step is the application of test series 2 which determines whether the substance is too insensitive for inclusion into ~~the class of explosives Class 1.~~ There is no real need to perform test series 1 at this point. ~~in the acceptance procedure since test series 2 answers the pertinent question regarding the degree of insensitiveness of the substance. Test series 1 is concerned with the resolution of questions relating to the explosive nature of the substance. The procedure for assignment to a division of Class 1 should be applied to~~ Substances which fail test series 2 but pass test series 3 ~~i.e. they are not too insensitive for acceptance into Class 1 nor are they thermally unstable or too dangerous to transport in the form in which they are tested~~ 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, ~~if properly packaged, leave~~ be excluded from the class of explosives ~~Class 1~~ provided that the substance ~~product~~ is not designed to have an practical explosive or pyrotechnic ~~explosive~~ effect, and ~~does not~~ nor exhibits any ~~explosive-hazardous effects~~ in test series 6 of the assignment procedure as packaged.

10.3.3.5 If articles contain expensive, inert, control components, for testing purposes these may be replaced by inert components having a similar mass and volume.

10.4 Procedure for assignment to a division of ~~Class 1~~ the class of explosives

10.4.1 General description

10.4.1.1 ~~Goods of Class 1~~ Unless classified as unstable, explosives are assigned to one of six divisions, depending on the type of hazard they present (see paragraph 2.1.1.4 of the Model Regulations and 2.1.2 of the GHS). The assignment procedure (figures 10.3 and 10.5) applies to all substances and ~~or~~ articles that are candidates for this class ~~Class 1~~ except those declared from the outset to be in Division 1.1. A substance or article is ~~should be~~ assigned to the division which corresponds to the results of the tests to which it ~~the substance or article, as offered for transport,~~ has been subjected. Other test results, and data assembled from accidents which have occurred, may also be taken into account. As indicated in box ~~39~~ ~~36~~ of Figure 10.3, there is authority to exclude an article from the class of explosives ~~Class 1~~ by virtue of test results and the “explosives” ~~Class 1~~ definition (see paragraph 2.1.1.1 (b) of the Model Regulations and paragraph 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 the Model Regulations (see paragraph 2.1.3.6.4).

10.4.2 Test types

10.4.2.1 The test methods used for assignment to a division are grouped into three series (~~numbered Test Series~~ 5 to 7) designed to provide the information necessary to answer the questions in Figure 10.3. The tests in series 5, 6 and 7 should not be varied unless the ~~competent national~~ authority is prepared to justify such action internationally.

10.4.2.2 The results from three types of series 5 tests are used to answer the question "Is it a very insensitive explosive substance with a mass explosion hazard?" (box ~~28~~ ~~21~~, Figure 10.3). The test types are:

Type 5 (a): a shock test to determine the sensitivity to intense mechanical stimulus;

Type 5 (b): thermal tests to determine the tendency for transition from deflagration to detonation; and

Type 5 (c): a test to determine if a substance, when in large quantities, explodes when subjected to a large fire.

Figure 10.3: PROCEDURE FOR ASSIGNMENT TO A DIVISION OF THE CLASS OF EXPLOSIVES †

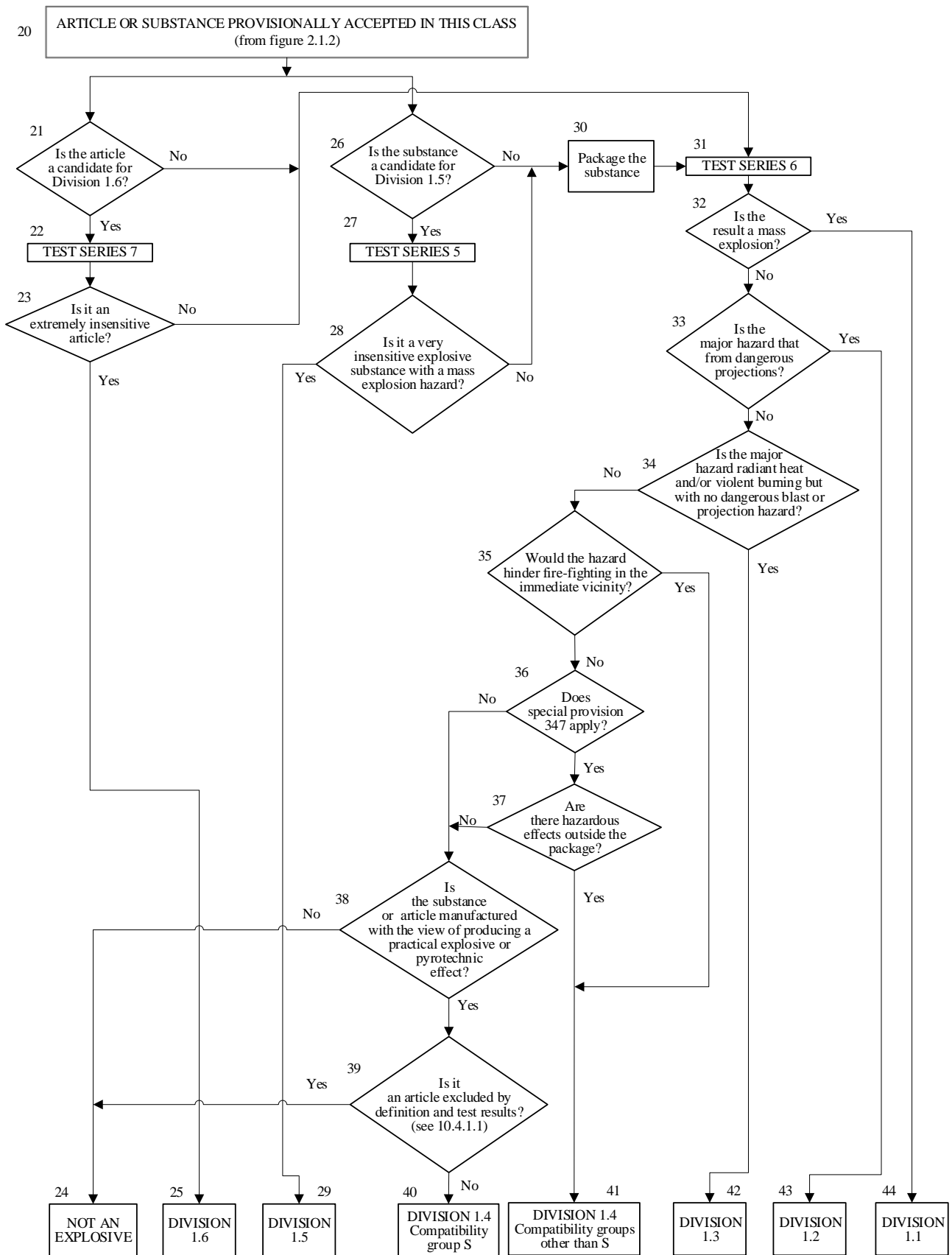


Figure 10.4: PROCEDURE FOR AMMONIUM NITRATE EMULSION, SUSPENSION OR GEL, INTERMEDIATE FOR BLASTING EXPLOSIVES

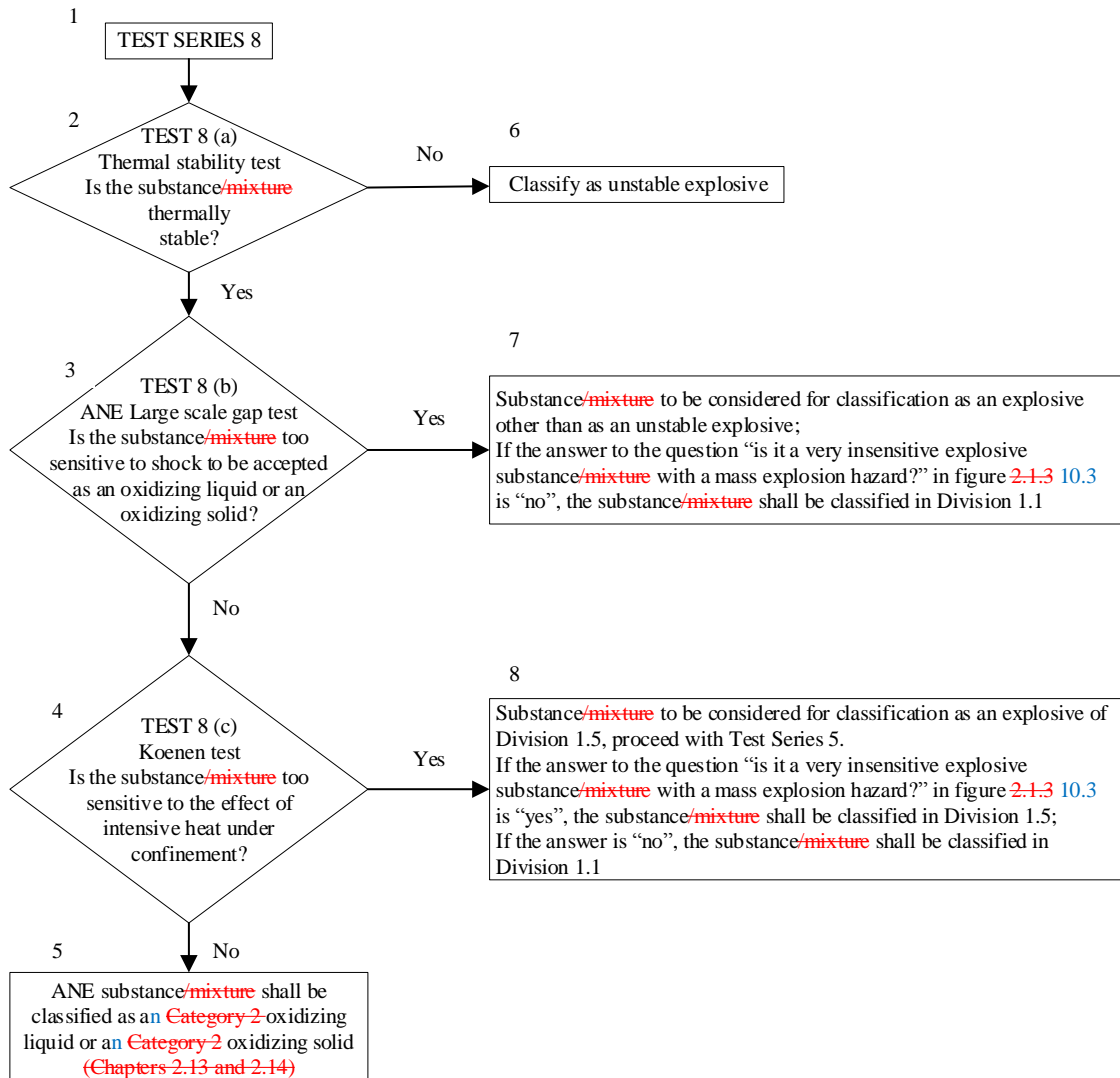
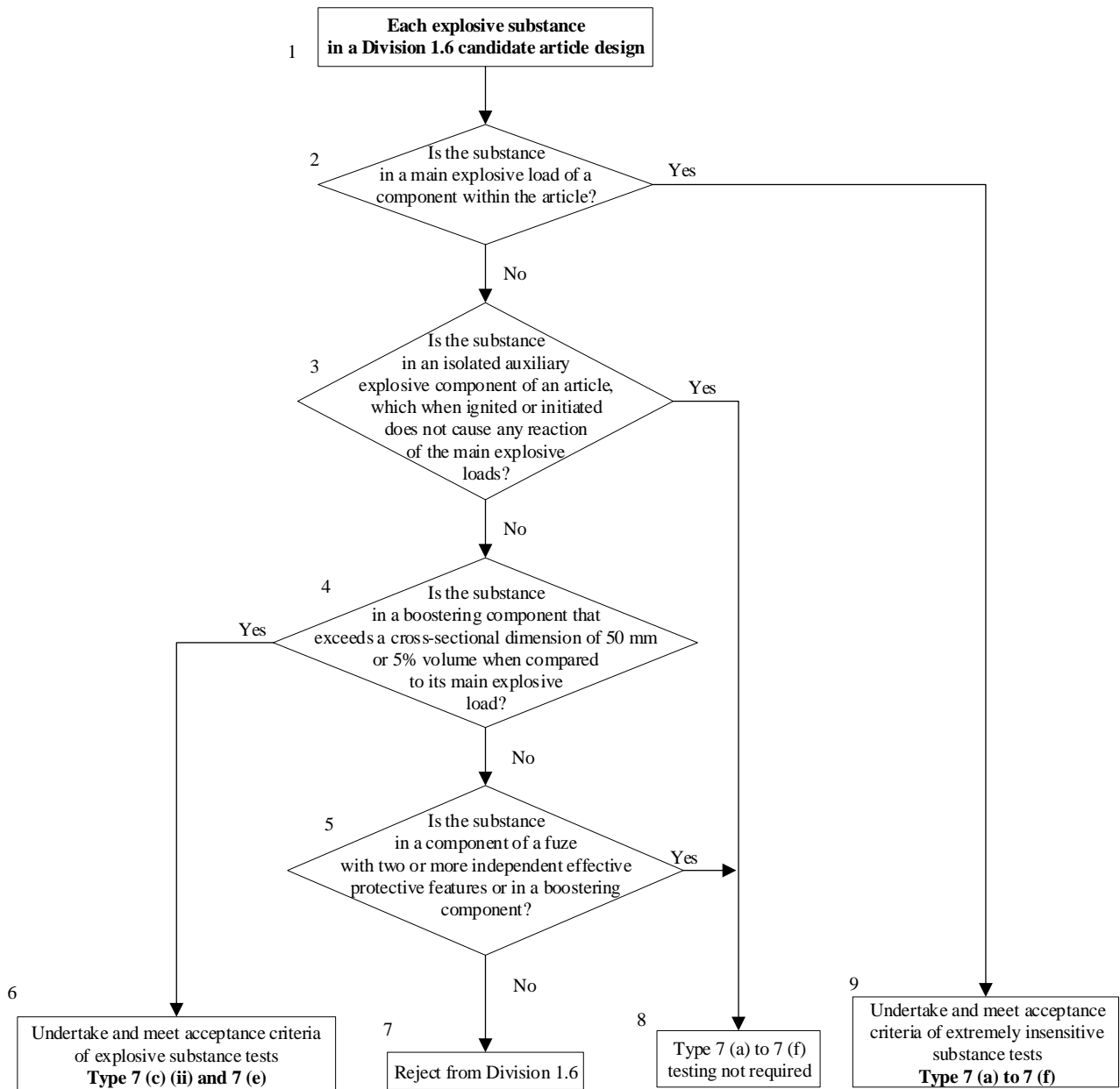


Figure 10.5: PROCEDURE TO DETERMINE REQUIRED SUBSTANCE TESTING FOR DIVISION 1.6



10.4.2.3 The results from four types of series 6 tests, as appropriate, are used to determine which division, amongst Divisions 1.1, 1.2, 1.3 and 1.4, corresponds most closely to the behaviour of a product the explosive if it a load is involved in a fire resulting from internal or external sources or an explosion from internal sources (boxes 26, 28, 30, 32, 32a and 33 32, 33, 34, 35, 36 and 37 of Figure 10.3). The results are also necessary to assess whether a product substance or article in the transport configuration can be assigned to compatibility group S of Division 1.4 and whether or not it can should be excluded from the class of explosives Class 1 (boxes 38 35 and 39 36 of Figure 10.3). The four types of test are:

- Type 6 (a): a test on a single package to determine if there is mass explosion of the contents;
- Type 6 (b): a test on packages of an explosive substance or explosive articles, or non-packaged explosive articles, to determine whether an explosion is propagated from one package to another or from a non-packaged article to another;
- Type 6 (c): a test on packages of an explosive substance or explosive articles, or non-packaged explosive articles, to determine whether there is a mass explosion or a hazard from dangerous projections, radiant heat and/or violent burning or any other dangerous effect when involved in a fire; and
- Type 6 (d): a test on an unconfined package of explosive articles to which special provision 347 of Chapter 3.3 of the Model Regulations applies, to determine if there are hazardous effects outside the package arising from accidental ignition or initiation of the contents.

10.4.2.4 The question "Is it an extremely insensitive explosive article?" (box 23 40, Figure 10.3) is answered by series 7 tests and any candidate for Division 1.6 shall should pass one of each of the eleven types of test comprising the series. The protocol for determining the test requirements is given in Figure 10.5. The first six types of test (7 (a) to 7 (f)) are used to establish if a substance is an extremely insensitive substance (EIS). The purpose of these tests is to develop an understanding of the sensitivity of substance(s) contained within the article, which informs and provides confidence in the article tests. The remaining five types of test (7 (g), 7 (h), 7 (j), 7 (k) and 7 (l)) are used to determine if an article predominantly containing an EIS may be assigned to Division 1.6. The eleven test types are:

- Type 7 (a): a shock test to determine the sensitivity to intense mechanical stimulus;
- Type 7 (b): a shock test with a defined booster and confinement to determine the sensitivity to shock;
- Type 7 (c): a test to determine the sensitivity of the explosive substance to deterioration under the effect of an impact;
- Type 7 (d): a test to determine the degree of reaction of the explosive substance to impact or penetration resulting from a given energy source;
- Type 7 (e): a test to determine the reaction of the explosive substance to an external fire when the material is confined;
- Type 7 (f): a test to determine the reaction of the explosive substance in an environment in which the temperature is gradually increased to 365 °C;
- Type 7 (g): a test to determine the reaction to an external fire of an article which is in the condition as presented for classification-transport;
- Type 7 (h): a test to determine the reaction of an article in an environment in which the temperature is gradually increased to 365 °C;
- Type 7 (j): a test to determine the reaction of an article to impact or penetration resulting from a given energy source;
- Type 7 (k): a test to determine whether the detonation of an article will initiate a detonation in an adjacent, like, article; and
- Type 7 (l): a test to determine the sensitivity of an article to shock directed at vulnerable components.

10.4.2.5 The question "Is ~~the substance~~ it a candidate for ammonium nitrate emulsion, ~~or~~ suspension or gel, intermediate for blasting explosives (ANE)?" (box 3 ~~2(a)~~, Figure 10.2) is answered by series 8 tests and any candidate should pass each of the three tests comprising the series. The three test types are:

- Type 8 (a): a test to determine the thermal stability;
- Type 8 (b): a shock test to determine sensitivity to intense shock;
- Type 8 (c): a test to determine the effect of heating under confinement;

Test series 8 (d) has been included in this section as one method to evaluate the suitability of ANEs for ~~containment the transport~~ in portable tanks ~~as a-oxidizing substances~~.

10.4.3 *Application of the test methods*

10.4.3.1 Explanations of certain terms used in the assignment of divisions and compatibility groups are given in the Glossary in Appendix B of the Model Regulations (e.g. mass explosion, pyrotechnic substance, entire load, total contents, explode, explosion of the total contents).

10.4.3.2 Test series 5 should be used to determine whether a substance can be assigned to Division 1.5. Only those substances which pass all three types of test may be assigned to Division 1.5.

10.4.3.3 Test series 6 should be applied to packages of explosive substances and articles in the condition and form in which they are offered for transport. The geometrical arrangement of the products should be realistic in regard to the packing method, and the conditions of transport, and should be such as to produce the most ~~severe disadvantageous~~ results. Where explosive articles are ~~classified to be carried~~ without packaging, the tests should be applied to the non-packaged articles. All types of packaging containing substances or articles should be subjected to the tests unless:

- (a) The product, including any packaging, can be unambiguously assigned to a division by the competent authority on the basis of results from other tests or of available information; or
- (b) The product, including any packaging, is assigned to Division 1.1.

10.4.3.4 Test types 6 (a), 6 (b), 6 (c) and 6 (d) are normally performed in alphabetical order. However, it is not always necessary to follow this order or to conduct all four types of test.

- (a) Test type 6 (a) may be waived if explosive articles are ~~classified carried~~ without packaging or when only one article is in the package; (see also ~~section sub-paragraph~~ 10.4.3.4 (d) ~~below~~);
- (b) Test type 6 (b) may be waived if, in each type of 6 (a) test; (see also ~~section sub-paragraph~~ 10.4.3.4 (d) ~~below~~):
 - (i) The exterior of the package is undamaged by internal ~~initiation detonation and/or ignition~~; or
 - (ii) The contents of the package fail to explode, or explode so feebly as would exclude propagation of the explosive effect from one package to another in test type 6 (b).
- (c) Test type 6 (c) may be waived if, in a type 6 (b) test, there is a practically instantaneous explosion of virtually the total contents of the stack. In such cases the product is assigned to Division 1.1.
- (d) Test type 6 (d) is a test used to determine whether a 1.4S classification is appropriate and is only used if special provision 347 of Chapter 3.3 of the Model Regulations applies. When testing articles to which special provision 347 applies, test type 6 (d) may be performed first. If the results of test type 6 (d) indicate that a 1.4S classification is appropriate, then test types 6 (a) and 6 (b) may be waived.

10.4.3.5 If a substance gives a "-" result (no propagation of detonation) in the Series 1 type (a) test, the 6 (a) test with a detonator may be waived. If a substance gives a "-" result (no or slow deflagration) in a Series 2 type (c) test, the 6 (a) test with an igniter may be waived.

10.4.3.6 Tests types 7 (a) to 7 (f) ~~are should be~~ used to establish that ~~an the~~ explosive is an extremely insensitive ~~detonating~~ substance and then test types 7 (g), 7 (h), 7 (j), 7 (k) and 7 (l) ~~are~~ used to establish that the articles ~~predominantly~~ containing EIS(s) may be assigned to Division 1.6.

10.4.3.7 Tests of types 7 (g), 7 (h), 7 (j), 7 (k) and 7(l) ~~are should be~~ performed to determine if an article with EIS main explosive load(s) and appropriately insensitive boosting components may be assigned to Division 1.6. These tests are applied to articles in the condition and form in which they are offered for ~~classification transport~~, except that non-explosive components may be omitted or simulated if the competent authority is satisfied that this does not invalidate the results of the tests. The procedure detailing testing requirements is given in Figure 10.5 and some points of explanation are given below.

- (a) Complex articles may contain multiple substances and ~~test types 7(a) to (f) shall this procedure should~~ be completed for all ~~main explosive load and boosting component~~ substances, ~~as appropriate~~, within the article to be classified ~~in Division 1.6~~.
- (b) The question "Is the substance in a main explosive load of a component within the article?" (Box 2 of Figure 10.5) is answered by examining the design of the article. Main explosive load substances are those loaded into components within the article that are not fuze, boosting, or isolated auxiliary explosive components. All substances in main explosive loads must "Undertake and meet acceptance criteria of extremely insensitive substance tests, Type 7 (a) to 7 (f)" (Box 39 of Figure 10.5). If a '+' result is obtained for any main explosive load substance to any Type 7 (a) to 7 (f) test, the substance is not an EIS and the answer to the question in Box 24 21 of Figure 10.3 is "No". The article is not a candidate for Division 1.6.
- (c) Answering the question "Is the substance in an isolated auxiliary explosive component of the article, which when ignited or initiated does not cause any reaction of the main explosive loads?" (Box 4 3 of Figure 10.5) requires knowledge of the design of the article plus the explosive effects that occur when such components are initiated or ignited, either in their design mode or accidentally. Typically these will be small explosive actuators or pyromechanical devices that produce movement, cutting or opening functions. If the answer is 'yes' to this question, Type 7 (a) to 7 (f) testing is not required for substances in isolated auxiliary explosive components and the article remains a candidate for Division 1.6.
- (d) The question "Is the substance in a boosting component that exceeds a cross-sectional dimension of 50 mm or 5% volume when compared to its main explosive load?" (Box 4 6 of Figure 10.5) is answered by examining the design of the article. All substances in such larger boosting components, including those contained in explosive components of dual-protected fuzes in an article, must "Undertake and meet acceptance criteria of explosive substance tests, Type 7 (c) (ii) and 7 (e)" (box 7 6 of Figure 10.5). If a '+' result is obtained for any such larger boosting component substance to either Type 7 (c) (ii) and 7 (e) tests, the answer to the question in Box 24 21 of Figure 10.3 is "No". The article is not a candidate for Division 1.6.
- (e) The question "Is the substance in a component of a fuze with two or more independent effective protective features or in a boosting component" (Box 5 8 of Figure 10.5) is answered by an understanding of the design and development of the article. If the answer is 'no', the article is not considered to have suitable intrinsic safety characteristics and the answer to the question in Box 24 21 of Figure 10.3 is 'No' the article is not a candidate for Division 1.6.

NOTE: Knowledge of the design and explosive effects can be obtained by modelling or indicative tests etc.

10.4.3.8 Test types 8 (a) to 8 (c) should be used to establish whether an ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives (ANE) may be accepted as an oxidizing solid or liquid assigned to Division 5.1. Substances failing any of the tests may be considered as a candidate for the class of explosives Class 1 in accordance with Figure 10.4.

~~10.4.3.9 If articles contain expensive, inert, control components, these may be replaced by inert components having a similar mass and volume.~~

10.5 Examples of test reports

10.5.1 Examples of test reports, with an illustration of the use of the flow charts on the application of the class of explosives Class 1 acceptance and assignment procedures to hexanitrostilbene (UN 0392) and musk xylene (UN 2956), are given in figures 10.6 (a) to (d) ~~to~~ and 10.9⁷ (a) to (d).

10.5.2 An example proforma for a test report on articles is given in Figure 10.10⁸.

Figure 10.6 (a): RESULTS FROM THE APPLICATION OF THE PROVISIONAL ACCEPTANCE PROCEDURE IN THE CLASS OF EXPLOSIVES (FIGURE 10.2) TO HEXANITROSTILBENE

1.	Name of substance:	Hexanitrostilbene
2.	General data	
2.1	Composition:	hexanitrostilbene
2.2	Molecular formula:	$C_{14}H_6N_6O_{12}$
2.3	Physical form:	powder
2.4	Colour:	yellow orange
2.5	Apparent density:	1700 kg /m ³
2.6	Particle size:	0.1 – 0.3 mm
3.	Box 2:	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
4.	Box 10:	Substance to be considered in this class
5.	Box 11:	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 form 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 form 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 form tested
5.17	Exit:	Go to box 12
6.	Box 12:	Is it thermally stable?
6.1	Answer from test 3(c):	Yes
6.2	Exit:	Go to box 13
7.	Box 13:	Is it unstable in the form it was tested?
7.1	Answer from Test Series 3:	No
7.2	Exit:	Go to box 19
8.	Conclusion:	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

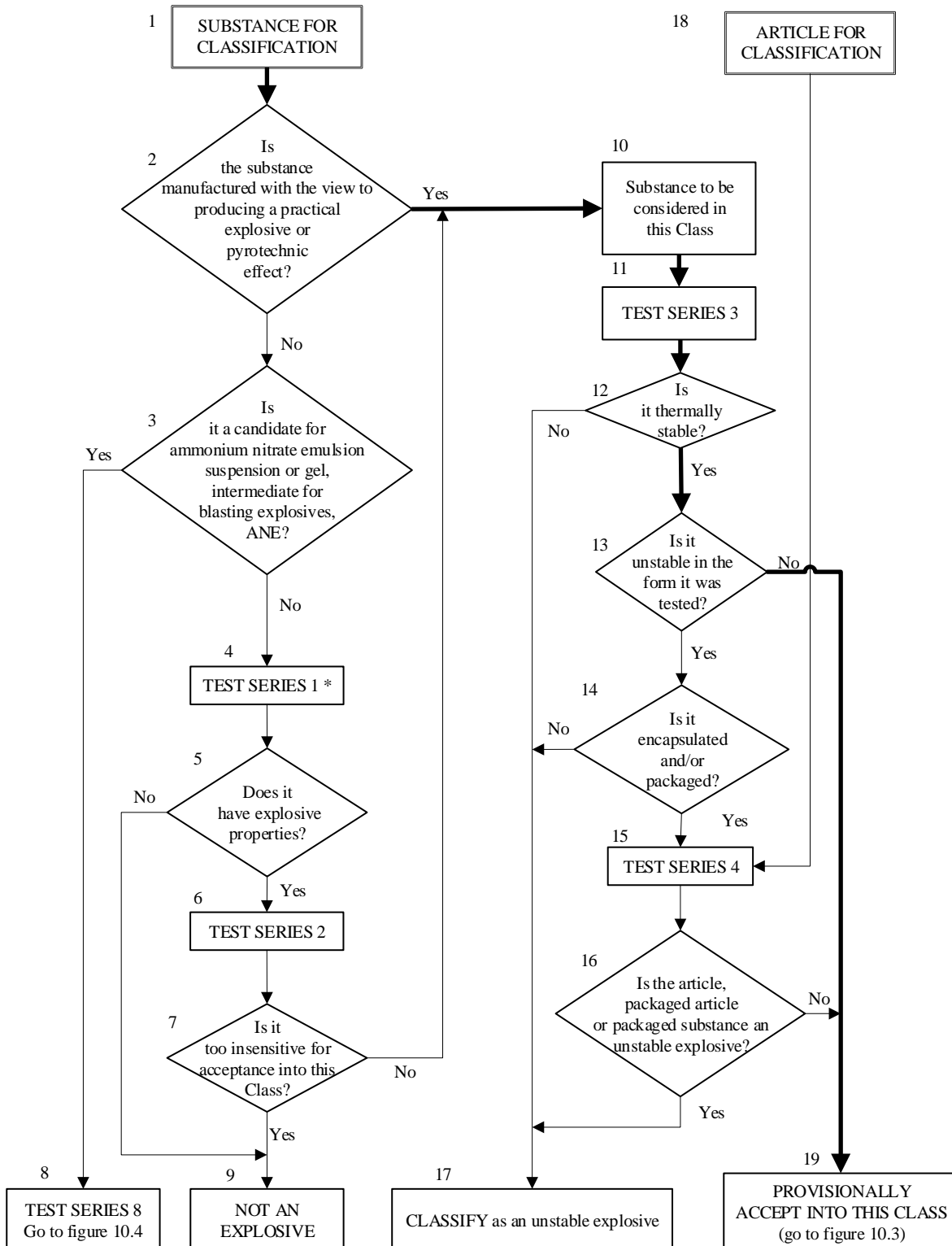


Figure 10.6 (c): RESULTS FROM APPLICATION OF THE PROCEDURE FOR ASSIGNMENT TO A DIVISION OF THE CLASS OF EXPLOSIVES (FIGURE 10.3) TO HEXANITROSTILBENE

- | | |
|--|--|
| 1. Box 26: | 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 |
| 2. Box 31: | 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 |
| 3. Box 32: | Is the result a mass explosion? |
| 3.1 Answer from Test Series 6 | Yes |
| 3.2 Exit | Go to box 44 |
| 4. Conclusion | Assign to Division 1.1 |

Figure 10.6 (d): FLOW CHART FOR ASSIGNMENT TO A DIVISION OF THE CLASS OF EXPLOSIVES OF HEXANITROSTILBENE

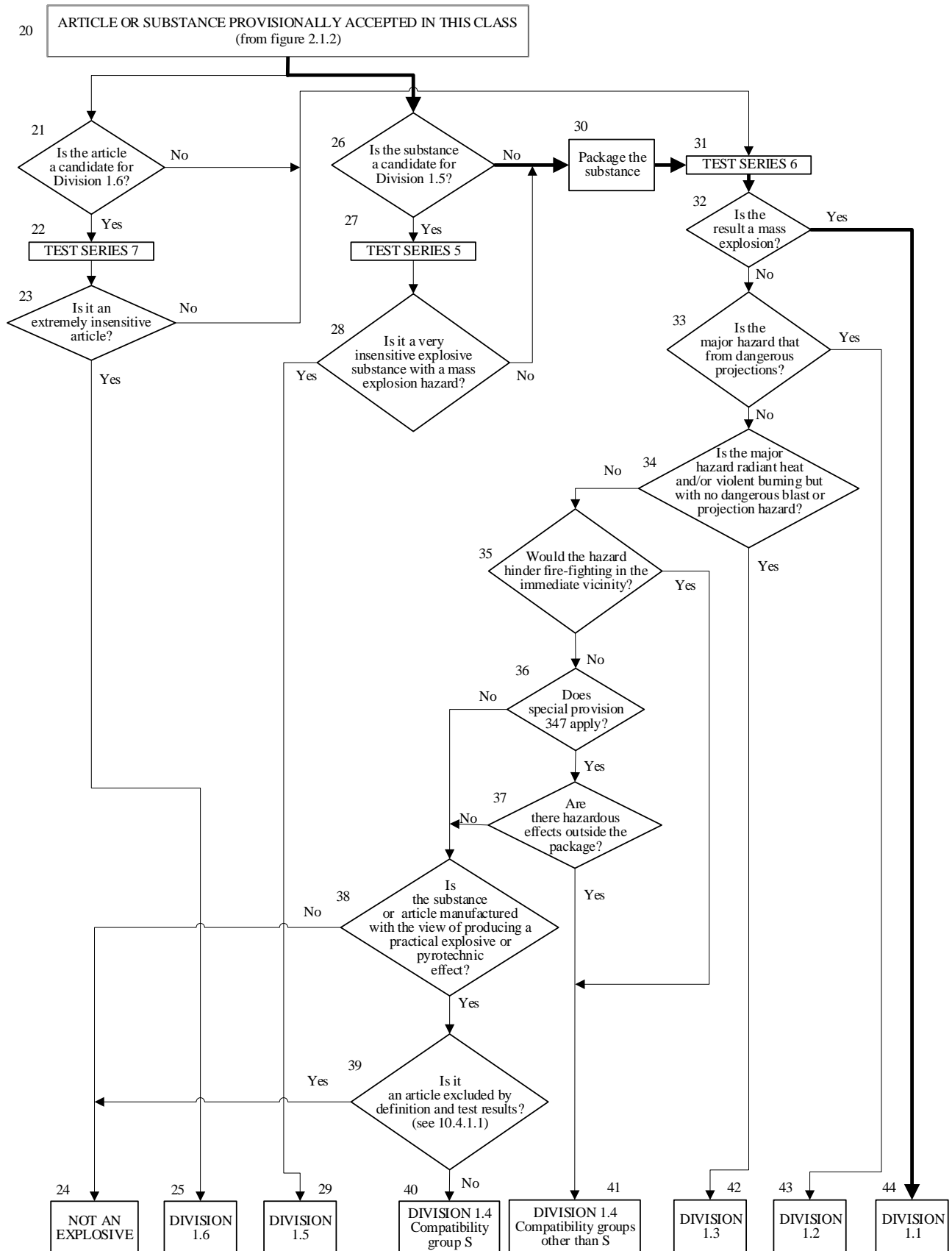


Figure 10.7(a): RESULTS FROM THE APPLICATION OF THE PROVISIONAL ~~THE CLASS 1~~ ACCEPTANCE PROCEDURE IN THE CLASS OF EXPLOSIVES (FIGURE 10.2) TO MUSK XYLENE

1.	Name of substance	:	5-tert-BUTYL-2,4,6-TRINITRO-m-XYLENE (MUSK XYLENE)
2.	General data		
2.1	Composition	:	99% tert-butyl-2,4,6-trinitro-m-xylene
2.2	Molecular formula	:	C ₁₂ H ₁₅ N ₃ O ₆
2.3	Physical form	:	Fine crystalline powder
2.4	Colour	:	Pale yellow
2.5	Apparent density	:	840 kg /m ³
2.6	Particle size	:	< 1.7 mm
3.	Box 2	:	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 2a 3
4.	Box 2a3	:	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
54.	Box 34	:	Test Series 1
54.1	Propagation of detonation	:	UN gap test (test 1(a))
54.2	Sample conditions	:	Ambient temperature
54.3	Observations	:	Fragmentation length 40 cm
54.4	Result	:	"+", propagation of detonation
54.5	Effect of heating under confinement	:	Koenen test (test 1(b))
54.6	Sample conditions	:	Mass 22.6 g
54.7	Observations	:	Limiting diameter 5.0 mm Fragmentation type "F" (time to reaction 52 s, duration of reaction 27 s)
54.8	Result	:	"+", shows some explosive effects on heating under confinement
54.9	Effect of ignition under confinement	:	Time/pressure test (test 1 (c) (i))
54.10	Sample conditions	:	Ambient temperature
54.11	Observations	:	No ignition
54.12	Result	:	"-", no effect on ignition under confinement
54.13	Exit	:	Go to Box 45
65.	Box 45	:	Is it an Does it have explosive substance properties?
65.1	Answer from Test Series 1	:	Yes
65.2	Exit	:	Go to box 56
76.	Box 5	:	Test Series 2
76.1	Sensitivity to shock	:	UN gap test (test 2(a))
76.2	Sample conditions	:	Ambient temperature
76.3	Observations	:	No propagation
76.4	Result	:	"-", not sensitive to shock

76.5	Effect of heating under confinement	:	Koenen test (test 2(b))
76.6	Sample conditions	:	Mass 22.6 g
76.7	Observations	:	Limiting diameter 5.0 mm Fragmentation type "F" (time to reaction 52 s, duration of reaction 27 s)
76.8	Result	:	"+", violent effect on heating under confinement
76.9	Effect of ignition under confinement	:	Time/pressure test (test 2 (c) (i))
76.10	Sample conditions	:	Ambient temperature
76.11	Observations	:	No ignition
76.12	Result	:	"-", no effect on ignition under confinement
76.13	Exit	:	Go to Box 67
87.	Box 67	:	Is the substance it too insensitive for acceptance into this Class 1 ?
87.1	Answer from Test Series 2:	No	
87.2	Conclusion	:	Substance to be considered for in this Class 1 (box 810)
87.3	Exit	:	Go to Box 911
98.	Box 911	:	Test Series 3
98.1	Thermal stability	:	75 °C/48 hour test (test 3 (c))
98.2	Sample conditions	:	100 g of substance at 75 °C
98.3	Observations	:	No ignition, explosion, self-heating or visible decomposition
98.4	Result	:	"-", thermally stable
98.5	Impact sensitivity	:	BAM fallhammer test (test 3 (a) (ii))
98.6	Sample conditions	:	as received
98.7	Observations	:	Limiting impact energy 25 J
98.8	Result	:	"-", not too dangerous to transport unstable in form tested
98.9	Friction sensitivity	:	BAM friction test (test 3 (b) (i))
98.10	Sample conditions	:	as received
98.11	Observations	:	Limiting load > 360 N
98.12	Result	:	"-", not too dangerous to transport unstable in form tested
98.13	Ease of deflagration to detonation transition	:	Small scale burning test (test 3 (d))
98.14	Sample conditions	:	Ambient temperature
98.15	Observations	:	Ignites and burns slowly
98.16	Result	:	"-", not too dangerous to transport unstable in form tested
98.17	Exit	:	Go to box 1012
109.	Box 1012	:	Is it the substance thermally stable?
109.1	Answer from test 3(c)	:	Yes
109.2	Exit	:	Go to box 1113
1110.	Box 1113	:	Is the substance too dangerous for transport it unstable in the form it was tested?
1110.1	Answer from Test Series 3:	No	
1110.2	Exit	:	Go to box 1918
1211.	Conclusion	:	PROVISIONALLY ACCEPT INTO THIS CLASS 1

1241.1 Exit : Apply ~~the Class 1 assignment~~ procedure for assignment to a division of the class of explosives

Figure 10.7 (b): **PROCEDURE-FLOW CHART FOR THE PROVISIONAL ACCEPTANCE OF MUSK XYLENE IN THE CLASS OF EXPLOSIVES¹**

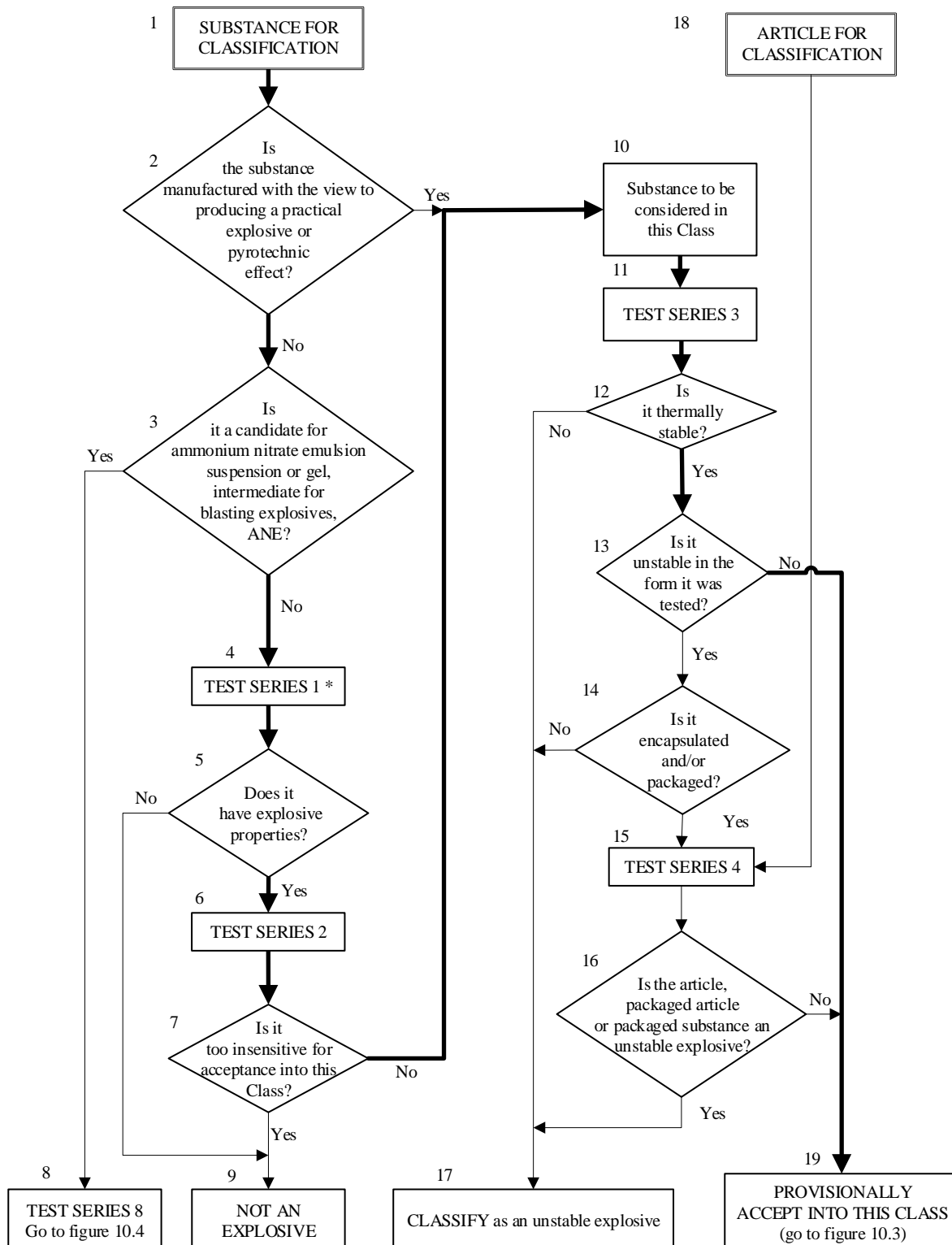


Figure 10.78(c): RESULTS FROM APPLICATION OF THE ~~CLASS 1 ASSIGNMENT~~ PROCEDURE FOR ASSIGNMENT TO A DIVISION OF THE CLASS OF EXPLOSIVES (FIGURE 10.3) OF MUSK XYLENE

- | | | | |
|-----------|-------------------------------------|----|--|
| 1. | Box 1926 | : | Is the substance a candidate for Division 1.5? |
| 1.1 | Answer | : | No |
| 1.2 | Result | : | Package the substance (box 2330) |
| 1.3 | Exit | : | Go to box 2531 |
| 2. | Box 2531 | : | 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 of 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 slow burning with black smoke occurred |
| 2.13 | Result | : | No effects which would hinder fire fighting |
| 2.14 | Exit | : | Go to box 2632 |
| 3. | Box 2632 | : | Is the result a mass explosion? |
| 3.1 | Answer from Test Series 6: | No | |
| 3.2 | Exit | : | Go to box 2833 |
| 4. | Box 2833 | : | Is the major hazard that from dangerous projections? |
| 4.1 | Answer from Test Series 6 | : | No |
| 4.2 | Exit | : | Go to box 3034 |
| 5. | Box 3034 | : | Is the major hazard radiant heat and/or violent burning but with no dangerous blast or projection hazard? |
| 5.1 | Answer from Test Series 6: | No | |
| 5.2 | Exit | : | Go to box 3235 |
| 6. | Box 3235 | : | Is there nevertheless a small hazard in the event of ignition or initiation? Would the hazard hinder fire-fighting in the immediate vicinity? |
| 6.1 | Answer from Test Series 6 | : | No |
| 6.2 | Exit | : | Go to box 32a36 |
| 7. | Box 32a36 | : | Does special provision 347 apply? |
| 7.1. | Answer | : | No |
| 7.2. | Exit | : | Go to box 3538 |
| 8. | Box 3538 | : | Is the substance or article manufactured with the view to of producing a practical explosive or pyrotechnic effect? |

- 8.1 Answer : No
- 8.2 Exit : Go to box ~~38~~24
- 9. **Conclusion** : NOT ~~CLASS 1~~AN EXPLOSIVE
- 9.1 Exit : Consider for another class/division

Figure 10.79(d): PROCEDURE FOR EXEMPTION OF MUSK XYLENE FROM THE CLASS OF EXPLOSIVES-1

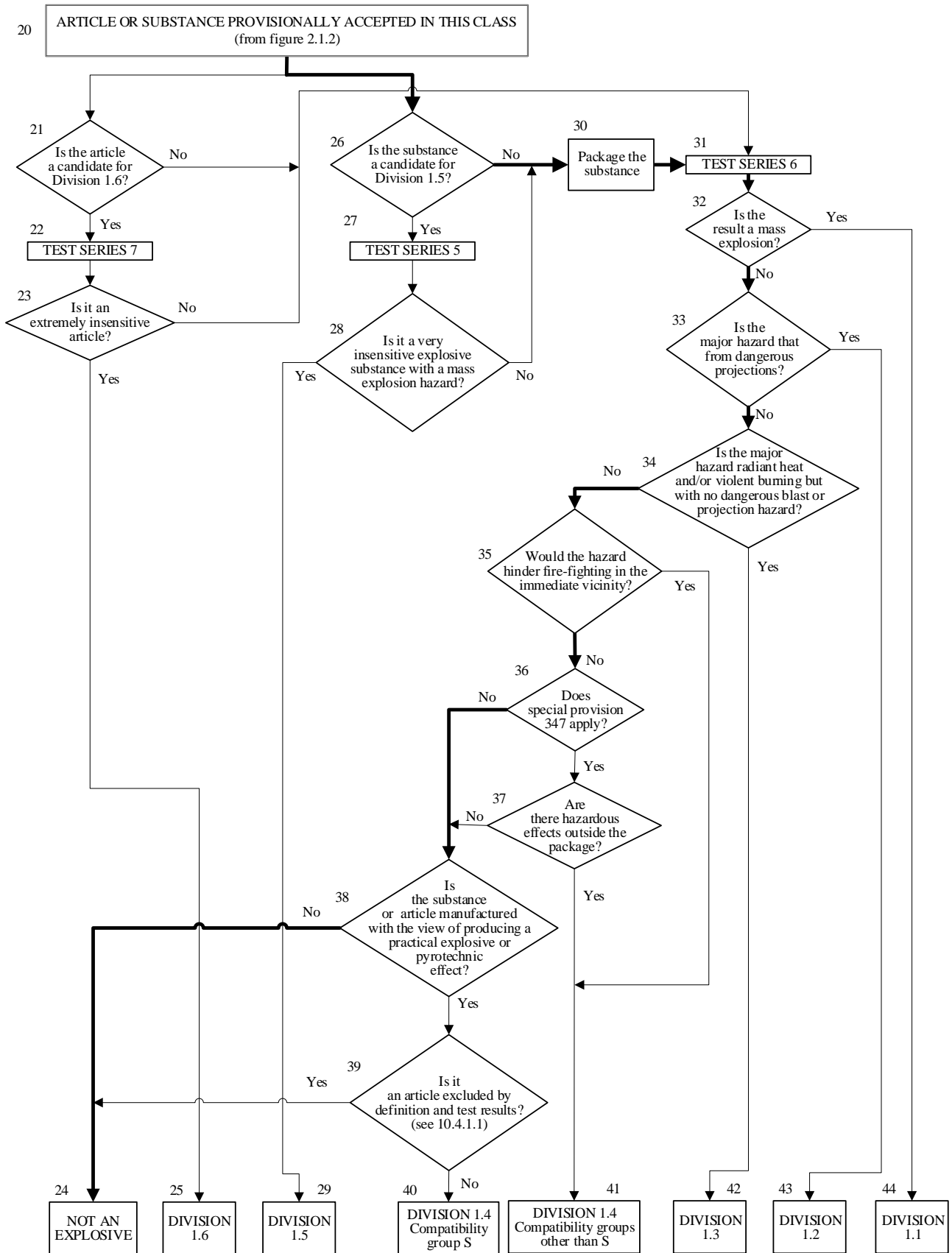


Figure 10.810: EXAMPLE OF A PROFORMA FOR A TEST REPORT FOR ARTICLES

Test method		Date of report		Data reference	
Product name		Lot number		Date of manufacture	

CONSTRUCTION AND CONTENTS (attach drawings)

PACKAGING (if any)

PRETREATMENT OR CONDITIONING (if any)

TEST CONFIGURATION (including any variations or deviations from procedures described in the Manual)

TEST CONDITIONS

Ambient temperature:

°C

Relative humidity:

%

OBSERVATIONS

TEST RESULT

CONCLUSION
