



**WORKING PAPER**

**DANGEROUS GOODS PANEL (DGP)**

**TWENTY-SIXTH MEETING**

**Montréal, 16 to 27 October 2017**

**Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2019-2020 Edition**

**DRAFT AMENDMENTS TO THE TECHNICAL INSTRUCTIONS TO ALIGN WITH THE UN RECOMMENDATIONS — PART 2**

(Presented by the Secretary)

**SUMMARY**

This working paper contains draft amendments to Part 2 of the Technical Instructions to reflect the decisions taken by the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals at its eighth session (Geneva, 9 December 2016). It also reflects amendments agreed by DGP-WG/16 (Montréal, 17 to 21 October 2016) and DGP-WG/17 (Montréal, 24 to 28 April 2017).

The DGP is invited to agree to the draft amendments in this working paper.

## Part 2

# CLASSIFICATION OF DANGEROUS GOODS

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### INTRODUCTORY CHAPTER

*Parts of this Chapter are affected by State Variations DE 5, NL 4; see Table A-1*

#### 1. RESPONSIBILITIES

1.1 Classification must be made by the appropriate national authority when so required or may otherwise be made by the shipper.

1.2 A shipper who has identified, on the basis of test data, that a substance listed by name in column 1 of the Dangerous Goods List in Part 3, Chapter 2, Table 3-1 meets classification criteria for a hazard class or division that is not identified in the list, may, with the approval of the appropriate national authority, consign the substance:

- a) under the most appropriate generic or not otherwise specified (n.o.s.) entry reflecting all hazards; or

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UN Model Regulations, 2.0.0.2 (see ST/SG/AC.10/44/Add.1)

ICAO translators and editors of versions other than English: There may be a need for an additional amendment to 2;0.1.2 b) for the sake of alignment with 2.0.0.2 b) of the UN Model Regulations, (see ST/SG/AC.10/44/Add.1)

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- b) under the same UN number and name but with additional hazard communication information as appropriate to reflect the additional subsidiary ~~risk~~ hazard(s) (documentation, label) provided that the primary hazard class remains unchanged and that any other transport conditions (e.g. limited quantity, packaging provisions) that would normally apply to substances possessing such a combination of hazards are the same as those applicable to the substance listed.

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ICAO translators and editors of versions other than English: There may be a need for amendments to 2;0.2.1 for the sake of alignment with 2.0.1.1 of the UN Model Regulations, (see ST/SG/AC.10/44/Add.1)

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#### 2. CLASSES, DIVISIONS, PACKING GROUPS — DEFINITIONS

2.1 Substances (including mixtures and solutions) and articles subject to these Instructions are assigned to one of nine classes according to the hazard or the most predominant of the hazards they present. Some of these classes are subdivided into divisions. These classes and divisions are:

##### Class 1: Explosives

- Division 1.1: Substances and articles which have a mass explosion hazard
- Division 1.2: Substances and articles which have a projection hazard but not a mass explosion hazard
- Division 1.3: Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard
- Division 1.4: Substances and articles which present no significant hazard
- Division 1.5: Very insensitive substances which have a mass explosion hazard
- Division 1.6: Extremely insensitive articles which do not have a mass explosion hazard

##### Class 2: Gases

- Division 2.1: Flammable gases
- Division 2.2: Non-flammable, non-toxic gases
- Division 2.3: Toxic gases

##### Class 3: Flammable liquids

Class 4: Flammable solids; substances liable to spontaneous combustion; substances which, on contact with water, emit flammable gases

- Division 4.1: Flammable solids, self-reactive and related substances and solid desensitized explosives and polymerizing substances
- Division 4.2: Substances liable to spontaneous combustion
- Division 4.3: Substances which, in contact with water, emit flammable gases

Class 5: Oxidizing substances and organic peroxides

- Division 5.1: Oxidizing substances
- Division 5.2: Organic peroxides

Class 6: Toxic and infectious substances

- Division 6.1: Toxic substances
- Division 6.2: Infectious substances

Class 7: Radioactive material

Class 8: Corrosive substances

Class 9: Miscellaneous dangerous substances and articles, including environmentally hazardous substances

The numerical order of the classes and divisions is not that of the degree of danger.

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ICAO translators and editor of versions other than English: There may be a need for amendments to 2.0.2.5 for the sake of alignment with 2.0.1.4 of the UN Model Regulations, (see ST/SG/AC.10/44/Add.1)

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2.5 Dangerous goods are determined to present one or more of the dangers represented by Classes 1 to 9 and divisions and, if applicable, the degree of danger on the basis of the requirements in Part 2, Chapters 1 to 9.

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UN Model Regulations, 2.0.1.5 (see ST/SG/AC.10/44/Add.1)

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2.6 Dangerous goods presenting a danger of a single class and division are assigned to that class and division and the degree of danger (packing group), if applicable, determined. When an article or substance is specifically listed by name in the Dangerous Goods List (Table 3-1), its class or division, its subsidiary risk hazard(s) and, when applicable, its packing group are taken from this list.

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UN Model Regulations, 2.0.1.6 (see ST/SG/AC.10/44/Add.1)

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Paragraph 2.7 does not currently align with the associated paragraph in the 19th edition of the UN Model Regulations (2.0.1.6). DGP is invited to consider whether the amendments highlighted in yellow below should be made for the sake of alignment. The only change incorporated in the 20th edition of the Model Regulations is the replacement of “subsidiary risk” with “subsidiary hazard”.

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2.7 Where a substance or article is not specifically listed by name in Table 3-1 and there are two or more hazards of Class 3, 4 or 8 or Division 5.1 or 6.1 associated with its air transport in that it meets the definition for two of those classes or divisions as shown in Part 2, Chapters 1 to 9, it must be classified in accordance with the precedence of hazards table (Table 2-1). Dangerous goods meeting the defining criteria of more than one hazard class or division and which are not listed by name in Table 3-1, are assigned to a class and division and subsidiary hazard(s) on the basis of the precedence of hazards in 4.

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### 3. UN NUMBERS AND PROPER SHIPPING NAMES

ICAO translators and editors of versions other than English: There may be a need for amendment to 2.0.3.1 for the sake of alignment with 2.0.2.1 of the UN Model Regulations, (see ST/SG/AC.10/44/Add.1)

3.1 Dangerous goods are assigned to UN numbers and proper shipping names according to their hazard classification and their composition.

UN Model Regulations, 2.0.2.2 (see ST/SG/AC.10/44/Add.1)

3.2 Dangerous goods commonly carried are listed in Table 3-1. Where an article or substance is specifically listed by name, it must be identified in transport by the proper shipping name in Table 3-1. Such substances may contain technical impurities (for example, those deriving from the production process) or additives for stability or other purposes that do not affect its classification. However, a substance listed by name containing technical impurities or additives for stability or other purposes affecting its classification must be considered a mixture or solution (see 3.5). For dangerous goods not specifically listed by name, “generic” or “not otherwise specified (n.o.s.)” entries are provided (see 3.8) to identify the article or substance in transport. The substances listed by name in column 1 of Table 3-1 must be transported according to their classification in the list or under the conditions specified in 1.2. Each entry in Table 3-1 is characterized by a UN number. Table 3-1 also contains relevant information for each entry, such as hazard class, subsidiary-risk hazard(s) (if any), packing group (where assigned), packing requirements, passenger and cargo aircraft requirements, etc. Entries in Table 3-1 are of the following four types:

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3.5 A mixture or solution meeting the classification criteria of these Instructions and composed of a single predominant substance identified by name in Table 3-1 and one or more substances not subject to these Instructions and/or traces of one or more substances identified by name in Table 3-1 must be assigned the UN number and proper shipping name of the predominant substance named in Table 3-1, unless:

- a) the mixture or solution is identified by name in Table 3-1 in which case this name must be applied; or
- b) the name and description of the substance named in Table 3-1 specifically indicates that it applies only to the pure substance; or

UN Model Regulations, (2.0.2.5 c) (see ST/SG/AC.10/44/Add.1)

- c) the hazard class or division, subsidiary-risk hazard(s), physical state or packing group of the solution or mixture is different from that of the substance named in Table 3-1; or
- d) the hazard characteristics and properties of the mixture or solution necessitate emergency response measures that are different from those required for the substance identified by name in Table 3-1.

If b), c) or d) is applicable, the mixture or solution must be treated as a dangerous substance not specifically listed by name in Table 3-1.

*Note.— Although traces of substances may not need to be taken into account for classification purposes, those traces may affect the properties of the substance and do need to be taken into account when considering the compatibility requirements of 4.1.1.3.*

3.6 For a solution or mixture when the hazard class, the physical state or the packing group is changed in comparison with the listed substance, the appropriate n.o.s. entry must be used including its packaging and labelling provisions.

3.7 A mixture or solution containing one or more substances identified by name in Table 3-1 or classified under an n.o.s. entry and one or more substances not subject to these Instructions is not subject to these Instructions if the hazard characteristics of the mixture or solution are such that they do not meet the criteria (including human experience criteria) for any class.

3.8 Substances or articles which are not specifically listed by name in Table 3-1 must be classified under a “generic” or “n.o.s.” entry. The substance or article must be classified according to the class definitions and test criteria in this Part, and is then assigned the “generic” or “n.o.s.” entry in Table 3-1 which most appropriately describes the article or substance.<sup>1</sup> This means that a substance is to be assigned to an entry of type c), as defined in 3.2, only if it cannot be assigned to an entry of type b), and to an entry of type d) only if it cannot be assigned to an entry of type b) or c)<sup>1</sup>.

<sup>1</sup>. See also the “List of n.o.s. and generic proper shipping names” in Attachment 1, Chapter 2.

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 UN Model Regulations, 2.0.2.9 (see ST/SG/AC.10/44/Add.1)
 

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3.9 A mixture or solution meeting the classification criteria of these Instructions that is not identified by name in Table 3-1 and that is composed of two or more dangerous goods must be assigned to an entry that has the proper shipping name, description, hazard class or division, subsidiary-risk **hazard**(s) and packing group that most precisely describe the mixture or solution.

#### 4. PRECEDENCE OF HAZARD CHARACTERISTICS

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 UN Model Regulations, 2.0.3.1 (see ST/SG/AC.10/44/Add.1)
 

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4.1 The precedence of hazards table (Table 2-1) must be used to determine the class of a substance, mixture or solution having more than one-risk **hazard**, when it is not named in Table 3-1 or to assign the appropriate entry for articles containing dangerous goods n.o.s (UN Nos. 3537 to 3548, see 6). For goods having multiple-risk **hazards**, which are not specifically listed by name in Table 3-1, the most stringent packing group denoted to the respective hazards of the goods takes precedence over other packing groups, irrespective of Table 2-1. The correct class or division to be used is shown at the point at which the column and row intersect in Table 2-1. The correct packing group to be used is also shown at the point at which the column and row intersect. The precedence of hazard characteristics of the following have not been dealt with in Table 2-1, as the primary characteristics always take precedence:

- a) substances and articles of Class 1;
- b) gases of Class 2;
- c) liquid desensitized explosives of Class 3;
- d) self-reactive substances and solid desensitized explosives of Division 4.1;
- e) pyrophoric substances of Division 4.2;
- f) substances of Division 5.2;
- g) substances of Division 6.1 with a Packing Group I inhalation toxicity. Except for substances or preparations meeting the criteria of Class 8 having an inhalation toxicity of dusts and mists (LC<sub>50</sub>) in the range of Packing Group I, but toxicity through oral ingestion or dermal contact only in the range of Packing Group III or less, which must be allocated to Class 8;
- h) substances of Division 6.2; and
- i) material of Class 7.

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 UN Model Regulations, 2.0.3.2 (see ST/SG/AC.10/44/Add.1)
 

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4.2 Apart from radioactive material in excepted packages (where the other hazardous properties take precedence), radioactive material having other hazardous properties must always be classified in Class 7 and the subsidiary-risk **hazard** must also be identified. For radioactive material in excepted packages, except for UN 3507, **Uranium hexafluoride, radioactive material, excepted package**, Special Provision A130 applies.

4.3 An article which, apart from its other hazards, also meets the criterion for a magnetized material, must be identified in accordance with the provisions of this section and in addition as a magnetized material.

#### 5. TRANSPORT OF SAMPLES

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 UN Model Regulations, 2.0.4.3 (see ST/SG/AC.10/44/Add.1)
 

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##### **5.4 Samples of energetic materials for testing purposes**

5.4.1 Samples of organic substances carrying functional groups listed in tables A6.1 and/or A6.3 in Appendix 6 (Screening Procedures) of the UN Manual of Tests and Criteria may be transported under UN 3224 (self-reactive solid type C) or UN 3223 (self-reactive liquid type C), as applicable, of Division 4.1 provided that:

- a) the samples do not contain any:
  - i) known explosives;
  - ii) substances showing explosive effects in testing;
  - iii) compounds designed with the view of producing a practical explosive or pyrotechnic effect; or

- iv) components consisting of synthetic precursors of intentional explosives;
- b) for mixtures, complexes or salts of inorganic oxidizing substances of Division 5.1 with organic material(s), the concentration of the inorganic oxidizing substance is:
  - i) less than 15%, by mass, if assigned to Packing Group I (high hazard) or II (medium hazard); or
  - ii) less than 30%, by mass, if assigned to Packing Group III (low hazard);
- c) available data do not allow a more precise classification;
- d) the sample is not packed together with other goods; and
- e) the sample is packed in accordance with Packing Instruction 459.

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UN Model Regulations, 2.0.5 (see ST/SG/AC.10/44/Add.1) and DGP-WG/17 (see paragraph 3.2.2.1 of DGP/26-WP/3)

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#### 6. TRANSPORT OF ARTICLES CONTAINING DANGEROUS GOODS N.O.S.

The dedicated working group tasked with reviewing the amendments at DGP-WG/17 proposed that these articles should be forbidden from transport by air under normal circumstances unless approval was granted by the State of Origin and the State of the Operator in accordance with Special Provision A2. An ad hoc group will develop provisions for inclusion in the DGP/26 working paper on UN harmonization (see DGP/26-WP/3, paragraph 3.2.2.1.3).

The text in the new note is different to the text in the UN Model Regulations as highlighted below. UN text is as follows: "... only dangerous goods **within the permitted limited quantity amounts** specified in Column 7a of the Dangerous Goods List"

DGP is invited to consider whether or not reference to Special Provision A107, which corresponds to UN special provision 301 referred to in the latter part of the note in the Model Regulations ("... see UN No. 3363 and special provision 301 of Chapter 3.3") should be added. Not much of SP 301 is included in A107. Some of SP 301 is provided in Packing Instruction 962.

Note.— For articles which do not have an existing proper shipping name and which contain only dangerous goods permitted in limited quantities within the limits specified in Column 11 of Table 3-1, see UN No. 3363.

6.1 Articles containing dangerous goods may be transported as otherwise provided by these Instructions under the proper shipping name for the dangerous goods they contain or in accordance with this section. For the purposes of this section "article" means machinery, apparatus or other devices containing one or more dangerous goods (or residues thereof) that are an integral element of the article, necessary for its functioning and that cannot be removed for the purpose of transport. An inner packaging must not be an article.

The ad hoc group developing provisions for inclusion in the DGP/26 working paper (see DGP/26-WP/3, paragraph 3.2.2.1.3) will consider whether it is appropriate to include the following provisions for lithium batteries for the air mode, recognizing the potential for additional complexity and risk.

6.2 Such articles may in addition contain batteries. Lithium batteries that are integral to the article must be of a type proven to meet the testing requirements of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3, except when otherwise specified by these Instructions (e.g. for pre-production prototype articles containing lithium batteries or for a small production run, consisting of not more than 100 such articles).

6.3 This section does not apply to articles for which a more specific proper shipping name already exists in Table 3-1.

6.4 This section does not apply to dangerous goods of Class 1, Division 6.2, Class 7 or radioactive material contained in articles.

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The ad hoc group developing provisions for inclusion in the DGP/26 working paper (see DGP/26-WP/3, paragraph 3.2.2.1.3 of this report) will consider whether all other dangerous goods should be considered a higher hazard if lithium batteries are contained within the article.

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6.5 Articles containing dangerous goods must be assigned to the appropriate class or division determined by the hazards present using, where applicable, Table 2-1 for each of the dangerous goods contained in the article. If dangerous goods classified as Class 9 are contained within the article, all other dangerous goods present in the article must be considered to present a higher hazard.

6.6 Subsidiary hazards must be representative of the primary hazard posed by the other dangerous goods contained within the article or they must be the subsidiary hazard(s) identified in column 4 of Table 3-1 when only one dangerous good is present in the article. If the article contains more than one dangerous good and these could react dangerously with one another during transport, each of the dangerous goods must be enclosed separately (see 4:1.1.8).

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**Table 2-1. Precedence of hazards and packing groups for Classes 3, 4 and 8 and for Divisions 5.1 and 6.1**

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The wording in the Model Regulations of the footnotes shown below is not the same as the wording in the Technical Instructions. The word “risk” is not used in the Model Regulations. Replacement of “risk” with “hazard” is proposed in accordance with the agreement by the UN Sub-Committee that the word “risk” was inappropriately used in many paragraphs of the Model Regulations and should be replaced by the word “hazard” (see ST/SG/AC.10/C.3/98).

DGP is also invited to consider the additional new text for the sake of alignment with the UN Model Regulations.

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\* Substances of Division 4.1 other than self-reactive substances, and solid desensitized explosives and substances of Class 3 other than liquid desensitized explosives.

\*\* For pesticides only, the primary-risk hazard must be Division 6.1.

— Denotes an impossible combination.

Note.— For hazards not shown in this table, see 4.

## Chapter 1

### CLASS 1 — EXPLOSIVES

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ICAO translators and editors of versions other than English: There may be a need for amendment to Note 4 2;1 for the sake of alignment with Note 4 at the beginning of Chapter 2.1.of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

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*Note 4.— Class 1 is unique in that the type of packaging frequently has a decisive effect on the hazard and therefore on the assignment to a particular division. The correct division is determined by use of the procedures provided in this Chapter.*

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#### 1.1 DEFINITIONS AND GENERAL PROVISIONS

Class 1 comprises:

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ICAO translators and editors of versions other than English: There may be a need for amendment to 2;1.1 a) for the sake of alignment 2.1.1.1 (a) of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

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- a) explosive substances (a substance that is not itself an explosive but which can form an explosive atmosphere of gas, vapour or dust is not included in Class 1), except those that are too dangerous to transport or those where the predominant hazard is appropriate to another class;
- b) explosive articles, except devices containing explosive substances in such quantity or of such a character that their inadvertent or accidental ignition or initiation during transport will not cause any effect external to the device either by projection, fire, smoke, heat or loud noise (see 1.5.2); and

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UN Model Regulations, 2.1.1.1 c) (see ST/SG/AC.10/44/Add.1)

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- c) substances and articles not mentioned under 1.1 a) and b), which are manufactured with a view to producing a practical, explosive or pyrotechnic effect.

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#### 1.3 DIVISIONS

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ICAO translators and editors of versions other than English There may be a need for amendments to 2;1.1.4 a) to f) for the sake of alignment 2.1.1.4 (a) to (f) of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

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1.3.1 Class 1 is divided into six divisions:

- a) Division 1.1 — Substances and articles which have a mass explosion hazard (a mass explosion is one which affects almost the entire load virtually instantaneously).
- b) Division 1.2 — Substances and articles which have a projection hazard but not a mass explosion hazard.
- c) Division 1.3 — Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

This division comprises substances and articles which:

- i) give rise to considerable radiant heat, or
- ii) burn one after another, producing minor blast or projection effects or both.
- d) Division 1.4 — Substances and articles which present no significant hazard.

This division comprises substances and articles which present only a small hazard in the event of ignition or initiation during transport. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

*Note.*— *Substances and articles of this division are in Compatibility Group S if they are so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package, unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder fire fighting or other emergency response efforts in the immediate vicinity of the package.*

- e) Division 1.5 — Very insensitive substances which have a mass explosion hazard.

This division comprises substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

*Note.*— *For the normal conditions of transport, see Notes 2 to 4 of the Introductory Notes to Part 4.*

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UN Model Regulations, 2.1.1.4 f) (see ST/SG/AC.10/44/Add.1)

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- f) Division 1.6 — Extremely insensitive articles which do not have a mass explosion hazard.

This division comprises articles which predominantly contain extremely insensitive substances and which demonstrate a negligible probability of accidental initiation or propagation.

*Note.*— *The risk hazard from articles of Division 1.6 is limited to the explosion of a single article.*

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ICAO translators and editors of versions other than English There may be a need for amendment to 2;1.4.1 for the sake of alignment 2.1.2.1 of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

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#### 1.4 COMPATIBILITY GROUPS

1.4.1 Goods of Class 1 are assigned to one of six divisions, depending on the type of hazard they present (see 1.3.1), and to one of thirteen compatibility groups which identify the kinds of explosive substances and articles that are deemed to be compatible. Tables 2-2 and 2-3 show the scheme of classification into compatibility groups, the possible hazard divisions associated with each group, and the consequential classification codes.

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UN Model Regulations (Part 1;4.2.1 provisions aren't included in the UN Model Regulations. Amendment is proposed for the sake of alignment with current reference.

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1.4.2.1 Certain Division 1.4S explosives, identified by Special Provision A165 in Table 3-1, are subject to Test Series 6 (d) of Part I of the *UN Manual of Tests and Criteria* (see ST/SG/AC.10/11/Rev.6 and Amend.1) to demonstrate that any hazardous effects arising from functioning are confined within the package. Evidence of a hazardous effect outside the package includes:

- a) denting or perforation of the witness plate beneath the package;
- b) a flash or flame capable of igniting such as a sheet of  $80 \pm 3$  g/m<sup>2</sup> paper at a distance of 25 cm from the package;
- c) disruption of the package causing projection of the explosives contents; or
- d) a projection which passes completely through the packaging (a projection or fragment retained or stuck in the wall of the packaging is considered as non-hazardous).

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*Editorial amendment.*— *Move paragraph 1.5 after Tables 2-2 and 2-3;*

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#### 1.5 CLASSIFICATION OF EXPLOSIVES

~~*Note.*— *For additional information regarding classification of explosives, see UN Recommendations, 2.1.3.1.4, 2.1.3.1.5 and 2.1.3.4.*~~

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UN Model Regulations, 2.1.2.1.1 (see ST/SG/AC.10/44/Add.1)

**Table 2-2. Classification codes**

<i>Description of substance or article to be classified</i>	<i>Compatibility group</i>	<i>Classification code</i>
...		
Explosive substance or article containing an explosive substance and presenting a special-risk hazard (e.g. due to water activation or presence of hypergolic liquids, phosphides or a pyrophoric substance) and needing isolation of each type	L	1.1L 1.2L 1.3L
...		

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ICAO translators and editors of versions other than English There may be a need for amendment to the heading of Table 2-3 for the sake of alignment 2.1.2.1.2 of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

**Table 2-3. Scheme of classification of explosives, combination of hazard division with compatibility group**

Hazard	Compatibility Group													A-S Σ
	A	B	C	D	E	F	G	H	J	K	L	N	S	
1.1	1.1A	1.1B	1.1C	1.1D	1.1E	1.1F	1.1G		1.1J		1.1L			9
1.2		1.2B	1.2C	1.2D	1.2E	1.2F	1.2G	1.2H	1.2J	1.2K	1.2L			10
1.3			1.3C			1.3F	1.3G	1.3H	1.3J	1.3K	1.3L			7
1.4		1.4B	1.4C	1.4D	1.4E	1.4F	1.4G						1.4S	7
1.5				1.5D										1
1.6												1.6N		1
1.1-1.6 Σ		3	4	4	3	4	4	2	3	2	3	1	1	35

...

*Editorial amendment.— Paragraph 1.5 has been moved from before Table 2-2.*

## **1.5 CLASSIFICATION OF EXPLOSIVES**

*Note.— For additional information regarding classification of explosives, see UN Recommendations, 2.1.3.1.4, 2.1.3.1.5 and 2.1.3.4.*

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UN Model Regulations, 2.1.3.1.2 c) (see ST/SG/AC.10/44/Add.1)

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1.5.1.3 Except for substances that are listed by their proper shipping name in the Dangerous Goods List (Table 3-1), goods must not be offered for transport as Class 1 until they have been subjected to the classification procedure prescribed in this Chapter. In addition, the classification procedure must be undertaken before a new product is offered for transport. In this context, a new product is one which, in the opinion of the appropriate national authority, involves any of the following:

- a) a new explosive substance or a combination or a mixture of explosive substances which is considered to be significantly different from other combinations or mixtures already classified;
- b) a new design of article or an article containing a new explosive substance or a new combination or mixture of explosive substances;
- c) a new design of package for an explosive substance or article including a new type of inner packaging.

*Note.— The importance of this can be overlooked unless it is realized that a relatively minor change in an inner or outer packaging can be critical and can convert a lesser-risk hazard into a mass explosion-risk hazard.*

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### 1.5.2 Exclusion from Class 1

1.5.2.1 The appropriate national authority may exclude an article or substance from Class 1 by virtue of test results and the Class 1 definition.

1.5.2.2 Where a substance provisionally accepted into Class 1 is excluded from Class 1 by performing Test Series 6 on a specific type and size of package, this substance, when meeting the classification criteria or definition for another class or division, should be listed in the Dangerous Goods List in that class or division with a special provision restricting it to the type and size of package tested.

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UN Model Regulations, 2.1.3.6.3 (see ST/SG/AC.10/44/Add.1)

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1.5.2.3 Where a substance is assigned to Class 1 but is diluted to be excluded from Class 1 by Test Series 6, this diluted substance (hereafter referred to as desensitized explosive) should be listed in the Dangerous Goods List with an indication of the highest concentration which excluded it from Class 1 (see 2;3.1.4 and 2;4.2.4) and if applicable, the concentration below which it is no longer deemed subject to these Instructions. New solid desensitized explosives subject to these Instructions should be listed in Division 4.1, and new liquid desensitized explosives should be listed in Class 3. When the desensitized explosive meets the criteria or definition for another class or division, the corresponding subsidiary-risk hazard(s) should be assigned to it.

1.5.2.4 An article may be excluded from Class 1 when three unpackaged articles, each individually activated by its own means of initiation or ignition or external means to function in the designed mode, meet the following test criteria:

- a) no external surface has a temperature of more than 65°C. A momentary spike in temperature up to 200°C is acceptable;
- b) no rupture or fragmentation of the external casing or movement of the article or detached parts thereof of more than one metre in any direction;

*Note.— Where the integrity of the article may be affected in the event of an external fire, these criteria must be examined by a fire test, such as described in ISO 12097-3.*

- c) no audible report exceeding 135 dB(C) peak at a distance of one metre;
- d) no flash or flame capable of igniting a material such as a sheet of 80 ± 10 g/m<sup>2</sup> paper in contact with the article; and
- e) no production of smoke, fumes or dust in such quantities that the visibility in a one cubic metre chamber equipped with appropriately sized blow out panels is reduced more than 50 per cent as measured by a calibrated light (lux) meter or radiometer located one metre from a constant light source located at the midpoint on opposite walls. The general guidance on optical density testing in ISO 5659-1 and the general guidance on the photometric system described in Section 7.5 in ISO 5659-2 may be used or similar optical density measurement methods designed to accomplish the same purpose may also be employed. A suitable hood cover surrounding the back and sides of the light meter must be used to minimize effects of scattered or leaking light not emitted directly from the source.

*Note 1.— If during the tests addressing criteria a), b), c) and d), no smoke, or very little smoke is observed, the test described in e) may be waived.*

---

UN Model Regulations, 2.1.3.6.4 (see ST/SG/AC.10/44/Add.1)

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*Note 2.— The appropriate national authority may require testing in packaged form if it is determined that, as packaged for transport, the article may pose a greater-risk hazard.*

...

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ICAO translators and editors of versions other than English: There may be a need for amendment to 2.1.5.3.4 f) for the sake of alignment 2.1.3.7.4 (f) of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

---

### 1.5.3 Classification documentation

...

1.5.3.4 Examples of the information that may be provided in the classification documents are as follows:

...

- f) the proper shipping name, UN number, class, hazard division and corresponding compatibility group of the explosives;

...

## Chapter 2

### CLASS 2 — GASES

...

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ICAO translators and editors of versions other than English: There may be a need for amendment to 2.2.2.1 for the sake of alignment 2.2.2.1 of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

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### 2.2 DIVISIONS

2.2.1 Substances of Class 2 are assigned to one of three divisions based on the primary hazard of the gas during transport.

*Note.— UN 1950 — Aerosols, UN 2037 — Receptacles, small, containing gas and UN 2037 — Gas cartridges must be regarded as being in Division 2.1 when the criteria in 2.5.1 a) are met.*

- a) Division 2.1 — Flammable gases.

Gases which at 20°C and a standard pressure of 101.3 kPa:

- i) are ignitable when in a mixture of 13 per cent or less by volume with air; or
- ii) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Flammability must be determined by tests or by calculation in accordance with methods adopted by ISO (see ISO 10156:2010). Where insufficient data are available to use these methods, tests by a comparable method recognized by the appropriate national authority must be used.

---

DGP-WG/16 (see paragraph 3.2.2.1 of DGP/26-WP/2):

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*Note.— UN 1950 — Aerosols and UN 2037 — Receptacles, small, containing gas must be regarded as being in Division 2.1 when the criteria in 2.5.1 a) are met.*

...

c) Division 2.3 — Toxic gases.

Gases which:

ICAO translators and editors of versions other than English: There may be a need for amendment to 2.2.2.1 c) i) for the sake of alignment 2.2.2.1 (c) (i) of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

- i) are known to be so toxic or corrosive to humans as to pose a hazard to health; or
- ii) are presumed to be toxic or corrosive to humans because they have an LC<sub>50</sub> value equal to or less than 5 000 mL/m<sup>3</sup> (ppm) when tested in accordance with 6.2.1.3.

UN Model Regulations, 2.2.2.1 (see ST/SG/AC.10/44/Add.1)

There appears to be an error in ST/SG/AC.10/44/Add.1 as it refers to the first sentence of 2.2.2.1 (c), but the word “risk” appears under 2.2.2.1 (c) (ii).

*Note.— Gases meeting the above criteria owing to their corrosivity are to be classified as toxic with a subsidiary corrosive-risk hazard.*

ICAO translators and editors of versions other than English: There may be a need for amendment to 2.2.3 for the sake of alignment 2.2.2.2 of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

**2.3 HAZARD PRECEDENCE**

Gases and gas mixtures with hazards associated with more than one division take the following precedence:

- a) Division 2.3 takes precedence over all other divisions;
- b) Division 2.1 takes precedence over Division 2.2.

UN Model Regulations, 2.2.3 (c) (see ST/SG/AC.10/44/Add.1)

**2.4 MIXTURES OF GASES**

For the classification of gas mixtures into one of the three divisions (including vapours of substance from other classes), the following principles must be used:

...

- c) A gas mixture has a subsidiary-risk hazard of corrosivity when the mixture is known by human experience to be destructive to the skin, eyes or mucous membranes or when the LC<sub>50</sub> value of the mixture’s corrosive components is equal to or less than 5 000 mL/m<sup>3</sup> (ppm) when the LC<sub>50</sub> value is calculated by the formula:

$$LC_{50} \text{ Corrosive (mixture)} = \frac{1}{\sum_{i=1}^n \frac{f_{ci}}{T_{ci}}}$$

...

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The Model Regulations do not contain the following provisions. The amendments proposed is in accordance with the agreement by the UN Sub-Committee that the word “risk” was inappropriately used in many paragraphs of the Model Regulations and should be replaced by the word “hazard” (see ST/SG/AC.10/C.3/98).

---

## 2.5 AEROSOLS

2.5.1 For aerosols, the division of Class 2 and the subsidiary-~~risk~~ hazards depend on the nature of the contents of the aerosol dispenser. The following provisions must apply:

- a) Division 2.1 applies if the contents include 85 per cent by mass or more flammable components and the chemical heat of combustion is 30 kJ/g or more;
- b) Division 2.2 applies if the content contains 1 per cent by mass or less flammable components and the heat of combustion is less than 20 kJ/g;
- c) otherwise the product must be classified as tested by the tests described in the UN *Manual of Tests and Criteria*, Part III, section 31. Extremely flammable and flammable aerosols must be classified in Division 2.1; non-flammable in Division 2.2;
- d) gases of Division 2.3 must not be used as a propellant in an aerosol dispenser;
- e) where the contents other than the propellant of aerosol dispensers to be ejected are classified as Division 6.1, Packing Groups II or III or Class 8, Packing Groups II or III, the aerosol must have a subsidiary-~~risk~~ hazard of Division 6.1 or Class 8;
- f) aerosols with contents meeting the criteria of Packing Group I for toxicity or corrosivity are forbidden from transport.

2.5.2 Flammable components are flammable liquids, flammable solids or flammable gases and gas mixtures as defined in Notes 1 to 3 of subsections 31.1.3 of Part III of the UN *Manual of Tests and Criteria*. This designation does not cover pyrophoric, self-heating or water-reactive substances. The chemical heat of combustion must be determined by one of the following methods: ASTM D 240, ISO/FDIS 13943: 1999 (E/F) 86.1 to 86.3 or NFPA 30B.

...

## Chapter 3

### CLASS 3 — FLAMMABLE LIQUIDS

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#### 3.2 ASSIGNMENT OF PACKING GROUPS

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UN Model Regulations, 2.3.2.1, 2.3.2.1.1 and 2.3.2.1.2 (see ST/SG/AC.10/44/Add.1) and DGP-WG/16 (see paragraph 3.2.1.6 of DGP/26-WP/2)

DGP is invited to consider changes in addition to the ones shown in ST/SG/AC.10/44/Add.1 for the purpose of alignment with UN Model Regulations to determine if the lack of harmonization was intentional and if so, if the UN should be informed.

---

3.2.1 Table 2-4 should be used for the determination of the packing group of a liquid that presents a ~~risk~~ hazard due to flammability. For liquids whose only hazard is flammability, the packing group for the ~~material~~ liquid is the packing group shown in Table 2-4. For a liquid possessing an additional hazard(s), the packing group, determined by using Table 2-4, and the packing group based on the severity of the additional hazard(s), must be considered. In such cases, the table of precedence of hazard characteristics appearing in Table 2-1 should be used to determine the correct classification of the liquid.

3.2.2 Viscous flammable liquids such as paints, enamels, lacquers, varnishes, adhesives and polishes having a flash point of less than 23°C may be assigned to Packing Group III in conformity with the procedures prescribed in Part III, subsection 32.3 of the UN *Manual of Tests and Criteria* provided that:

- a) the viscosity<sup>2</sup> and flash point are in accordance with Table 2-5;

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<sup>2</sup>. Viscosity determination: Where the substance concerned is non-Newtonian, or where a flow cup method of viscosity determination is otherwise

- b) less than 3 per cent of the clear solvent layer separates in the solvent separation test;
- c) the mixture or any separated solvent does not meet the criteria for Division 6.1 or Class 8;
- d) the net quantity per package does not exceed 30 L for passenger aircraft or 100 L for cargo aircraft.

3.2.3 Substances classified as flammable liquids due to their being transported or offered for transport at elevated temperatures are included in Packing Group III.

...

## Chapter 4

### CLASS 4 — FLAMMABLE SOLIDS; SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION; SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

#### INTRODUCTORY NOTES

*Note 1.— Where the term “water-reactive” is used in these Instructions, it refers to a substance which, in contact with water, emits flammable gas.*

*Note 2.— Because of the different properties exhibited by the dangerous goods within Divisions 4.1 and 4.2, it is impracticable to establish a single criterion for classification in either of these divisions. Tests and criteria for assignment to the three divisions of Class 4 are addressed in this chapter and in the UN Manual of Tests and Criteria, Part III, section 33.*

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UN Model Regulations, 2.4, Introductory notes (see ST/SG/AC.10/44/Add.1)

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*Note 3.— Since organometallic substances can be classified in Divisions 4.2 or 4.3 with additional subsidiary-risks hazards, depending on their properties, a specific classification flowchart for these substances is given in 2.4.5 of the UN Recommendations on the Transport of Dangerous Goods.*

...

#### 4.2.3 Division 4.1 — Self-reactive substances

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UN Model Regulations, 2.4.2.3.2.2 (see ST/SG/AC.10/44/Add.1)

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4.2.3.2.3 Self-reactive substances permitted for transport are listed in 4.2.3.2.4. For each permitted substance listed, the appropriate generic entry of the Dangerous Goods List (UN 3221 to 3240) is assigned, and appropriate subsidiary-risks hazard(s) and remarks providing relevant information are given. The generic entries specify:

- the self-reactive substance type (B to F);
- the physical state (i.e. liquid/solid); and
- when temperature control is required.

...

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unsuitable, a variable shear-rate viscometer must be used to determine the dynamic viscosity coefficient of the substance, at 23°C, at a number of shear rates. The values obtained are plotted against shear rate and then extrapolated to zero shear rate. The dynamic viscosity thus obtained, divided by the density, gives the apparent kinematic viscosity at near-zero shear rate.

## UN Model Regulations, 2.4.2.3.2.3 (see ST/SG/AC.10/44/Add.1)

**Table 2-6. List of currently assigned self-reactive substances in packages**

<i>Self-reactive substance</i>	<i>Concentration (%)</i>	<i>Control temperature (°C)</i>	<i>Emergency temperature (°C)</i>	<i>UN generic entry</i>	<i>Notes</i>
...					
4-Nitrosophenol	100	+35	+40	3236	
<u>Phosphorothioic acid, O-[(cyanophenyl methylene) azanyl] O,O-diethyl ester</u>	<u>82-91 (Z isomer)</u>			<u>3227</u>	<u>8</u>
Self-reactive liquid, sample				3223	6
...					

## UN Model Regulations, 2.4.2.3.2.3 Remarks 2 and 10 (see ST/SG/AC.10/44/Add.1)

## NOTES:

1. Azodicarbonamide formulations which fulfil the criteria of 2.4.2.3.3.2 (b) of the UN Recommendations.
2. "EXPLOSIVE" subsidiary-risk hazard label required and consequently forbidden for transport by air under any circumstance.
3. Azodicarbonamide formulations which fulfil the criteria of 2.4.2.3.3.2 (c) of the UN Recommendations.
4. Azodicarbonamide formulations which fulfil the criteria of 2.4.2.3.3.2 (d) of the UN Recommendations.
5. With a compatible diluent having a boiling point of not less than 150°C.
6. See 4.2.3.2.6.
7. This entry applies to mixtures of esters of 2-diazo-1-naphthol-4-sulphonic acid and 2-diazo-1-naphthol-5-sulphonic acid meeting the criteria of 2.4.2.3.3.2 d) of the UN Recommendations.
8. This entry applies to the technical mixture in n-butanol within the specified concentration limits of the (Z) isomer.

...

**4.2.5 Division 4.1 — Polymerizing substances and mixtures (stabilized)**4.2.5.1 *Definitions and properties*

4.2.5.1.1 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 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 in which the substance or mixture is to be transported;
- 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.

4.2.5.1.2 A mixture meeting the criteria of a polymerizing substance must be classified as a polymerizing substance of Division 4.1.

## UN Model Regulations, 2.4.2.5.2 (see ST/SG/AC.10/44/Add.1)

4.2.5.1.3 Polymerizing substances are subject to temperature control in transport if their self-accelerating polymerization temperature (SAPT) is 50 °C or less in the packaging in which the substance is to be transported.

Note.—Substances meeting the criteria of a polymerizing substance and also for inclusion in Classes 1 to 8 are subject to the requirements of Special Provision A209.

### 4.3 SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION (DIVISION 4.2)

#### 4.3.1 Definitions and properties

4.3.1.1 Division 4.2 includes:

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ICAO translators and editors of versions other than English: There may be a need for amendment to 2;4.3.1.1 a) for the sake of alignment 2.4.3.1.1 (a) of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

---

- a) pyrophoric substances: substances, including mixtures and solutions (liquid or solid), which even in small quantities ignite within 5 minutes of coming into contact with air. These substances are the most liable to spontaneous combustion and are called pyrophoric substances; and
- b) self-heating substances: other substances which in contact with air without energy supply are liable to self-heating. These substances will ignite only when in large amounts (kilograms) and after long periods of time (hours or days) and are called self-heating substances.

...

### 4.4 SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES (DIVISION 4.3)

#### 4.4.1 Definitions and properties

---

DGP-WG/16 (see paragraph 3.2.2.3 of DGP/26-WP/2):

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~~4.4.1.1 Division 4.3 Substances which, in contact with water, emit flammable gases.~~

~~4.4.1.2 Certain substances in contact with water emit flammable gases which can form explosive mixtures with air. Such mixtures are easily ignited by all ordinary sources of ignition, for example, naked lights, sparking handtools or unprotected lamps. The resulting blast wave and flames may endanger people and the environment. The test method referred to in 4.4.2 must be used to determine whether the reaction of a substance with water leads to the development of a dangerous amount of gases which may be flammable. It must not be applied to pyrophoric substances.~~

...

## Chapter 5

### CLASS 5 — OXIDIZING SUBSTANCES; ORGANIC PEROXIDES

...

#### 5.2 OXIDIZING SUBSTANCES (DIVISION 5.1)

##### 5.2.1 Classification in Division 5.1

5.2.1.1 Oxidizing substances are classified in Division 5.1 in accordance with the test methods, procedures and criteria in 5.2.2, 5.2.3 and the UN *Manual of Tests and Criteria*, Part III, section 34. In the event of divergence between test results and known experience, the appropriate authority of the State in which the dangerous goods were manufactured must be consulted to establish the appropriate classification and packing group.

*Note.— Where substances of this division are listed in the Dangerous Goods List in 3;2, reclassification of those substances in accordance with these criteria need only be undertaken when this is necessary for safety.*

---

UN Model Regulations, 2.5.2.1.2 (see ST/SG/AC.10/44/Add.1)

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5.2.1.2 By exception, solid ammonium nitrate based fertilizers must be classified in accordance with the procedure as set out in the UN *Manual of Tests and Criteria*, Part III, section 39.

---

**DGP:**

The following provision from the Model Regulations (2.5.2.1.2 of 19th revised edition) is not included in the Technical Instructions. The meeting is invited to consider whether it should be included as 2;5.2.1.3 as shown below.

---

5.2.1.3 For substances having other hazards, e.g. toxicity or corrosivity, the requirements of Part 2, Introductory Chapter must be met.

...

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Paragraph 2;5.3.2.3 does not currently align with the associated paragraph in the 19th edition of the UN Model Regulations (2.5.3.2.3). The dedicated working group tasked with reviewing the amendments at DGP-WG/17 concluded that the text in the Technical Instructions should be maintained. The only change incorporated in the 20th edition of the Model Regulations was the replacement of “subsidiary risks” with “subsidiary hazards”. Not relevant to the Technical Instructions if the provisions staying misaligned.

---

5.3.2.3 Organic peroxides permitted for transport are listed in 5.3.2.4. For each permitted substance, Table 2-7 assigns the appropriate generic entry in the Dangerous Goods List (UN 3103 to 3120) and provides relevant information. The generic entries specify:

- a) organic peroxide type (B to F);
- b) physical state (liquid or solid); and
- c) temperature control, when required (see 5.3.3).

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DGP is invited to consider editorial changes to paragraph 5.3.2.4 for the sake of clarity, removal of redundancy, and harmonization with the UN Model Regulations.

---

5.3.2.4 *List of currently assigned organic peroxides in packagings*

~~The following table (Table 2-7) is reproduced from 2.5.3.2.4 of the UN *Recommendations on the Transport of Dangerous Goods* (Eighteenth revised edition), with irrelevant material removed.~~

5.3.2.5 Table 2-7 provides a list of currently assigned organic peroxides in packagings. Classification of organic peroxides not listed in ~~5.3.2.4 Table 2-7~~ and assignment to a generic entry must be made by the appropriate authority of the State in which the dangerous goods were manufactured on the basis of a test report. Principles applying to the classification of such substances are provided in 2.5.3.3 of the UN Recommendations. The applicable classification procedures, test methods and criteria, and an example of a suitable test report, are given in the current edition of the UN *Manual of Tests and Criteria*, Part II. The statement of approval must contain the classification and the relevant transport conditions.

5.3.2.6 Samples of new formulations of organic peroxides not listed in 5.3.2.4 for which complete test data are not available and which are to be transported for further testing or evaluation may be assigned to one of the appropriate entries for **Organic peroxide Type C** provided that the following conditions are met:

- a) the available data indicate that the sample would be no more dangerous than organic peroxide type B;
- b) it is packed in a combination packaging consisting of a plastic IP.2 inner packaging with a capacity not exceeding 0.5 L or 0.5 kg which is placed in a wooden box (4C1), plywood box (4D) or fibreboard box (4G) with the maximum net quantity per package not exceeding 1 L or 1 kg; and
- c) the available data indicate that the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation.

...

**Table 2-7. List of currently assigned organic peroxides in packages packagings**

UN Model Regulations 2.5.3.2.4 (see ST/SG/AC.10/44/Add.1)

DGP is invited to consider whether the last column of Table 2-7 should be entitled “Subsidiary hazards and notes” for the sake of the alignment with the UN Model Regulations

<i>Organic peroxide</i>	<i>Concentration (per cent)</i>	<i>Diluent type A (per cent)</i>	<i>Diluent type B (per cent) (Note 1)</i>	<i>Inert solid (per cent)</i>	<i>Water (per cent)</i>	<i>Control tempera- ture (°C)</i>	<i>Emergency tempera- ture (°C)</i>	<i>UN generic entry</i>	<i>Notes<sup>S</sup> <u>ub- sidiary hazards and notes</u></i>
...									
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	≤100					+30	+35	3114	
<u>Di-(4-tert-butylcyclohexyl) peroxydicarbonate</u>	<u>≤42 as a paste</u>					<u>35</u>	<u>40</u>	<u>3116</u>	
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	≤42 as a stable dispersion in water					+30	+35	3119	
...									
Diisobutyl peroxide	>32-52		≥48			-20	-10	FORBIDDEN	3
<u>Diisobutyl peroxide</u>	<u>≤42 as a stable dispersion in water</u>					<u>-20</u>	<u>-10</u>	<u>3119</u>	
Diisobutyl peroxide	≤32		≥68			-20	-10	3115	
nn ...									
Peroxy lauric acid	≤100					+35	+40	3118	
<u>1-Phenylethyl hydroperoxide</u>	<u>≤38</u>		<u>≥ 62</u>					<u>3109</u>	
Pinanyl hydroperoxide	>56-100							3105	13
...									

UN Model Regulations, 2.5.3.2.4 (see ST/SG/AC.10/44/Add.1)

Notes:

- Diluent type B may always be replaced by diluent type A. Boiling point diluent type B should be at least 60°C higher than the SADT of the organic peroxide.
- Available oxygen ≤4.7 per cent.
- “EXPLOSIVE” subsidiary-risk hazard label required and consequently forbidden for transport by air under any circumstance.
- Diluent may be replaced by Di-tert-butyl peroxide.
- Available oxygen ≤9 per cent.
- With ≤9 per cent hydrogen peroxide; available oxygen ≤10 per cent.
- Only non-metallic packagings allowed.
- Available oxygen >10 per cent and ≤10.7 per cent, with or without water.
- Available oxygen ≤10 per cent, with or without water.
- Available oxygen ≤8.2 per cent, with or without water.
- See 5.3.2.6.
- Not used.
- “CORROSIVE” subsidiary-risk hazard label required (see Figure 5-24).
- Peroxyacetic acid formulations which fulfil the criteria of 5.3.2.5.
- Peroxyacetic acid formulations which fulfil the criteria of 5.3.2.5.
- Peroxyacetic acid formulations which fulfil the criteria of 5.3.2.5.

17. Addition of water to this organic peroxide will decrease its thermal stability.
18. No "CORROSIVE" subsidiary-risk **hazard** label required for concentrations below 80 per cent.
19. Mixtures with hydrogen peroxide, water and acid(s).
20. With diluent type A, with or without water.
21. With  $\geq 25$  per cent diluent type A by mass, and in addition ethylbenzene.
22. With  $\geq 19$  per cent diluent type A by mass, and in addition methyl isobutyl ketone.
23. With  $< 6$  per cent di-tert-butyl peroxide.
24. With  $\leq 8$  per cent 1-isopropylhydroperoxy-4-isopropylhydroxybenzene.
25. Diluent type B with boiling point  $> 110^{\circ}\text{C}$ .
26. With  $< 0.5$  per cent hydroperoxides content.
27. For concentrations more than 56 per cent, "CORROSIVE" subsidiary-risk **hazard** label required (see Figure 5-24).
28. Available active oxygen  $\leq 7.6$  per cent in diluent type A having a 95 per cent boil-off point in the range of  $200\text{--}260^{\circ}\text{C}$ .
29. Not subject to the requirements of these Instructions for Division 5.2.
30. Diluent type B with boiling point  $> 130^{\circ}\text{C}$ .
31. Active oxygen  $\leq 6.7$  per cent.

## Chapter 6

### CLASS 6 — TOXIC AND INFECTIOUS SUBSTANCES

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ICAO translators and editors of versions other than English: There may be a need for amendment to 2.6.2.2.1 for the sake of alignment with 2.6.2.2.1 of the UN Model Regulations (see ST/SG/AC.10/44/Add.1)

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UN Model Regulations, 2.6.2.2.1 (a) (b) and (c) (see ST/SG/AC.10/44/Add.1)

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#### 6.2.2 Assignment of packing groups

6.2.2.1 Substances of Division 6.1, including pesticides, are allocated among the three packing groups, according to the degree of their toxic hazards in transport as follows:

- a) Packing Group I — Substances and preparations presenting a very severe toxicity-risk **hazard**;
- b) Packing Group II — Substances and preparations presenting a serious toxicity-risk **hazard**;
- c) Packing Group III — Substances and preparations presenting a relatively low toxicity-risk **hazard**.

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#### Editorial amendment:

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6.2.2.4.1 The grouping criteria for the oral and dermal routes as well as for inhalation of dusts and mists are as shown in Table 2-8.

*Note.* — Substances meeting the criteria of Class 8 and with an inhalation toxicity of dusts and mists ( $LC_{50}$ ) leading to Packing Group I are only accepted for an allocation to Division 6.1 if the toxicity through oral ingestion or dermal contact is at least in the range of Packing Group I or II. Otherwise, an allocation to Class 8 is made when appropriate (see ~~8.2.3~~ **8.2.4**).

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#### 6.2.4 Classification of pesticides

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UN Model Regulations, 2.6.4.1 (see ST/SG/AC.10/44/Add.1)

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6.2.4.1 All active pesticide substances and their preparations for which the  $LC_{50}$  and/or  $LD_{50}$  values are known and which are classified in Division 6.1 must be classified under appropriate packing groups in accordance with the criteria given in 6.2.2. Substances and preparations which are characterized by subsidiary-risks **hazards** must be classified according to the precedence of hazards table (Table 2-1) with the assignment of appropriate packing groups.

6.2.4.2 If the oral or dermal LD<sub>50</sub> value for a pesticide preparation is not known, but the LD<sub>50</sub> value of its active substance(s) is known, the LD<sub>50</sub> value for the preparation may be obtained by applying the procedures in 6.2.3.

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**ICAO translators and editors of versions other than English: There may be a need for amendments to the note below for the sake of alignment with Special Provision 61 of the UN Model Regulations, (see ST/SG/AC.10/44/Add.1)**

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*Note.— LD<sub>50</sub> toxicity data for a number of common pesticides may be obtained from the most current edition of the document The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification available from the International Programme on Chemical Safety, World Health Organization (WHO), 1211 Geneva 27, Switzerland. While that document may be used as a source of LD<sub>50</sub> data for pesticides, its classification system should not be used for purposes of transport classification of, or assignment of packing groups to, pesticides which must be in accordance with these Instructions.*

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UN Model Regulations, 2.6.4.3 (see ST/SG/AC.10/44/Add.1)

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6.2.4.3 The proper shipping name used in the transport of the pesticide must be selected on the basis of the active ingredient, of the physical state of the pesticide and any subsidiary risks hazards it may exhibit.

...

### 6.3 DIVISION 6.2 — INFECTIOUS SUBSTANCES

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#### 6.3.6 Infected animals

##### 6.3.6.1 *Infected live animals*

Live animals must not be used to consign infectious substances unless such a substance cannot be consigned by any other means. A live animal that has been intentionally infected and is known or suspected to contain an infectious substance may only be transported by air under the terms and conditions of an approval granted by the appropriate national authorities of the States of Origin, Transit, Destination and Operator in accordance with the Supplement to these Instructions (Part S-1;2).

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UN Model Regulations, 2.6.3.6.2 (see ST/SG/AC.10/44/Add.1)

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##### 6.3.6.2 ~~Infected animal material~~ Deleted

~~Animal material from animals intentionally infected for the purpose of propagating pathogens of Category A or which would be assigned to Category A in cultures only, must be assigned to UN 2814 or UN 2900, as appropriate. Animal material infected by pathogens of Category B other than those which would be assigned to Category A if they were in cultures must be assigned to UN 3373.~~

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UN Model Regulations, Chapter 2.8 (see ST/SG/AC.10/44/Add.1)

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## Chapter 8

### CLASS 8 — CORROSIVE SUBSTANCES

#### 8.1 DEFINITION OF CLASS 8 AND GENERAL PROVISIONS

8.1.1 Class 8 substances (Corrosive substances) are substances which, by chemical action, will cause severe irreversible damage when in contact with living tissue to the skin or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

8.1.2 For substances and mixtures that are corrosive to skin, general classification provisions are provided in 8.2. Skin corrosion refers to the production of irreversible damage to the skin, namely, visible necrosis through the epidermis and into the dermis occurring after exposure to a substance or mixture.

8.1.3 Liquids and solids which may become liquid during transport, which are judged not to be skin corrosive, must still be considered for their potential to cause corrosion to certain metal surfaces in accordance with the criteria in 8.3.3 c) ii).

## **8.2 ASSIGNMENT OF PACKING GROUPS GENERAL CLASSIFICATION PROVISIONS**

8.2.1 Substances and ~~preparations~~ mixtures of Class 8 are divided among the three packing groups according to their degree of ~~hazard~~ danger in transport as follows:

- a) Packing Group I: Very dangerous substances and ~~preparations~~ mixtures;
- b) Packing Group II : Substances and ~~preparations~~ mixtures presenting medium danger;
- c) Packing Group III: Substances and ~~preparations~~ mixtures presenting minor danger.

8.2.2 Allocation of substances in Class 8 listed in Table 3-1 to the packing groups ~~referred to in the Introductory Chapter to Part 2 in Class 8~~ has been made on the basis of experience, taking into account such additional factors as inhalation risk (see 8.2.4.) and reactivity with water, including the formation of hazardous decomposition products.

8.2.3 New substances, including and mixtures, can be assigned to packing groups on the basis of the length of time of contact necessary to produce full thickness destruction of human skin irreversible damage of intact skin tissue in accordance with the criteria in 8.3. Liquids, and solids which may become liquid during transport, which are judged not to cause full thickness destruction of human skin must still be considered for their potential to cause corrosion to certain metal surfaces in accordance with the criteria in 8.2.5 c) ii). Alternatively, for mixtures, the criteria in 8.4 can be used.

~~8.2.3~~ 8.2.4 A substance or ~~preparation~~ mixture meeting the criteria of Class 8 having an inhalation toxicity of dusts and mists (LC<sub>50</sub>) in the range of Packing Group I, but toxicity through oral ingestion or dermal contact only in the range of Packing Group III or less, must be allocated to Class 8 (see Note under 6.2.2.4.1).

## **8.3 PACKING GROUP ASSIGNMENT FOR SUBSTANCES AND MIXTURES**

8.3.1 Existing human and animal data, including information from single or repeated exposure, must be the first line of evaluation, as they give information directly relevant to effects on the skin.

~~8.2.4~~ 8.3.2 In assigning the packing group to a substance in accordance with ~~8.2.2~~ 8.2.3, account must be taken of human experience in instances of accidental exposure. In the absence of human experience, the packing grouping must be based on data obtained from experiments in accordance with OECD Guideline for the Testing of Chemicals No. 404, *Acute Dermal Irritation/Corrosion*, ~~2002~~ 2015 or No. 435, *In Vitro Membrane Barrier Test Method for Skin Corrosion*, ~~2006~~ 2015. A substance or mixture which is determined not to be corrosive in accordance with OECD Guideline for the Testing of Chemicals No. 430, *In Vitro Skin Corrosion: Transcutaneous Electrical Resistance Test (TER)*, ~~2004~~ 2015 or No. 431, *In Vitro Skin Corrosion: Human Skin Model Test*, ~~2004~~ 2015 may be considered not to be corrosive to skin for the purposes of these Instructions without further testing.

~~8.2.5~~ 8.3.3 Packing groups are assigned to corrosive substances in accordance with the following criteria (see Table 2-15):

- a) *Packing Group I* is assigned to substances that cause ~~full thickness destruction~~ irreversible damage of intact skin tissue within an observation period of up to 60 minutes starting after ~~an~~ the exposure time of 3 minutes or less.
- b) *Packing Group II* is assigned to substances that cause ~~full thickness destruction~~ irreversible damage of intact skin tissue within an observation period of up to 14 days starting after ~~an~~ the exposure time of more than 3 minutes but not more than 60 minutes.
- c) *Packing Group III* is assigned to substances that:
  - i) cause ~~full thickness destruction~~ irreversible damage of intact skin tissue within an observation period of up to 14 days starting after ~~an~~ the exposure time of more than 60 minutes but not more than 4 hours; or
  - ii) are judged not to cause ~~full thickness destruction~~ irreversible damage of intact skin tissue but which exhibit a corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55°C when tested on both materials. For the purposes of testing steel, type S235JR+CR (1.0037 resp. St 37-2), S275J2G3+CR (1.0144 resp. St 44-3), ISO 3574, or Unified Numbering System (UNS) G10200 or a similar type or SAE 1020, and for testing aluminium, non-clad types 7075-T6 or AZ5GU-T6, must be used. An acceptable test is prescribed in the UN *Manual of Tests and Criteria*, Part III, Section 37.

*Note.— Where an initial test on either steel or aluminium indicates the substance being tested is corrosive, the follow up test on the other metal is not required.*

Paragraph 8.3 of the 2017-2018 Edition is moved to 8.5

**8.3— SUBSTANCES FORBIDDEN FOR TRANSPORT**

Chemically unstable substances of Class 8 are forbidden for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport. For the precautions necessary to prevent polymerization, see Special Provision A209. To this end, particular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions.

**Table 2-15. Summary of criteria for assigning packing groups to corrosive substances**

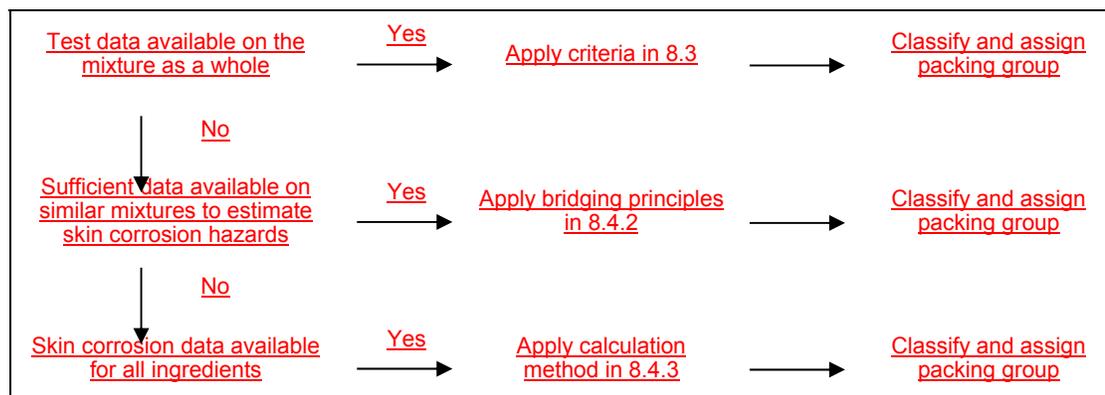
Packing group	Exposure time	Observation period	Effect
	≤ 3 min	≤ 60 min	<del>Full thickness destruction</del> <u>Irreversible damage</u> of intact skin
II	> 3 min ≤ 1 h	≤ 14 d	<del>Full thickness destruction</del> <u>Irreversible damage</u> of intact skin
III	> 1 h ≤ 4 h	≤ 14 d	<del>Full thickness destruction</del> <u>Irreversible damage</u> of intact skin
III	—	—	Corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55°C when tested on both materials

**8.4 Alternative packing group assignment methods for mixtures: Step-wise approach**

**8.4.1 General provisions**

8.4.1.1 For mixtures, it is necessary to obtain or derive information that allows the criteria to be applied to the mixture for the purpose of classification and assignment of packing groups. The approach to classification and assignment of packing groups is tiered, and is dependent upon the amount of information available for the mixture itself, for similar mixtures and/or for its ingredients. The flow chart of Figure 2-2 outlines the process to be followed.

Editorial difference from UN Model Regulations: First column, last row: “Skin corrosion data available” instead of “Available skin corrosion data” (consistent with first two rows)



**Figure 2-2 Step-wise approach to classify and assign packing group of corrosive mixtures**

**8.4.2 Bridging principles**

8.4.2.1 Where a mixture has not been tested to determine its skin corrosion potential, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately classify and assign a packing group for the mixture, these data will be used in accordance with the following bridging principles. This ensures that the classification process uses

the available data to the greatest extent possible in characterizing the hazards of the mixture.

- a) Dilution. If a tested mixture is diluted with a diluent which does not meet the criteria for Class 8 and does not affect the packing group of other ingredients, then the new diluted mixture may be assigned to the same packing group as the original tested mixture.

Note.— In certain cases, diluting a mixture or substance may lead to an increase in the corrosive properties. If this is the case, this bridging principle cannot be used.

- b) Batching. The skin corrosion potential of a tested production batch of a mixture can be assumed to be substantially equivalent to that of another untested production batch of the same commercial product when produced by or under the control of the same manufacturer, unless there is reason to believe there is significant variation such that the skin corrosion potential of the untested batch has changed. If the latter occurs, a new classification is necessary.

- c) Concentration of mixtures of Packing Group I. If a tested mixture meeting the criteria for inclusion in Packing Group I is concentrated, the more concentrated untested mixture may be assigned to Packing Group I without additional testing.

- d) Interpolation within one packing group. For three mixtures (A, B and C) with identical ingredients, where mixtures A and B have been tested and are in the same skin corrosion packing group, and where untested mixture C has the same Class 8 ingredients as mixtures A and B but has concentrations of Class 8 ingredients intermediate to the concentrations in mixtures A and B, then mixture C is assumed to be in the same skin corrosion packing group as A and B.

- e) Substantially similar mixtures. Given the following:

i) two mixtures: (A+B) and (C+B);

ii) the concentration of ingredient B is the same in both mixtures;

iii) the concentration of ingredient A in mixture (A+B) equals the concentration of ingredient C in mixture (C+B);

iv) data on skin corrosion for ingredients A and C are available and substantially equivalent, i.e. they are the same skin corrosion packing group and do not affect the skin corrosion potential of B;

if mixture (A+B) or (C+B) is already classified based on test data, then the other mixture may be assigned to the same packing group.

### **8.4.3 Calculation method based on the classification of the substances**

8.4.3.1 Where a mixture has not been tested to determine its skin corrosion potential, nor is sufficient data available on similar mixtures, the corrosive properties of the substances in the mixture must be considered to classify and assign a packing group. Applying the calculation method is only allowed if there are no synergistic effects that make the mixture more corrosive than the sum of its substances. This restriction applies only if Packing Group II or III would be assigned to the mixture.

8.4.3.2 When using the calculation method, all Class 8 ingredients present at a concentration of ≥1 per cent must be taken into account, or <1 per cent if these ingredients are still relevant for classifying the mixture to be corrosive to skin.

8.4.3.3 To determine whether a mixture containing corrosive substances must be considered a corrosive mixture and to assign a packing group, the calculation method in the flow chart in Figure 2-3 must be applied.

8.4.3.4 When a specific concentration limit (SCL) is assigned to a substance following its entry in Table 3-1 or in a special provision, this limit must be used instead of the generic concentration limits (GCL). This appears where 1 per cent is used in the first step for the assessment of the Packing Group I substances, and where 5 per cent is used for the other steps respectively in Figure 2-3.

8.4.3.5 For this purpose, the summation formula for each step of the calculation method must be adapted. This means that, where applicable, the generic concentration limit must be substituted by the specific concentration limit assigned to the substance(s) (SCL<sub>i</sub>), and the adapted formula is a weighted average of the different concentration limits assigned to the different substances in the mixture:

$$\frac{PGx_1}{GCL} + \frac{PGx_2}{SCL_2} + \dots + \frac{PGx_i}{SCL_i} \geq 1$$

Where:

PG<sub>x</sub> = concentration of substance 1, 2 ... i in the mixture, assigned to Packing Group x (I, II or III)

GCL = generic concentration limit

$SCL_i$  = specific concentration limit assigned to substance  $i$

The criterion for a packing group is fulfilled when the result of the calculation is  $\geq 1$ . The generic concentration limits to be used for the evaluation in each step of the calculation method are those found in Figure 2-3.

Note.— Examples for the application of the above formula:

Example 1

A mixture contains one corrosive substance in a concentration of 5 per cent assigned to Packing Group I without a specific concentration limit:

Calculation for packing group I:

$$\frac{5}{5 (GCL)} = 1 \rightarrow \text{assign to Class 8, Packing Group I:}$$

Example 2

A mixture contains three substances corrosive to skin; two of them (A and B) have specific concentration limits; for the third one (C) the generic concentration limits apply. The rest of the mixture needs not to be taken into consideration:

Editorial difference from UN Model Regulations: Second column, included “%” with values in lieu of specifying “in %” in header row (consistent with values in columns 3-6)

Substance X in the mixture and its packing group assignment within Class 8	Concentration (conc) in the mixture	Specific concentration limit (SCL) for Packing Group I	Specific concentration limit (SCL) for Packing Group II	Specific concentration limit (SCL) for Packing Group III
A — assigned to Packing Group I	3%	30%	none	none
B — assigned to Packing Group I	2%	20%	10%	none
C — assigned to Packing Group III	10%	none	none	none

Calculation for Packing Group I:

$$\frac{3 (conc A)}{30 (SCL PGI)} + \frac{2 (conc B)}{20 (SCL PGI)} = 0.2 < 1$$

The criterion for Packing Group I is not fulfilled.

Calculation for Packing Group II:

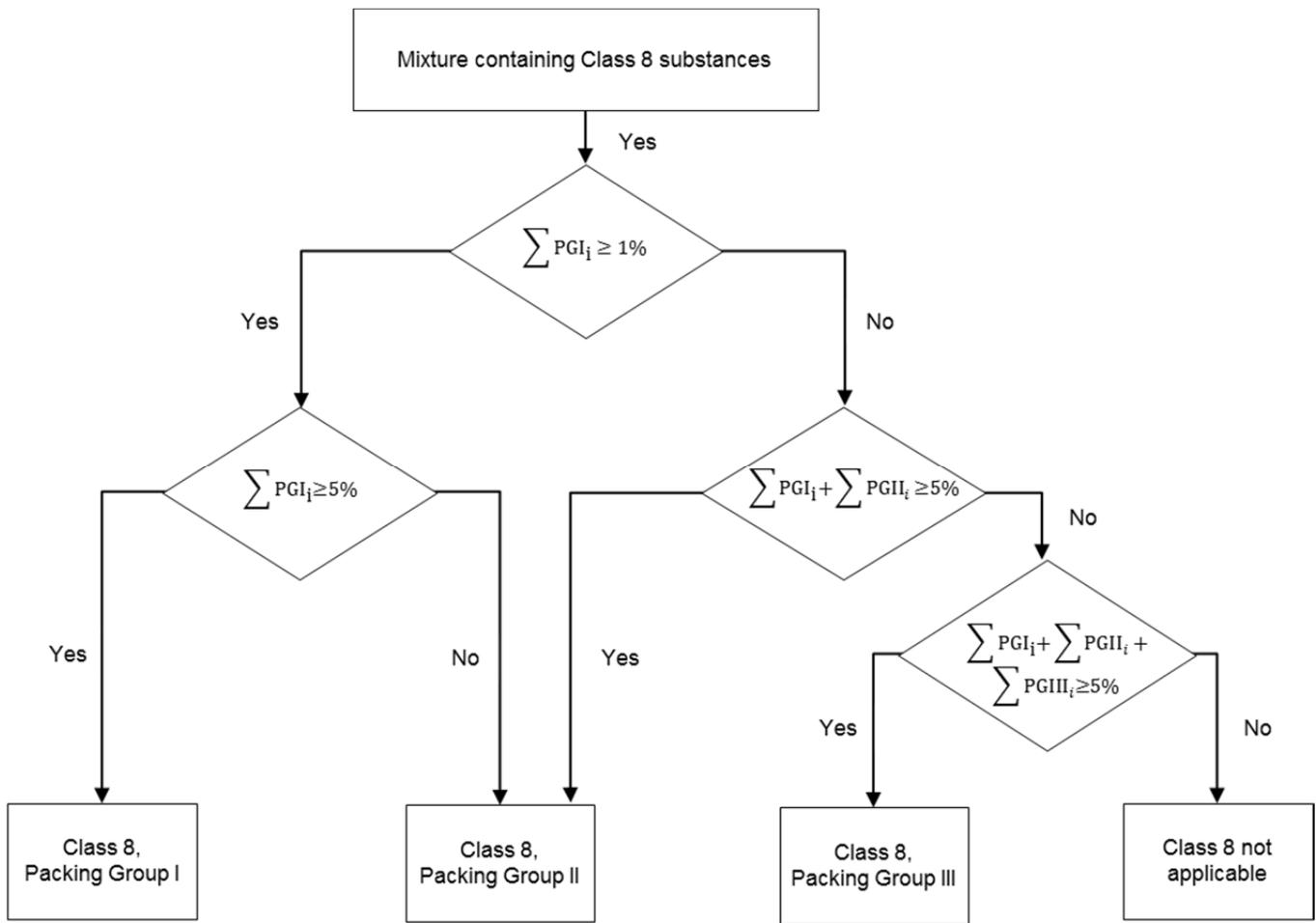
$$\frac{3 (conc A)}{5 (GCL PG II)} + \frac{2 (conc B)}{10 (SCL PG II)} = 0.8 < 1$$

The criterion for Packing Group II is not fulfilled.

Calculation for Packing Group III:

$$\frac{3 (conc A)}{5 (GCL PG III)} + \frac{2 (conc B)}{5 (GCL PG III)} + \frac{10 (conc C)}{5 GCL PG III} = 3 \geq 1$$

The criterion for Packing Group III is fulfilled, the mixture must be assigned to Class 8, Packing Group III.



**Figure 2-3. Calculation method**

Paragraph 8.5 was moved from 8.3 of the 2017-2018 Edition (no changes).

### **8.5 SUBSTANCES FORBIDDEN FOR TRANSPORT**

Chemically unstable substances of Class 8 are forbidden for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport. For the precautions necessary to prevent polymerization, see Special Provision A209. To this end, particular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions.

## Chapter 9

### CLASS 9 — MISCELLANEOUS DANGEROUS SUBSTANCES AND ARTICLES, INCLUDING ENVIRONMENTALLY HAZARDOUS SUBSTANCES

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#### 9.3 LITHIUM BATTERIES

9.3.1 Cells and batteries, cells and batteries contained in equipment, or cells and batteries packed with equipment, containing lithium in any form must be assigned to UN Nos. 3090, 3091, 3480 or 3481, as appropriate. They may be transported under these entries if they meet the following provisions:

- a) each cell or battery is of the type proved to meet the requirements of each test of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;

Cells and batteries manufactured according to a type meeting the requirements of subsection 38.3 of the UN *Manual of Tests and Criteria*, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, unless otherwise provided in these Instructions.

Cell and battery types only meeting the requirements of the UN *Manual of Tests and Criteria*, Revision 3, are no longer valid. However, cells and batteries manufactured in conformity with such types before 1 July 2003 may continue to be transported if all other applicable requirements are fulfilled.

*Note.— Batteries must be of a type proved to meet the testing requirements of the UN Manual of Tests and Criteria, Part III, subsection 38.3, irrespective of whether the cells of which they are composed are of a tested type.*

- b) each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under conditions normally incident to transport;
- c) each cell and battery is equipped with an effective means of preventing external short circuits;
- d) each battery containing cells or a series of cells connected in parallel is equipped with effective means as necessary to prevent dangerous reverse current flow (e.g. diodes, fuses, etc.);
- e) cells and batteries must be manufactured under a quality management programme that includes:
- 1) a description of the organizational structure and responsibilities of personnel with regard to design and product quality;
  - 2) the relevant inspection and test, quality control, quality assurance, and process operation instructions that will be used;
  - 3) process controls that should include relevant activities to prevent and detect internal short circuit failure during manufacture of cells;
  - 4) quality records, such as inspection reports, test data, calibration data and certificates. Test data must be kept and made available to the appropriate national authority upon request;
  - 5) management reviews to ensure the effective operation of the quality management programme;
  - 6) a process for control of documents and their revision;
  - 7) a means for control of cells or batteries that are not conforming to the type tested in accordance with Part III, subsection 38.3 of the UN *Manual of Tests and Criteria*;
  - 8) training programmes and qualification procedures for relevant personnel; ~~and~~
  - 9) procedures to ensure that there is no damage to the final product; ~~and~~

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**Editorial amendment: Note should be aligned under sub-paragraph e) as shown here**

*Note.— In-house quality management programmes may be accepted. Third-party certification is not required, but the procedures listed in 1) to 9) above must be properly recorded and traceable. A copy of the quality management programme must be made available to the appropriate national authority upon request.*

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UN Model Regulations, 2.9.4 (see ST/SG/AC.10/44/Add.1)

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f) lithium batteries, containing both primary lithium metal cells and rechargeable lithium ion cells, that are not designed to be externally charged (see Special Provision A213) must meet the following conditions:

(i) the rechargeable lithium ion cells can only be charged from the primary lithium metal cells;

ii) overcharge of the rechargeable lithium ion cells is precluded by design;

iii) the battery has been tested as a lithium primary battery;

iv) component cells of the battery must be of a type proved to meet the respective testing requirements of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3.; and

g) manufacturers and subsequent distributors of cells or batteries must make available the test summary as specified in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3, paragraph 38.3.5.

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— END —