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DRAFT UGANDA STANDARD

First Edition
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The classification and identification of dangerous goods for road and rail transport

Reference number
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National foreword

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This Draft Uganda Standard, DUS DEAS 949: 2019*, The classification and identification of dangerous goods for road and rail transport,* is identical with and has been reproduced from an International Standard, DEAS 949: 2019, *The classification and identification of dangerous goods for road and rail transport,* and is being proposed for adoption as a Uganda Standard.

The committee responsible for this document is Technical Committee UNBS/TC 8, *Transport and communication.*

Wherever the words, “East African Standard " appear, they should be replaced by "Uganda Standard."

DEAS 949 :2019

DRAFT EAST AFRICAN STANDARD

The classification and identification of dangerous goods for road and rail transport.

First Edition 2019

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

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East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 041……………………………..

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

During the preparation of this Standard, reference was made to the following document:

SANS 10228:2012, The identification and classification of dangerous goods for transport by road and rail modes

Acknowledgement is hereby made for the assistance derived from this source.

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DEAS 949 :2019

The classification and identification of dangerous goods for road and rail transport

1 Scope

This draft East African Standard covers classification and identification of dangerous goods that are capable of posing a significant risk to health safety , property and the environment.

This standard applies to road and rail modes of transport.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM D93, *Standard test methods for flash point by Pensky-Martens closed-cup tester*

ASTM D240, *Standard test method for heat of combustion of liquid hydrocarbon fuels by bomb calorimeter*

ASTM D4359, *Standard test method for determining whether a material is a liquid or a solid.*

ISO 780, Packaging – Pictorial marking for handling of goods

ISO 1523, *Determination of flash point – Closed cup equilibrium method*

ISO 2431, *Paints and varnishes – Determination of flow time by use of flow cups*

ISO 2592, *Determination of flash and fire points – Cleveland open cup method*

ISO 2719, *Determination of flash point – Pensky-Martens closed cup method*

ISO 3711, *Lead chromate pigments and lead chromate-molybdate pigments – Specifications and methods of test*

ISO 8115, *Cotton bales – Dimensions and density*

ISO 9038, *Test for sustained combustibility of liquids*

ISO 10156, *Gases and gas mixtures – Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets*

ISO 10156-2, *Gas cylinders – Gases and gas mixtures – Part 2: Determination of oxidizing ability of toxic and corrosive gases and gas mixtures*

ISO 13736, *Determination of flash point – Abel closed-cup method*

ISO 13943, *Fire safety – Vocabulary – Part 86.1: Affective heat of combustion*

ISO 13943, *Fire safety – Vocabulary – Part 86.2: Gross heat of combustion*

ISO 13943, *Fire safety – Vocabulary – Part 86.3: Net heat of combustion*

NFPA 30B, *Manufacture and storage of aerosol products*

DEAS 951:2019 *Transport of dangerous goods – Packaging and large packaging for road and rail transport*

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)

International Atomic Energy Agency (IAEA). Regulations for the safe transport of radioactive material. Safery standards series No. TS-R-1. IAEA. Vienna, 2005

International Civil Aviation Organization. Technical instructions for the safe transport of dangerous goods by air. Montreal, Quebec: ICAO, 2005-2006

International Maritime Organization. International convention for safe containers. Edition 3. London: IMO, 1996

International Programme on Chemical Safety (IPCS). WHO recommended classification of pesticides by hazard and guidelines to classification. World Health Organization. Geneva, 2005

United Nations. Recommendations on the transport of dangerous goods; Manual of tests and criteria
Part I: Classification procedures, test methods and criteria relating to explosives of class 1. 6th rev. ed.New York and Geneva: UN, 2015

United Nations. Recommendations on the transport of dangerous goods; Manual of tests and criteria –Part II: Classification procedures, test methods and criteria relating to self-reactive substances of division 4.1 and organic peroxides of division 5.2. 6th rev. ed. New York and Geneva: UN, 2015

United Nations. Recommendations on the transport of dangerous goods; Manual of tests and criteria –Part III: Classification procedures, test methods and criteria relating to class 2, class 3, class 4, division 5.1, class 8 and class 9. 6th rev. ed. New York and Geneva: UN, 2015

OECD Test Guidelines
NOTE The United Nations' Recommendations on the transport of dangerous goods; Manual of tests and criteria, will be referred to as the United Nations' Manual of tests and criteria in the text of this standard.

3 Definitions and abbreviations

For the purposes of this document, the following definitions and abbreviations shall apply.

3.1 Definitions

3.1.1

A1 and A2
values for individual radionuclides that are basic activity values used for characterizing radioactive material to be transported, and for specifying activity limits

NOTE See D.1 for individual radionuclides.

3.1.2

activity concentration activity of one mass unit or volumetric unit of radioactive material, expressed in becquerels per kilogram or becquerels per cubic metre respectively, or their fractions, or their multiples

3.1.3

acute aquatic toxicity intrinsic property of a substance to be injurious to an organism in a short-term exposure to that substance

3.1.
ambient temperature temperature of 23 °C ± 2 °C

3.1.5
availability extent to which a substance becomes a soluble or disaggregate species

3.1.6
bioaccumulation net result of uptake, transformation and elimination of a substance in an organism due to all routes of exposure (air, water, sediment/soil and food)

3.1.7
bioconcentration factor
BCF
ratio of a test substance concentrating in a test organism to the concentration in the test water at equilibrium

3.1.8
biotic relating to life or to living things

3.1.9
bulk container containment system (including any liner or coating) intended for the transport of solid substances that are in direct contact with the containment system

3.1.10
chronic aquatic toxicity potential or actual properties of a substance to cause adverse effects to aquatic organisms during exposures that are determined in relation to the life-cycle of the organism

3.1.11
combustible solid that is relatively difficult to ignite and that burns relatively slowly, and a liquid that sustains combustion for more than 15 s at 60,5 °C ± 1,0 °C

3.1.12
competent authority
national body or authority designated, or otherwise recognized, for the control or regulation of a particular aspect of the transport of dangerous goods

NOTE See the advice sheet provided with this standard for contact information.

3.1.13
critical temperature above at which a substance cannot exist in the liquid state

3.1.14
Dangerous goods
substances or articles that pose hazard to people, health, property or the environment, due to their chemical or physical properties

NOTE 1 Dangerous goods are listed in B.2 and Annex C.

NOTE 2 For the purposes of this standard, "dangerous substances" and "dangerous goods" are synonymous.

3.1.15
degradation decomposition of organic molecules to smaller molecules and eventually to carbon dioxide, water and salts

3.1.16
diluent, type A
organic liquid that is compatible with an organic peroxide and a self-reactive substance, and that has a boiling point of not less than 150 °C

3.1.17
diluent, type B
organic liquid that is compatible with an organic peroxide and that has a boiling point of less than 150 °C but not less than 60 °C, and a flash point of not less than 5 °C

3.1.18

EC$_5$
concentration of a substance, in milligrams per litre of water, that causes the maximum response to 50 % of a population of daphnia (water flea)

3.1.19
fuel cell
electrochemical device that converts the chemical energy of a fuel to electrical energy, heat and reaction products

3.1.20
fuel cell cartridge
article that stores fuel for discharge into the fuel cell through a valve that controls the discharge of fuel into the fuel cell

3.1.21
gas
state of matter that is characterized by very low density and viscosity (relative to liquids and solids),
comparatively great expansion and contraction with changes in pressure and temperature, the ability to diffuse into other gases, and the ability to occupy with almost complete uniformity the whole of any container

3.1.24
genetically modified micro-organism
GMMO micro-organism in which the genetic material has been purposely altered through genetic engineering in a way that does not occur naturally

3.1.23
genetically modified organism
GMO organism in which the genetic material has been purposely altered through genetic engineering in away that does not occur naturally

3.1.24
LC$_{50}$
concentration of a substance in air or in water that causes the death of 50 % of a group of test animals

3.1.25

LD_{50}

is a single dose of the substance that, when administered orally, is most likely to cause the death, within 14 days, of 50 % of both male and female young adult albino test rats

3.1.26
liquid
substance that has a vapour pressure not exceeding 300 kPa at 50 °C and that has a melting point or an initial melting point of not higher than 20 °C at a pressure of 101,3 kPa

NOTE A viscous substance for which a specific melting point cannot be determined should be tested in accordance with ASTM D4359.

3.1.27
log Kow
octanol-water partition coefficient
measure of the transfer of a substance from the aquatic environment to an organism, for example fish, and the potential bioaccumulation of the substance at equilibrium concentration

NOTE The partition coefficient is the quotient of octanol to water and is given in the form of its logarithm to base ten.

3.1.28
no observed effect concentration
NOEC test concentration immediately below the lowest tested concentration with statistically significant adverse effect

NOTE The NOEC has no statistically significant adverse effect compared to the control.

3.1.29
packing group
group symbol that indicates the degree of danger/hazard of the primary property of a specific substance in accordance with internationally recognized classifications

3.1.30
paste

soft, viscous mass of solids dispersed in a liquid

NOTE A paste can be classified either as a liquid or as a solid, depending on the results obtained when it is tested in accordance with ASTM D4359.

3.1.31
proper shipping name

description used for dangerous goods in transport documentation, in the marking of packages, and in the placarding of containers and vehicles to ensure that goods can be readily identified during transport

NOTE 1 In the case of spillage and leakage, the proper shipping name is instrumental in determining what response actions, emergency equipment or antidotes, are necessary.

NOTE 2 The proper shipping name is shown in capital letters in B.2 and in annex C.

NOTE 3 If more than one distinct entry is given under a single United Nations (UN) number, as indicated by the conjunction "or" or by punctuation, the more appropriate of the names is to be used.

NOTE 4 If several names are in use for the same substance, one or more of these names can be used as the proper shipping name; the rest, being synonyms, are given in lower case for reference purposes only.

NOTE 5 Technical names and trade names can be used on documents and packages in addition to the proper shipping name.

3.1.32
rated capacity

output of a fuel cell cartridge that can continue indefinitely in compliance with a criterion, for example heating

3.1.33
solid

powders, flakes, granules and kibbles, and also pastes and viscous substances that comply with the test for solids in accordance with ASTM D4359, other than gas, and that does not meet the definition of a liquid

3.1.34
specific activity

activity of one mass unit of radioactive material, expressed in becquerels per kilogram, or its fractions,
or its multiples

3.1.35
total activity
activity of the radionuclide material contained in a consignment, expressed in the basic unit of becquerel (Bq)

3.1.36
United Nations (UN) number
serial number that consists of four digits and that is assigned to dangerous goods by the United Nations' Committee of Experts on the Transport of Dangerous Goods

3.1.37
waste, chemical
unusable product from chemical and metal processing operations that, if improperly disposed of, contains dangerous or polluting materials that pose a threat to humans or animals or the environment

3.1.38
Division

3.2 Abbreviations

BCF	bioconcentration factor
BOD	biochemical oxygen demand
Bq	Becquerel
COD	chemical oxygen demand
GLP	good laboratory practice
GMMO	genetically modified micro-organism

GMO	genetically modified organism
IBC	intermediate bulk container
N.O.S.	not otherwise specified
OECD	Organization for Economic Co-operation and Development
SADT	self-accelerating decomposition temperature
UN	United Nations
WHO	World Health Organization
†	add the technical name of the product in parentheses after the proper shipping name

4 General provisions

4.1 This standard does not apply to the transport of:

a) Dangerous goods that are required for the propulsion of the means of transport or the operation of its specialized equipment during transport, for example refrigeration units, or that are required in accordance with the operating requirements, for example fire extinguishers; and

b) Dangerous goods that are transported as packed for retail sale by private individuals for their own use.

4.2 In accordance with the Universal Postal Union Convention, dangerous goods as defined in this standard, with the exception of those listed below, are not permitted in mail transported internationally.

The following dangerous goods are acceptable in international mail subject to the provisions of the national postal authority:

a) infectious substances assigned to category B (UN 3373) and solid carbon dioxide (dry ice) when used as a refrigerant for infectious substances of UN 3373; and

b) radioactive material in an excepted package (see IAEA SS-6), the total activity of which does not exceed one tenth of that listed in Table 1.

4.3 Any substance or article that is liable to react in one of the following ways under normal conditions of transport in the condition it is presented for transport, is forbidden from transport unless otherwise provided by this standard:

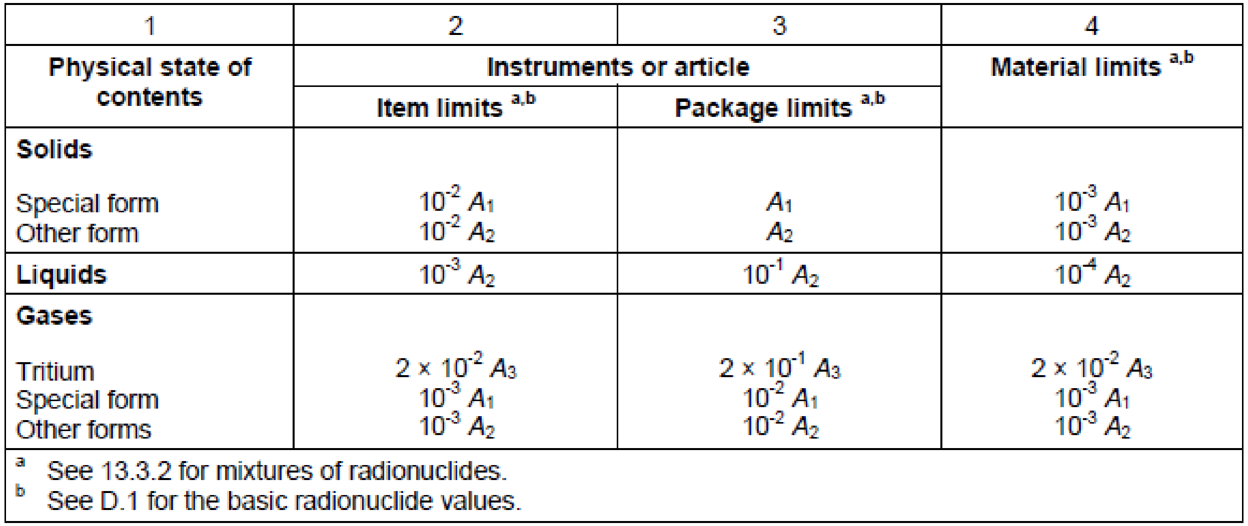
a) explode;

b) react dangerously;

c) produce a flame or dangerous evolution of heat; or

d) emit toxic, corrosive or flammable gases or vapours.

Table 1 — Activity limits for excepted packages



1	2	3	4
Physical state of contents	**Instruments or article**		**Material limits** [a,b]
	Item limits [a,b]	**Package limits** [a,b]	
Solids			
Special form	$10^{-2} A_1$	A_1	$10^{-3} A_1$
Other form	$10^{-2} A_2$	A_2	$10^{-3} A_2$
Liquids	$10^{-3} A_2$	$10^{-1} A_2$	$10^{-4} A_2$
Gases			
Tritium	$2 \times 10^{-2} A_3$	$2 \times 10^{-1} A_3$	$2 \times 10^{-2} A_3$
Special form	$10^{-3} A_1$	$10^{-2} A_1$	$10^{-3} A_1$
Other forms	$10^{-3} A_2$	$10^{-2} A_2$	$10^{-3} A_2$

[a] See 13.3.2 for mixtures of radionuclides.

[b] See D.1 for the basic radionuclide values.

NOTE The Acts of the Universal Postal Union do not apply to the domestic transport of dangerous goods by mail.

4 Classification system, packing group allocation and subsidiary risk

Dangerous goods are classified in nine classes and three packing groups in accordance with the United Nations' Recommendations on the Transport of Dangerous Goods. Model Regulations. The nine classes relate to the type of hazard whereas the three packing groups relate to the degree of danger posed within the class.

4.1 Classification system

4.1.1 Class 1: Explosives

This class is subdivided into six divisions (see 7.2).

4.1.2 Class 2: Gases

This class is subdivided as follows:

a) Division 2.1: flammable gases;

b) Division 2.2: non-flammable, non-toxic gases; and

c) Division 2.3: toxic gases.

4.1.3 Class 3: Flammable liquids

This class comprises liquids capable of being ignited.

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

This class is subdivided as follows:

a) Division 4.1: Flammable solids, self-reactive substances and solid desensitized explosives;

b) Division 4.2: Substances liable to spontaneous combustion; and

c) Division 4.3: Substances that, on contact with water, emit flammable gases.

4.1.5 Class 5: Oxidizing substances and organic peroxides

This class is subdivided as follows:

a) Division 5.1: Oxidizing substances; and

b) Division 5.2: Organic peroxides.

4.1.6 Class 6: toxic and infectious substances

This class is subdivided as follows:

a) Division 6.1: Toxic substances; and

b) Division 6.2: Infectious substances.

4.1.7 Class 7: radioactive material

This class comprises materials that spontaneously emit ionizing radiation.

4.1.8 Class 8: corrosives

This class comprises substances that, by chemical action, cause damage to living tissue, to commonly used metals, or to other cargo.

4.1.9 Class 9: Miscellaneous dangerous substances and goods

This class comprises any substance not covered by the other classes, but that has been or could be shown by experience to be of such a dangerous character that the provisions of this class should apply to it.

5.2 Packing group allocation

5.2.1 General

For packing purposes, certain substances listed in this standard are assigned to three packing groups in accordance with their degree of danger.

NOTE Dangerous goods of classes 1, 2 and 7, and divisions 5.2 and 6.2 and self-reactive substances of division 4.1 are excluded from the packing group allocation.

5.2.2 Packing groups

The packing groups have the following meaning:

a) Packing group I: Substances that present a high danger;

b) Packing group II: Substances that present a medium danger; and

c) Packing group III: Substances that present a low danger.

5.3 Subsidiary risk

Where applicable, the subsidiary danger risk of a substance is also identified in terms of the classification system.

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4.2 Classes

4.2.1 Class 1: Explosives

4.2.1.1 General

7.1.1 Introductory notes

7.1.1.1 Class 1 is a restricted class, i.e. only those explosive substances and articles that are listed in B.2 shall be accepted for transport. However, the competent authority retains the right by mutual agreement to approve transport of explosive substances and articles for special purposes under special conditions. Therefore, entries have been included in B.2 for "Substances, explosive, N.O.S." and "Articles, explosive, N.O.S." These entries shall be used only when no other method of operation is possible.

7.1.1.2 A number of explosive substances and articles are described in annex G because an explosive term might not be well known or might be at variance with its usage for regulatory purposes.

7.1.1.3 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 (see 7.2).

7.1.1.4 General entries such as “Explosives, blasting Type A” are used to allow for the transport of new explosive substances.

7.1.2 Explosive substances and articles

7.1.2.1 An explosive substance is a solid substance or a liquid substance, or a mixture of substances, that is in itself capable, by chemical reaction, of producing gas at such a temperature, pressure and speed as to cause damage to the surroundings.

NOTE The following explosive substances are excluded from class 1:

a) those that are too dangerous to transport;

b) those of which the predominant hazard is appropriate to another class; and

c) those that are in themselves not explosives but that can form an explosive atmosphere of gas, vapour or dust.

7.1.2.2 An explosive article is an article that contains one or more explosive substances or an article that is manufactured with a view to producing a practical explosive.

NOTE Devices that contain explosive substances in such quantity or of such character that their inadvertent or accidental ignition or initiation during transport does not cause any external effect to the device, by projection, fire, smoke, heat or loud noise, are excluded from class 1.

7.1.2.3 Class 1 includes substances and articles not mentioned in 7.1.2.1 and 7.1.2.2 that are manufactured to produce an effect by heat, light, sound, gas or smoke, or a combination of these, as the result of non-detonative self-sustaining exothermic chemical reactions (pyrotechnic effect).

7.1.2.4 A phlegmatizer is a substance that has been added to an explosive to enhance its safety in handling and transport. The phlegmatizer renders the explosive insensitive, or less sensitive, to the following actions: heat, shock, impact, percussion or friction. Typical phlegmatizing agents include, but not limited to, wax, paper, water, polymer, alcohol and oils.

7.2 Divisions of class 1

7.2.1 Division 1.1

This division consists of substances and articles that present a mass explosion hazard.

NOTE A mass explosion is one that affects virtually the entire consignment of explosives almost instantaneously.

7.2.2 Division 1.2

This division consists of substances and articles that present a projection hazard, but not a mass explosion hazard.

7.2.3 Division 1.3

This division consists of substances and articles that, in the event of ignition or initiation during transport

a) give rise to considerable radiant heat, or

b) burn one after the other, producing a minor blast or a minor projection effect (or both).

7.2.4 Division 1.4

This division consists of substances and articles that

a) present no significant hazard, and

b) present only a small hazard in the event of ignition or initiation during transport. The effects are largely confined within the package and no projection of fragments of appreciable size or range is to be expected. An external fire will not cause virtually instantaneous explosion of almost the entire contents of the package.

NOTE Substances and articles in this division that are so packaged or so designed that any hazardous effects arising from accidental functioning are confined to 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), are placed in compatibility group S (see 7.3).

7.2.5 Division 1.5

6(c) in part I of the United Nations' Manual of tests and criteria).

NOTE The probability of transition from burning to detonation is greater when large quantities are transported.

7.2.6 Division 1.6

This division consists of extremely insensitive articles that do not have a mass explosion hazard and the probability of accidental initiation or propagation is negligible.

NOTE The risk of explosion is limited to a single article.

7.3 Compatibility groups

Substances and articles of class 1 are considered to be "compatible" if they can be safely stored together or transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident. In accordance with this criterion, goods listed in this class have been divided into a number of compatibility groups, each denoted by letter from A to N (excluding I and M) and S. Table 2 gives the possible hazard divisions associated with each compatibility group and the consequential classification code. Table 3 gives the scheme of classification and the combination of hazard division with compatibility group.

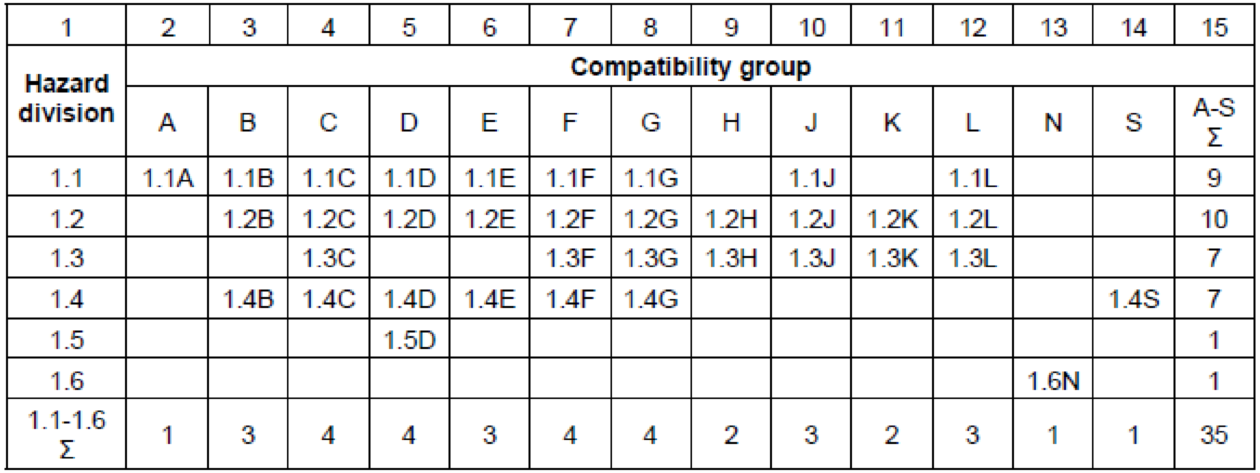
7.4 Competent authority for the classification of explosives

The classification of all explosive articles and substances, together with their compatibility group allocation, shall be approved by the relevant competent authority.

Table 2 — Classification codes

1	2	3
Article or substance to be classified	**Compatibility group**[a]	**Classification code**
Primary explosive substance	A	1.1A
Article that contains a primary explosive substance and does not contain two or more independent safety features. Some articles, such as detonators for blasting, detonator assemblies for blasting and primers, cap-type, are included, even though they do not contain primary explosives	B	1.1B; 1.2B; 1.4B
Propellant explosive substance or other deflagrating explosive substance or article that contains a propellant explosive substance	C	1.1C; 1.2C; 1.3C; 1.4C
Secondary detonating explosive substance or black powder or article that contains a secondary detonating explosive substance, in each case without means of initiation, and without a propelling charge, or article that contains a primary explosive substance and two or more effective protective features	D	1.1D; 1.2D; 1.4D; 1.5 D
Article that contains a secondary detonating explosive substance, without means of initiation, with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquids)	E	1.1E; 1.2E; 1.4E
Pyrotechnic substance, or article that contains a pyrotechnic substance, or article that contains both an explosive substance and an illuminating, incendiary, tear-producing or smoke-producing substance (other than a water-activated article or one that contains white phosphorus, phosphides, a pyrophoric substance, a flammable liquid or gel, or hypergolic liquids)	G	1.1G; 1.2G; 1.3G; 1.4G
Article that contains both an explosive substance and white phosphorus	H	1.2H; 1.3H
Article that contains both an explosive substance and a flammable liquid or gel	J	1.1J; 1.2J; 1.3J
Article that contains both an explosive substance and a toxic chemical agent	K	1.2K; 1.3K
Explosive article or substance that contains an explosive substance and presents a special risk (for example owing to water activation or the presence of hypergolic liquids, phosphides or a pyrophoric substance) and of which each type needs to be isolated	L	1.1L; 1.2L; 1.3L
Article that contains an extremely insensitive detonating substance	N	1.6N
Article or substance so packed or so 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	S	1.4S

Table 3 — Scheme of classification of explosives, combination of hazard division with compatibility group



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hazard division	**Compatibility group**													
	A	B	C	D	E	F	G	H	J	K	L	N	S	A-S Σ
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	1	3	4	4	3	4	4	2	3	2	3	1	1	35

7.5 Classification of explosives

7.5.1 General

7.5.1.1 Any substance or article that has, or is suspected of having, explosives characteristics shall be considered for classification in class 1. Substances classified as explosives of class 1 shall be assigned to the appropriate division and compatibility group (see 7.2 and 7.3).

7.5.1.2 A substance or an article that is not listed by its proper shipping name in B.2 and in Annex C shall not be offered for transport as an explosive of class 1 unless it has been subjected to the classification procedure prescribed in this clause. The classification procedure shall also be undertaken before a new product is offered for transport.

A new product considered for classification in class 1 is

a) a substance, or a combination of substances, or a mixture of explosive substances that is considered to be significantly different from other combinations or mixtures already classified, or

b) a new design of article, or an article that contains a new explosive substance, or a new combination or mixture of explosive substances, or

c) a new design of packaging for an explosive substance or article that includes a new type of inner packaging.

It is important to realize that a relatively minor change in an inner or outer packaging can be critical and can convert a lesser risk into a mass explosion risk.

7.5.1.3 The manufacturer or other applicant requesting classification of an explosive product shall provide adequate information regarding the names and characteristics of all the explosive substances present in the product, and shall provide the results of all relevant tests that have been done.

NOTE It is assumed that all the explosive substances in a new article have been properly tested and that they carry competent authority approval.

7.5.1.4 Verification of the classification shall be undertaken if the explosive substance or article, or its packaging, is degraded and if the degradation might affect the behaviour of the substance or item in the tests.

7.5.1.5 A report on the series of tests that have been performed shall be drawn up in accordance with the requirements of the competent authority. Such a report shall contain at least the following information:

a) the composition of the substance or the structure of the article;

b) the quantity of substance or the number of articles used per test;

c) the type and construction of the packaging;

d) the test assembly, including the nature, quantity and arrangement of the means of initiation or ignition used;

e) the course of the test, including the time elapsing until the occurrence of the first noteworthy reaction of the substance or article, the duration and characteristics of the reaction, and whether the reaction was complete;

f) the effect of the reaction on the immediate surroundings, up to 25 m from the site of the test;

g) the effect of the reaction on the surroundings further than 25 m from the site of the test; and

h) the atmospheric conditions during the test.

7.5.2 Procedure

Figure 1 indicates the general scheme for the classification of a substance or an article that is to be considered for inclusion in class 1. The assessment is done in two stages:

a) Ascertain the potential of a substance or an article to explode and whether its stability and sensitivity, both chemical and physical, are shown to be acceptable.
In order to assist the competent authority with the assessment, the test data shall be analysed systematically with respect to the appropriate test criteria by using the flow chart of in part I of the United Nations' Manual of tests and criteria; and

b) If the substance or article is acceptable for class 1, assign the correct hazard division in accordance with figure 10.3 in part I of the United Nations' Manual of tests and criteria.

NOTE 1 The tests for acceptance and the further tests to determine the correct division in class 1 are grouped into seven series as listed in part I of the United Nations' Manual of tests and criteria. The numbering of these series relates to the sequence of assessing results rather than the order in which the tests are conducted.

NOTE 2 The scheme of assessment given in flow chart 1 is only designed for the classification of

a) packed explosive substances and articles, and

b) individual unpacked explosive articles.

NOTE 3 Transport in freight containers, road vehicles and rail wagons could require special tests that take into consideration the quantity (self-confinement), the kind of substance and the container used for the substance. Such tests can be specified by the competent authority (see the foreword).

7.5.3 Acceptance criteria

7.5.3.1 The results from preliminary tests and those from test series 1 to 4 in part I of the United Nations' Manual of tests and criteria, are used to determine whether or not the product is acceptable for class 1. If the substance is manufactured with a view to producing a practical explosive or pyrotechnic effect (see 7.1.2.3), it is unnecessary to conduct tests series 1 and 2. If an article, a packaged article or a packaged substance is rejected by test series 3 or 4 (or both), it could be practicable to redesign the article or the packaging to render it acceptable.

7.5.3.2 The competent authority may exclude an article or a substance from class 1 by virtue of test results and the class 1 definition.

7.5.3.3 An explosive substance that has been diluted to exclude it from class 1 by test series 6 in part I of the United Nations' Manual of tests and criteria, is referred to as a "desensitized explosive" (see 9.2, 10.1.2.6 and 10.1.3). Such a substance shall be classified as a desensitized explosive with an indication of the highest concentration of explosive allowed to exclude it from class 1 and, if applicable, the concentration below which it is no longer deemed as dangerous goods.

7.5.3.4 A new solid desensitized explosive shall be classified in division 4.1, and a new liquid desensitized explosive shall be classified in class 3. When a desensitized explosive complies with the criteria or definition for another class or division, the corresponding subsidiary risk(s) shall be assigned to it.

7.5.3.5 Some explosive devices could function during transport. Theoretical analysis, test data or other evidence of safety shall be provided to the competent authority to show that such an event is very unlikely or that the consequences would not be significant. The assessment shall take the following into account:

a) vibration related to the proposed mode(s) of transport;

b) static electricity;

c) electromagnetic radiation at all relevant frequencies up to a maximum intensity of 100 W/m2;

d) adverse climatic conditions; and

e) compatibility with glues, paints and packaging materials with which the explosive substances might come into contact.

7.5.3.6 All articles that contain primary explosive substances shall be assessed to evaluate the risk and consequences of accidental functioning during transport. The reliability of fuzes shall be assessed by taking the number of independent safety features into account.

7.5.3.7 All explosive articles and packaged explosive substances shall be assessed to ensure that they have been designed in a good workmanlike manner, for example, that there is no possibility of the formation of voids or thin films of an explosive substance, and that there is no possibility of grinding or nipping of explosive substances between hard surfaces.

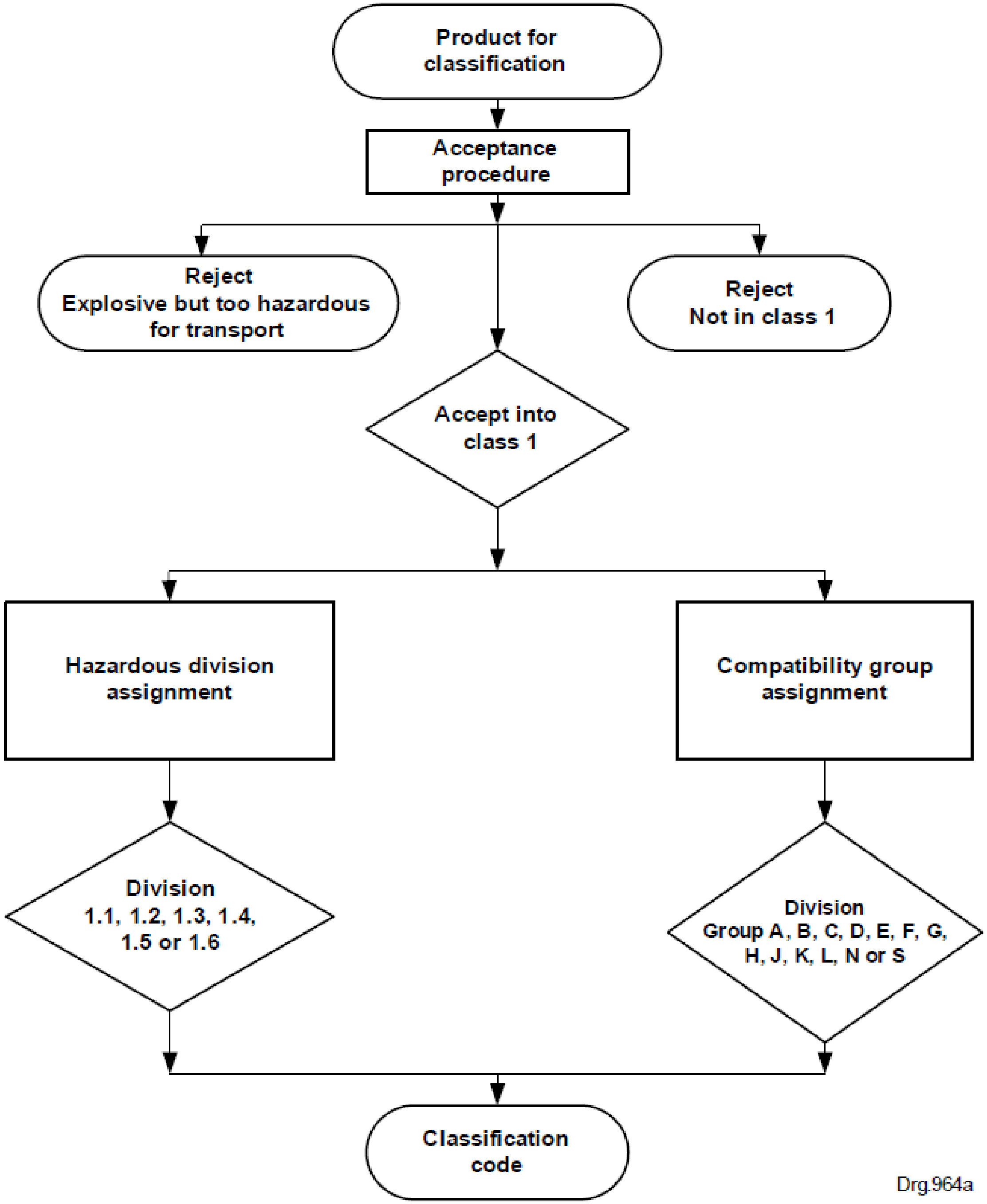

Product for classification
Acceptance procedure
Reject Explosive but too hazardous for transport
Reject Not in class 1
Accept into class 1
Hazardous division assignment
Compatibility group assignment
Division 1.1, 1.2, 1.3, 1.4, 1.5 or 1.6
Division Group A, B, C, D, E, F, G, H, J, K, L, N or S
Classification code
Drg.964a

Figure 1 — Scheme of procedure for the classification of an explosive substance or article

7.5.4 Assignment to hazard divisions

7.5.4.1 An explosive substance or article shall be assigned to the hazard division that corresponds to the tests to which the substance or article, as offered for transport, has been subjected. Other test results, and data assembled from accidents that have occurred, can also be taken into account.

7.5.4.2 The following test series in part I of the United Nations' Manual of tests and criteria are used to determine the hazard division:

a) test series 5: whether a substance can be assigned to division 1.5;

b) test series 6: whether a substance or article can be assigned to divisions 1.1, 1.2, 1.3 and 1.4; and

c) test series 7: whether an article can be assigned to division 1.6.

NOTE In the case of compatibility group S, the tests may be waived by the competent authority, if classification by analogy is possible by using the test results of a comparable article.

7.5.5 Exclusion from class 1

7.5.5.1 The competent authority may exclude a substance or an article from class 1 by virtue of test results and the class 1 definition.

7.5.5.2 Where a substance, provisionally classified as an explosive, is excluded from class 1 by virtue of test results of series 6 of part I of the United Nations’ Manual of tests and criteria on a specific type and size of package such a substance (when complying with the classification criteria or definition of another class or division), shall be classified in that class or division with a special provision restricting it to the type and size of the package tested.

7.5.5.3 An explosive substance that has been diluted to exclude it from class 1 by test series 6, is referred to as a “desensitized explosive” (see 9.2, 10.1.2.6 and 10.1.3). Such a substance shall be classified as a desensitized explosive with an indication of the highest concentration of explosive allowed to exclude it from class 1 and, if applicable, the concentration below which it is no longer deemed as dangerous goods.

7.5.5.4 A new solid desensitized explosive shall be classified in division 4.1 and a new liquid desensitized explosive shall be classified in class 3. When a desensitized explosive complies with the criteria or definition of another class or division, the corresponding subsidiary risk(s) shall be assigned to it.

7.5.6 Fireworks

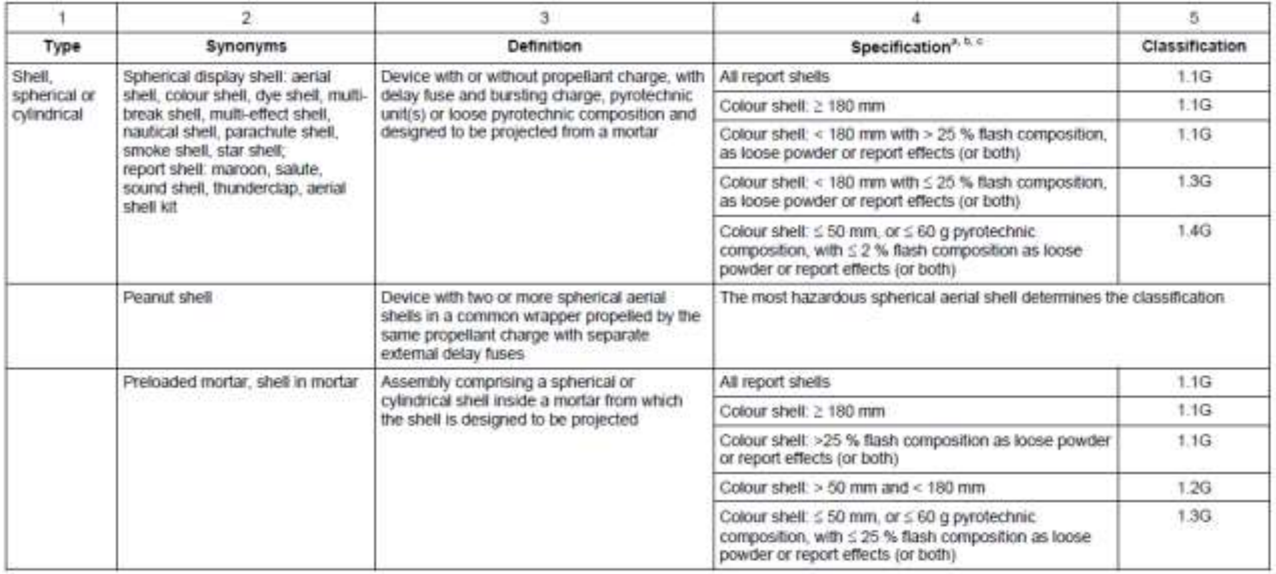
7.5.6.1 Fireworks shall be assigned to divisions 1.1, 1.2, 1.3, and 1.4 on the basis of test data derived from test series 6 in part I of the United Nations' Manual of tests and criteria. However, since the range of fireworks is very extensive and the availability of test facilities might be limited, assignment to hazard divisions could also be made in accordance with 7.5.6.2.

7.5.6.2 Assignment of fireworks to UN Nos 0333, 0334, 0335 or 0336 may be made on the basis of analogy, without the need for test series 6 testing, in accordance with the default fireworks classification (see table 3) and with the agreement of the competent authority. Items not specified in table 3 shall be classified on the basis of test data derived from test series 6.

7.5.6.3 Where fireworks of more than one division of class 1 are packed in the same package they shall be classified on the basis of the highest hazard division unless test data derived from test series 6 indicate otherwise.

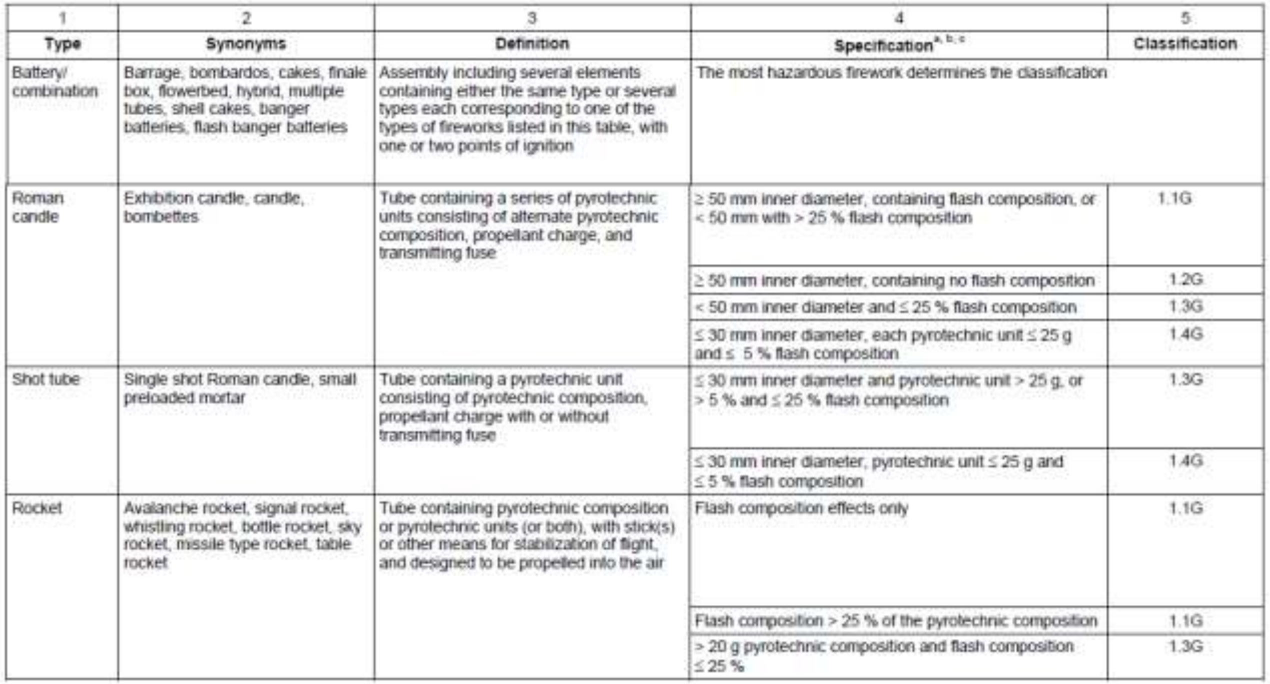
7.5.6.4 The default classification shown in table 4 applies only to articles packed in fibreboard boxes (4G) .

Table 4 — Default fireworks classification



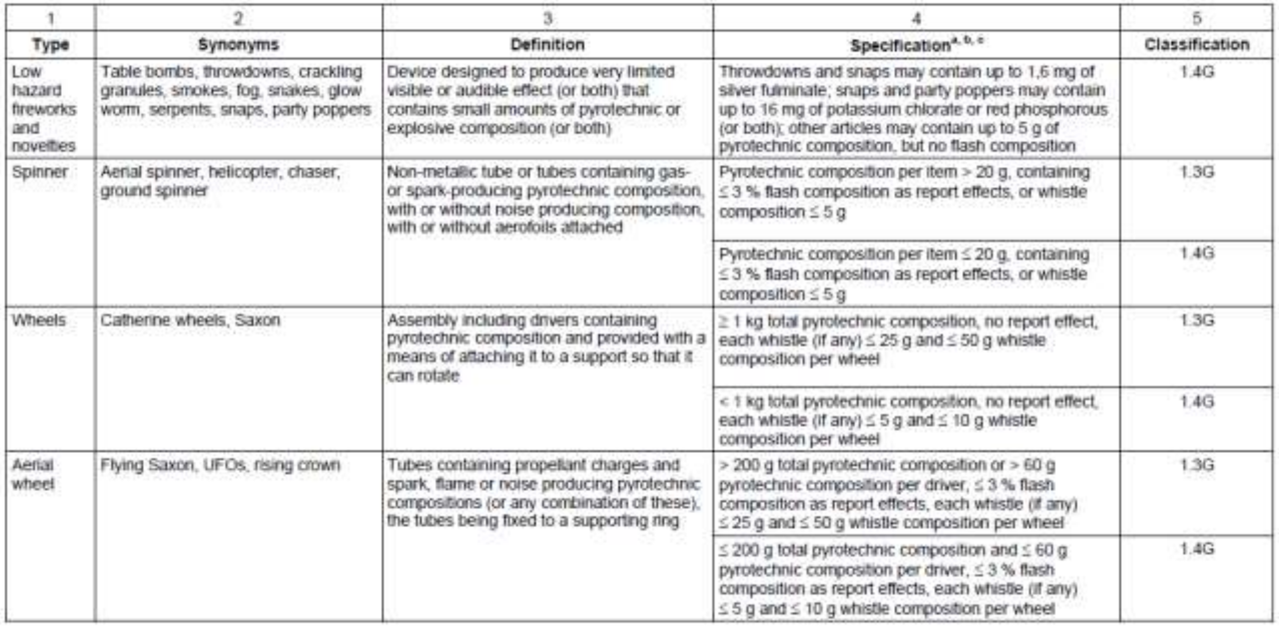
1	2	3	4	5
Type	**Synonyms**	**Definition**	**Specification**[a, b, c]	**Classification**
Shell, spherical or cylindrical	Spherical display shell: aerial shell, colour shell, dye shell, multi-break shell, multi-effect shell, nautical shell, parachute shell, smoke shell, star shell; report shell: maroon, salute, sound shell, thunderclap, aerial shell kit	Device with or without propellant charge, with delay fuse and bursting charge, pyrotechnic unit(s) or loose pyrotechnic composition and designed to be projected from a mortar	All report shells	1.1G
			Colour shell: ≥ 180 mm	1.1G
			Colour shell: < 180 mm with > 25 % flash composition, as loose powder or report effects (or both)	1.1G
			Colour shell: < 180 mm with ≤ 25 % flash composition, as loose powder or report effects (or both)	1.3G
			Colour shell: ≤ 50 mm, or ≤ 60 g pyrotechnic composition, with ≤ 2 % flash composition as loose powder or report effects (or both)	1.4G
	Peanut shell	Device with two or more spherical aerial shells in a common wrapper propelled by the same propellant charge with separate external delay fuses	The most hazardous spherical aerial shell determines the classification	
	Preloaded mortar, shell in mortar	Assembly comprising a spherical or cylindrical shell inside a mortar from which the shell is designed to be projected	All report shells	1.1G
			Colour shell: ≥ 180 mm	1.1G
			Colour shell: >25 % flash composition as loose powder or report effects (or both)	1.1G
			Colour shell: > 50 mm and < 180 mm	1.2G
			Colour shell: ≤ 50 mm, or ≤ 60 g pyrotechnic composition, with ≤ 25 % flash composition as loose powder or report effects (or both)	1.3G

1	2	3	4	5
Type	**Synonyms**	**Definition**	**Specification**[a, b, c]	**Classification**
Shell, spherical or cylindrical (continued)	Shell of shells (spherical) (Reference to percentages for shell of shells is to the gross mass of the fireworks article)	Device without propellant charge, with delay fuse and bursting charge, containing report shells and inert materials and designed to be projected from a mortar	> 120 mm	1.1G
		Device without propellant charge, with delay fuse and bursting charge, containing report shells ≤ 25 g flash composition per report unit, with ≤ 33 % flash composition and ≥ 60 % inert materials and designed to be projected from a mortar	≤ 120 mm	1.3G
		Device without propellant charge, with delay fuse and bursting charge, containing colour shells or pyrotechnic units (or both) and designed to be projected from a mortar	> 300 mm	1.1G
		Device without propellant charge, with delay fuse and bursting charge, containing colour shells ≤ 70 mm or pyrotechnic units (or both) with ≤ 25 % flash composition and ≤ 60 % pyrotechnic composition and designed to be projected from a mortar	> 200 mm and ≤ 300 mm	1.3G
		Device with propellant charge, with delay fuse and bursting charge, containing colour shells ≤ 70 mm or pyrotechnic units (or both), with ≤ 25 % flash composition and ≤ 60 % pyrotechnic composition and designed to be projected from a mortar	≤ 200 mm	1.3G

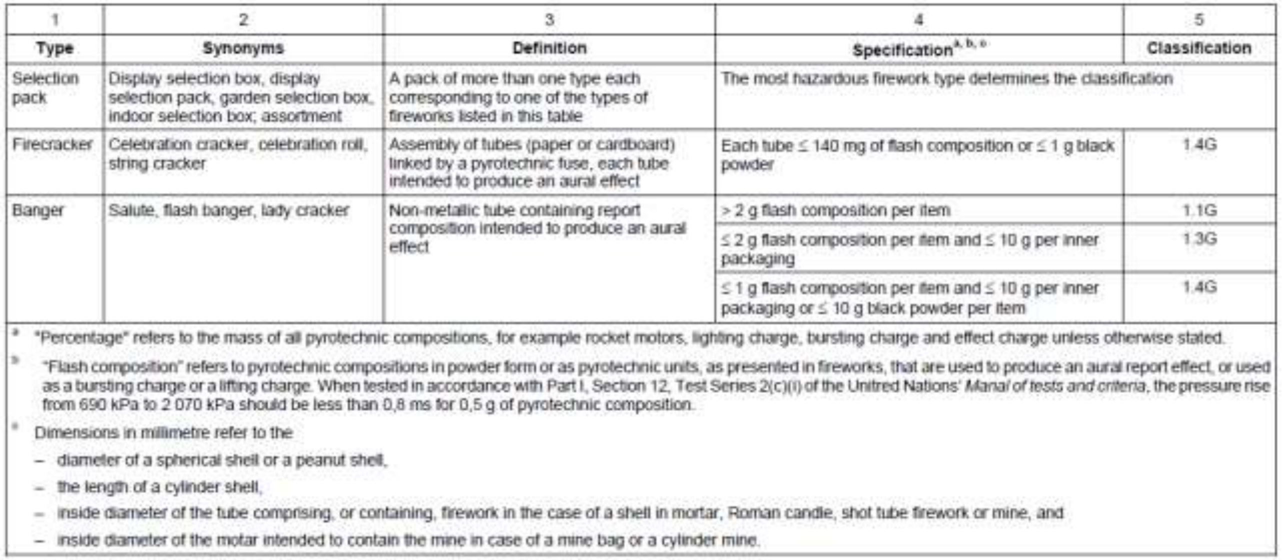


1	2	3	4	5
Type	**Synonyms**	**Definition**	**Specification**$^{a, b, c}$	**Classification**
Battery/ combination	Barrage, bombardos, cakes, finale box, flowerbed, hybrid, multiple tubes, shell cakes, banger batteries, flash banger batteries	Assembly including several elements containing either the same type or several types each corresponding to one of the types of fireworks listed in this table, with one or two points of ignition	The most hazardous firework determines the classification	
Roman candle	Exhibition candle, candle, bombettes	Tube containing a series of pyrotechnic units consisting of alternate pyrotechnic composition, propellant charge, and transmitting fuse	≥ 50 mm inner diameter, containing flash composition, or < 50 mm with > 25 % flash composition	1.1G
			≥ 50 mm inner diameter, containing no flash composition	1.2G
			< 50 mm inner diameter and ≤ 25 % flash composition	1.3G
			≤ 30 mm inner diameter, each pyrotechnic unit ≤ 25 g and ≤ 5 % flash composition	1.4G
Shot tube	Single shot Roman candle, small preloaded mortar	Tube containing a pyrotechnic unit consisting of pyrotechnic composition, propellant charge with or without transmitting fuse	≤ 30 mm inner diameter and pyrotechnic unit > 25 g, or > 5 % and ≤ 25 % flash composition	1.3G
			≤ 30 mm inner diameter, pyrotechnic unit ≤ 25 g and ≤ 5 % flash composition	1.4G
Rocket	Avalanche rocket, signal rocket, whistling rocket, bottle rocket, sky rocket, missile type rocket, table rocket	Tube containing pyrotechnic composition or pyrotechnic units (or both), with stick(s) or other means for stabilization of flight, and designed to be propelled into the air	Flash composition effects only	1.1G
			Flash composition > 25 % of the pyrotechnic composition	1.1G
			> 20 g pyrotechnic composition and flash composition ≤ 25 %	1.3G

1	2	3	4	5
Type	**Synonyms**	**Definition**	**Specification**[a, b, c]	**Classification**
Rocket *(continued)*	Avalanche rocket, signal rocket, whistling rocket, bottle rocket, sky rocket, missile type rocket, table rocket	Tube containing pyrotechnic composition or pyrotechnic units (or both), with stick(s) or other means for stabilization of flight, and designed to be propelled into the air	≤ 20 g pyrotechnic composition, black powder bursting charge and ≤ 0,13 g flash composition per report and ≤ 1 g in total	1.4G
Mine	Pot-a-feu, ground mine, bag mine, cylinder mine	Tube containing propellant charge and pyrotechnic units and designed to be placed on the ground or to be fixed in the ground. The principal effect is ejection of all the pyrotechnic units in a single burst producing a widely dispersed visual or aural effect (or both); in the air; or Cloth or paper bag or cloth or paper cylinder containing propellant charge and pyrotechnic units, designed to be placed in a mortar and to function as a mine	> 25 % flash composition, as loose powder or report effects (or both)	1.1G
			≥ 180 mm and ≤ 25 % flash composition, as loose powder or report effects (or both)	1.1G
			< 180 mm and ≤ 25 % flash composition, as loose powder or report effects (or both)	1.3G
			≤ 150g pyrotechnic composition, containing ≤ 5 % flash composition as loose powder or report effects (or both). Each pyrotechnic unit ≤ 25 g, each report effect < 2 g; each whistle, if any, ≤ 3 g	1.4G
Fountain	Volcanos, gerbs, showers, lances, Bengal fire, flitter sparkle, cylindrical fountains, cone fountains, illuminating torch	Non-metallic case containing pressed or consolidated sparks and flame producing pyrotechnic composition	≥ 1 kg pyrotechnic composition	1.3G
			< 1 kg pyrotechnic composition	1.4G
Sparkler	Handheld sparklers, non-handheld sparklers, wire sparklers	Rigid wire partially coated (along one end) with slow burning pyrotechnic composition with or without an ignition tip	Perchlorate based sparklers: > 5 g per item or > 10 items per pack	1.3G
			Perchlorate based sparklers: ≤ 5 g per item and ≤ 10 items per pack; nitrate based sparklers: ≤ 30 g per item	1.4G
Bengal stick	Dipped stick	Non-metallic stick partially coated (along one end) with slow-burning pyrotechnic composition and designed to be held in the hand	Perchlorate based items: > 5 g per item or > 10 items per pack	1.3 G
			Perchlorate based items: ≤ 5 g per item and ≤ 10 items per pack; nitrate based items: ≤ 30 g per item	1.4G



1	2	3	4	5
Type	**Synonyms**	**Definition**	**Specification**[a, b, c]	**Classification**
Low hazard fireworks and novelties	Table bombs, throwdowns, crackling granules, smokes, fog, snakes, glow worm, serpents, snaps, party poppers	Device designed to produce very limited visible or audible effect (or both) that contains small amounts of pyrotechnic or explosive composition (or both)	Throwdowns and snaps may contain up to 1,6 mg of silver fulminate; snaps and party poppers may contain up to 16 mg of potassium chlorate or red phosphorous (or both); other articles may contain up to 5 g of pyrotechnic composition, but no flash composition	1.4G
Spinner	Aerial spinner, helicopter, chaser, ground spinner	Non-metallic tube or tubes containing gas- or spark-producing pyrotechnic composition, with or without noise producing composition, with or without aerofoils attached	Pyrotechnic composition per item > 20 g, containing ≤ 3 % flash composition as report effects, or whistle composition ≤ 5 g	1.3G
			Pyrotechnic composition per item ≤ 20 g, containing ≤ 3 % flash composition as report effects, or whistle composition ≤ 5 g	1.4G
Wheels	Catherine wheels, Saxon	Assembly including drivers containing pyrotechnic composition and provided with a means of attaching it to a support so that it can rotate	≥ 1 kg total pyrotechnic composition, no report effect, each whistle (if any) ≤ 25 g and ≤ 50 g whistle composition per wheel	1.3G
			< 1 kg total pyrotechnic composition, no report effect, each whistle (if any) ≤ 5 g and ≤ 10 g whistle composition per wheel	1.4G
Aerial wheel	Flying Saxon, UFOs, rising crown	Tubes containing propellant charges and spark, flame or noise producing pyrotechnic compositions (or any combination of these), the tubes being fixed to a supporting ring	> 200 g total pyrotechnic composition or > 60 g pyrotechnic composition per driver, ≤ 3 % flash composition as report effects, each whistle (if any) ≤ 25 g and ≤ 50 g whistle composition per wheel	1.3G
			≤ 200 g total pyrotechnic composition and ≤ 60 g pyrotechnic composition per driver, ≤ 3 % flash composition as report effects, each whistle (if any) ≤ 5 g and ≤ 10 g whistle composition per wheel	1.4G



1	2	3	4	5
Type	**Synonyms**	**Definition**	**Specification**[a, b, c]	**Classification**
Selection pack	Display selection box, display selection pack, garden selection box, indoor selection box; assortment	A pack of more than one type each corresponding to one of the types of fireworks listed in this table	The most hazardous firework type determines the classification	
Firecracker	Celebration cracker, celebration roll, string cracker	Assembly of tubes (paper or cardboard) linked by a pyrotechnic fuse, each tube intended to produce an aural effect	Each tube ≤ 140 mg of flash composition or ≤ 1 g black powder	1.4G
Banger	Salute, flash banger, lady cracker	Non-metallic tube containing report composition intended to produce an aural effect	> 2 g flash composition per item	1.1G
			≤ 2 g flash composition per item and ≤ 10 g per inner packaging	1.3G
			≤ 1 g flash composition per item and ≤ 10 g per inner packaging or ≤ 10 g black powder per item	1.4G

[a] "Percentage" refers to the mass of all pyrotechnic compositions, for example rocket motors, lighting charge, bursting charge and effect charge unless otherwise stated.

[b] "Flash composition" refers to pyrotechnic compositions in powder form or as pyrotechnic units, as presented in fireworks, that are used to produce an aural report effect, or used as a bursting charge or a lifting charge. When tested in accordance with Part I, Section 12, Test Series 2(c)(i) of the Unitred Nations' *Manal of tests and criteria*, the pressure rise from 690 kPa to 2 070 kPa should be less than 0,8 ms for 0,5 g of pyrotechnic composition.

[c] Dimensions in millimetre refer to the

- diameter of a spherical shell or a peanut shell,
- the length of a cylinder shell,
- inside diameter of the tube comprising, or containing, firework in the case of a shell in mortar, Roman candle, shot tube firework or mine, and
- inside diameter of the motar intended to contain the mine in case of a mine bag or a cylinder mine.

8 Class 2: Gases

8.1 General

8.1.1 Permanent gas

A permanent gas is a gas that, at a temperature of 50 °C, has a vapour pressure exceeding 300 kPa or is completely gaseous at a temperature of 20 °C and at a standard pressure of 101,3 kPa.

NOTE Carbonated beverages are not subject to the requirements of this standard.

8.1.2 Compressed gas

A compressed gas is a gas that, when packaged under pressure for transport, is entirely gaseous at a temperature of −50 °C. A gas with a critical temperature of less than, or equal to, –50 °C is regarded as a compressed gas.

8.1.3 Liquefied gas

A liquefied gas is a gas that, when packaged under pressure for transport, can become partially liquid at a temperature above −50 °C. A distinction is made between

a) high pressure liquefied gas: a gas with a critical temperature between −50 °C and +65 °C, and

b) low pressure liquefied gas: a gas with a critical temperature above +65 °C.

8.1.4 Refrigerated liquefied gas

A refrigerated liquefied gas is a gas that, when packaged under pressure for transport, is partially liquid due to its low temperature, for example liquid nitrogen and liquid oxygen.

8.1.5 Dissolved gas

A dissolved gas is a gas that, when packaged under pressure for transport, is dissolved in a liquid phase solvent.

8.1.6 Aerosol dispenser

An aerosol dispenser is a non-refillable receptacle made of metal, glass or plastics, that contains a gas that is compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and that is fitted with a release device to allow the contents to be ejected as solid or liquid particles in suspension in a gas, or as a foam, a paste or a powder, or in a liquid state, or in a gaseous state.

The flammability of an aerosol shall be determined in accordance with A.2.1.

8.2 Divisions of class 2

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

8.2.1 Division 2.1: Flammable gases

8.2.1.1 Flammable gases are gases that, at a temperature of 20 °C and at a standard pressure of 101,3 kPa

a) are ignitable when in a mixture of 13 % or less (by volume) with air, or

b) have a flammable range with air of at least 12 percentage points, regardless of the lower flammable limit. Flammability shall be determined by tests or by calculation in accordance with ISO 10156. Where insufficient data are available for the calculation in accordance with ISO 10156, tests by a comparable internationally recognized method may be used.

8.2.2 Division 2.2: Non-flammable, non-toxic gases

8.2.2.1 Non-flammable, non-toxic gases are gases that are transported at a pressure of at least 280 kPa at a temperature of 20 °C, or as refrigerated liquids, and that

a) are asphyxiant (gases that dilute or replace the oxygen in the atmosphere), or

b) are oxidizing (gases that can, generally by providing oxygen, cause or contribute to the combustion of other material to a greater extent than air does). The oxidizing ability of a gas shall be determined by tests or by calculation in accordance with ISO 10156 and ISO 10156-2, or

c) do not fall under division 2.1 or division 2.3.

8.2.2.2 Gases of division 2.2 are not subject to these requirements when contained in the following:

a) foodstuffs, including carbonated beverages, except UN 1950;

b) balls intended for use in sports;

c) tyres, except for air transport; or

d) light bulbs, provided they are packed so that the projectile effect of any rupture of the bulb will be contained within the package.

8.2.3 Division 2.3: Toxic gases

Toxic gases are gases that

a) are known to be so toxic or corrosive to humans that they pose a health hazard, or
b) are presumed to be toxic or corrosive to humans because they have an inhalation toxicity (LC50) value equal to or less than 5 000 mL/m3 when tested in accordance with A.6.

NOTE Gases that meet the above criteria owing to their corrosiveness are classified as toxic with a subsidiary corrosive risk.

8.4 Warning notes about gases

Although some gases are chemically and physiologically inert, these gases, and other gases accepted as non-toxic under normal circumstances, will nevertheless be suffocating in high concentrations.

Many gases can have a marked narcotic effect at comparatively low concentrations, or can emit highly toxic vapours or fumes when involved in a fire. All gases that are heavier than air present a potential danger if allowed to accumulate.

8.5 Classification of gas mixtures

8.5.1 General

Gas mixtures (including vapours of substances from other classes) are classified in at least one of the three divisions in accordance with the principles discussed in 8.4.2 to 8.4.5 (inclusive).

8.5.2 Flammability

The flammability of a gas mixture is determined in accordance with ISO 10156. Where insufficient data are available for the calculation in accordance with ISO 10156, tests by a comparable internationally recognized method may be used.

8.5.3 Toxicity

The toxicity of a gas mixture is determined in accordance with 12.1.2.4 or is calculated by means of the following formula:

$$LC_{50} = \frac{1}{\sum_{i=1}^{n} \frac{f_i}{T_i}}$$

where

LC50	is the acute inhalation toxicity, in milligrams per litre for dust or mist, and in millilitres per cubic metre for vapours;
n	is the number of toxic gases in the gas mixture;
fi	is the mole fraction of the ith toxic component substance of the mixture;
Ti	is the toxicity index of the ith toxic component substance of the mixture (Ti equals the LC50 value when available).

NOTE When the LC50 values are unknown, the toxicity index is determined by

a) using the lowest LC50 value of substances with similar physiological and chemical effects, or

b) testing, if this is the only practical possibility.

8.5.4 Corrosiveness

Corrosiveness as a subsidiary risk of a gas mixture is applicable when the mixture is known to be destructive to the human skin, eyes or mucous membranes, or when the calculated LC50 value is less than or equal to 5 000 mL/m3 when the following formula is applied:

$$LC_{50} = \frac{1}{\sum_{i=1}^{n} \frac{f_{ci}}{T_{ci}}}$$

LC*50* is the acute inhalation toxicity, in milligrams per litre for dust and mist, and in millilitres per cubic metre for vapours;

n is the number of toxic gases in the gas mixture;

fci is the mole fraction of the ith corrosive component substance of the mixture;

Tci is the toxicity index of the ith corrosive component substance of the mixture (Tci equals the LC50 value when available).

8.5.5 Oxidizing ability

The oxidizing ability of a gas mixture is determined by tests or by the calculation in accordance with ISO 10156 and ISO 10156-2.

8.6 Hazard precedence for gases

Gases and gas mixtures that present hazards associated with more than one division of class 2 take the following precedence:

a) hazards associated with division 2.3 take precedence over divisions 2.1 and 2.2; and

b) hazards associated with division 2.1 take precedence over hazards associated with division 2.2.

9 Class 3: Flammable liquids

9.1 General

9.1.1 Class 3 includes the following substances:

a) flammable liquids (see 9.1.2 and 9.1.3); and

b) liquid desensitized explosives (see 9.2).

9.1.2 Flammable liquids are liquids, or mixtures of liquids, that might contain solids in solution or in suspension (for example paints, varnishes and lacquers, but not substances that, on account of their other dangerous characteristics, have been included in other classes), that give off a flammable vapour at or below 60 °C, closed-cup test (which corresponds to 65,6 °C, open-cup test). This class also includes the following:

a) liquids offered for transport at temperatures at or above their flash point; and

b) substances that are transported, or offered for transport, at elevated temperatures in a liquid state and that give off a flammable vapour at a temperature at or below the maximum transport temperature.

9.1.3 A non-toxic, non-corrosive liquid that complies with the requirements of 9.1.2, that has a closed cup flash point exceeding 35 °C and that does not sustain combustion, need not be considered flammable if

a) it has passed the combustibility test (see A.3.4), or

b) the (fire) point exceeds 100 °C when tested in accordance with ISO 2592, or

c) it is a water miscible solution with a water content exceeding 90 % (by mass).

However, such a substance shall be classified as a product of class 3 if it is intended for transport at an elevated temperature equal to or higher than its flash point.

NOTE 1 The flash point of a liquid can be altered by the presence of impurities. Therefore, chemically pure liquids that are not regarded as flammable liquids of class 3, may be classified under this class if they are commercial products.

NOTE 2 Substances listed by name in this class are regarded as chemically pure.

9.1.4 Substances classified as flammable liquids due to their being transported, or offered for transport at elevated temperatures, are included in packing group III.

9.2 Liquid desensitized explosives

A liquid desensitized explosive is an explosive substance that is dissolved or suspended in water or in another liquid substance, to form a homogeneous liquid mixture to suppress its explosive properties (see 7.5.5.3). Entries in B.2 and in annex C for liquid desensitized explosives are UN 1204, UN 2059, UN 3064, UN 3343, UN 3357 and UN 3379.

9.3 Packing groups based on flammability (see Table 5)

9.3.1 General

9.3.1.1 The criteria given in table 5 are used to determine the packing group of a liquid that presents a risk owing to its flammability.

9.3.1.2 If a liquid has an additional risk(s) to flammability, the packing group determined from Table 5 and the packing group based on the severity of the additional risk(s) shall be considered. The classification and packing group of such a substance shall be allocated in accordance with Table 19, provided that the substance is not listed in B.2 and in Annex C.

9.3.1.3 The flash point data in this standard are generally based on closed-cup methods. Where it is customary for flash points to be determined by the open-cup method, the temperatures determined by that method would have to be reduced for comparison with those in this standard (see 9.1.2).

Table 5 — Packing groups based on flammability

1	**2**	**3**
Packing group	**Closed up flash point ˚C**	**Initial boiling point ˚C**
I	**—**	≤35

II	**<23**	≤35
III	**≥23 and ≤ 60**	≤35

9.4 Viscous flammable liquids

9.4.1 Paints, varnishes, enamels, lacquers, adhesives, polishes and other viscous flammable substances of class 3 that have a closed-cup flash point of less than 23 °C can be assigned to packing group III on the basis of

a) the viscosity expressed as the flow time, in seconds, exceeding the limits given in table 6,

b) the closed-cup flash point (see A.3.1), and

c) a solvent separation test (see A.3.3).

9.4.2 Viscous flammable liquids that have a closed-cup flash point of less than 23 °C are assigned to packing group III, provided that

a) less than 3 % of the clear solvent layer separates in the solvent separation test (see 9.5(c)), and

b) the mixture or any separated solvent does not comply with the criteria of division 6.1 (see 12.1) or class 8 (see clause 14).

9.4.3 Viscous substances that

a) have a flash point equal to or exceeding 23 °C and less than or equal to 60 °C,

b) are not toxic, corrosive, or hazardous to the environment,

c) contain not more than 20 % nitrocellulose, provided that the nitrocellulose contains not more than 12,6 % nitrogen (by dry mass), and

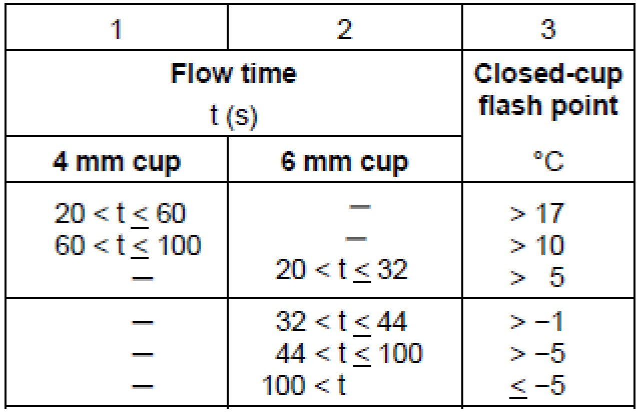
d) are packed in receptacles of capacity less than 450 L, are not subject to the requirements of this standard if

1) the solvent separation test (see A.3.3) shows that the height of the separated layer of solvent is less than 3 % of the total height, and

2) the viscosity of the substance (see A.3.2) is such that it has a flow time (6 mm cup) equal to or exceeding

   i) 60 s, or
   ii) 40 s, if the substance contains not more than 60 % of class 3 substances.

Table 6 — Criteria for viscous flammable substances



1	2	3
Flow time t (s)		**Closed-cup flash point** °C
4 mm cup	**6 mm cup**	
20 < t ≤ 60	—	> 17
60 < t ≤ 100	—	> 10
—	20 < t ≤ 32	> 5
—	32 < t ≤ 44	> −1
—	44 < t ≤ 100	> −5
—	100 < t	≤ −5

9.5 Test methods for flammable liquids

The testing of flammable liquids for classification purposes shall be in accordance with the test methods given in A.3 for

a) flash point A.3.1,

b) initial boiling point A.3.2,

c) solvent separation A.3.4, and

d) combustibility A.3.5.

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

10.1 Division 4.1: Flammable solids, self-reactive substances and solid desensitized explosives

10.1.1 Flammable solids

10.1.1.1 General

10.1.1.1.1 Flammable solids are readily combustible and can cause, or contribute to, fire through friction.

10.1.1.1.2 Readily combustible solids are powdered, granular, or pasty substances that can easily be ignited on brief contact with an ignition source, such as a burning match, and the flames of which spread rapidly. When heated or when on fire, some of these substances can emit toxic combustion products.

10.1.1.1.3 Metal powders are especially dangerous because extinguishing the fire of burning metal powders with normal extinguishing agents such as carbon dioxide or water can increase the fire hazard.

10.1.1.2 Classification of flammable solids

10.1.1.2.1 Powdered, granular or pasty substances shall be classified in division 4.1 when the time of burning of one or more of the tests performed in accordance with A.4.1.2, is less than 45 s or the rate of burning exceeds 2,2 mm/s.

10.1.1.2.2 Powders of metals or metal alloys shall be classified in division 4.1 when they can be ignited and the reaction spreads over the entire length of the sample in 10 min or less (see A.4.1.2).

10.1.1.2.3 Solids that can cause fire through friction shall be classified in division 4.1 by analogy with existing entries, for example matches, until definitive criteria are established.

10.1.1.3 Assignment of packing groups to flammable solids

10.1.1.3.1 General

The packing groups for flammable solids are assigned on the basis of the results obtained in the preliminary screening test (see A.4.1.1) and the burning rate test (see A.4.1.2). The packing group of a solid that can cause fire through friction shall be assigned by analogy with an existing entry, or in accordance with an appropriate special provision.

10.1.1.3.2 Packing group II

Packing group II is assigned to

a) readily combustible solids (other than metal powder) if the burning time is less than 45 s and the flame passes the wetted zone, and

b) metal powders or metal alloys if the zone of reaction spreads over the entire length of the specimen in 5 min or less.

10.1.1.3.3 Packing group III

Packing group III is assigned to

a) readily combustible solids (other than metal powders) if the burning time is less than 45 s and the wetted zone stops the flame propagation for at least 4 min, and

b) metal powders or metal alloys if the reaction spreads over the whole length of the specimen in more than 5 min but in less than 10 min.

10.1.2 Self-reactive substances

10.1.2.1 General

10.1.2.1.1 Self-reactive substances of division 4.1 are thermally unstable substances that are liable to undergo a strong exothermic decomposition, even without the participation of oxygen or air. The following substances are not considered to be self-reactive substances of division 4.1:

a) explosives of class 1;

b) oxidizing substances of division 5.1 (see also 10.1.2.1.3);
c) organic peroxides of division 5.2;

d) substances of which the heat of decomposition is less than 300 J/g; and

e) substances of which the self-accelerating decomposition temperature (SADT) exceeds 75 °C for a 50 kg package.

NOTE The heat of decomposition can be determined by means of any internationally recognized method, for example differential scanning calorimetry or adiabatic calorimetry.

10.1.2.1.2 A substance that shows the properties of a self-reactive substance shall be classified in division 4.1 even if it gives a positive result according to 10.2.3 for inclusion in division 4.2.

10.1.2.1.3 A mixture of oxidizing substances of division 5.1 that contains 5,0 % or more of combustible organic susbances and does not meet the criteria given in 10.1.2.1.1(a), (c), (d) or (e), shall be subjected to the self-reactive substance classification procedure (see 10.1.2.3).

10.1.2.2 Properties of self-reactive substances

10.1.2.2.1 The decomposition of self-reactive substances can be initiated by friction, impact or heat, or by contact with catalytic impurities, for example acids, heavy metal compounds and heavy metal bases.

10.1.2.2.2 The rate of decomposition increases with temperature and varies with the substance. Decomposition, particularly if no ignition occurs, can result in the evolution of toxic gases or vapours. In the case of certain self-reactive substances, the temperature has to be controlled. Some self-reactive substances can decompose explosively, particularly if confined; this characteristic can be modified by the addition of diluents (see 10.1.2.6) or by the use of appropriate packaging.

10.1.2.2.3 Some self-reactive substances burn vigorously. Self-reactive substances include some of the following types of compounds:

a) aliphatic azo compounds (-C-N=N-C-);

b) organic azides (-C-N3);

c) diazonium salts (-CN2 +Z-);

d) N-nitroso compounds (-N-N=O); and

e) aromatic sulfohydrazides (-SO2-NH-NH2).

10.1.2.2.4 Substances of other reactive groups and some mixtures of substances can have properties similar to those of self-reactive substances.

10.1.2.3 Classification of self-reactive substances

10.1.2.3.1 Self-reactive substances are classified into seven types according to the degree of danger they present (see 10.1.2.4). The types of self-reactive substances range from type A (shall not be accepted for transport in the packaging in which they are tested) to type G, which is not subject to the provisions for self-reactive substances of division 4.1. The classification of types B to F is directly related to the maximum quantity allowed in one packaging.

10.1.2.3.2 Self-reactive substances permitted for transport in packaging are listed in Table 6 those permitted for transport in IBCs are listed in packing instruction IBC520 and those permitted for transport in portable tanks are listed in tank instruction T23. For each permitted substance listed in table 6, the appropriate generic entry (UN 3221 to UN 3240) is given in B.2.

10.1.2.3.3 The classification given in table 7 is based on the pure substance except where a concentration of less than 100 % is specified. For other concentrations, the substance shall be classified differently in accordance with the procedures given in 10.1.2.4 and 10.1.2.5.

10.1.2.3.4 Classification of self-reactive substances not listed in Table 7, packing instruction IBC520 or tank instruction T23 (see B.2) and assignment to a generic entry shall be made by the relevant competent authority of the country of origin on the basis of a test report. Principles applying to the classification of such substances are provided in 10.1.2.4. The applicable classification procedures, test methods and criteria, and an example of a suitable test report, are given in Part II of the United Nations' Manual of Tests and Criteria. The statement of approval by the competent authority shall contain the classification and the relevant transport conditions.

10.1.2.3.5 Activators, such as zinc compounds, may be added to some self-reactive substances to change their reactivity. Depending on both the type and the concentration of the activator, this could result in a decrease in thermal stability and a change in explosive properties. If either of these properties is altered, the new formulation shall be assessed in accordance with the classification criteria of this standard.

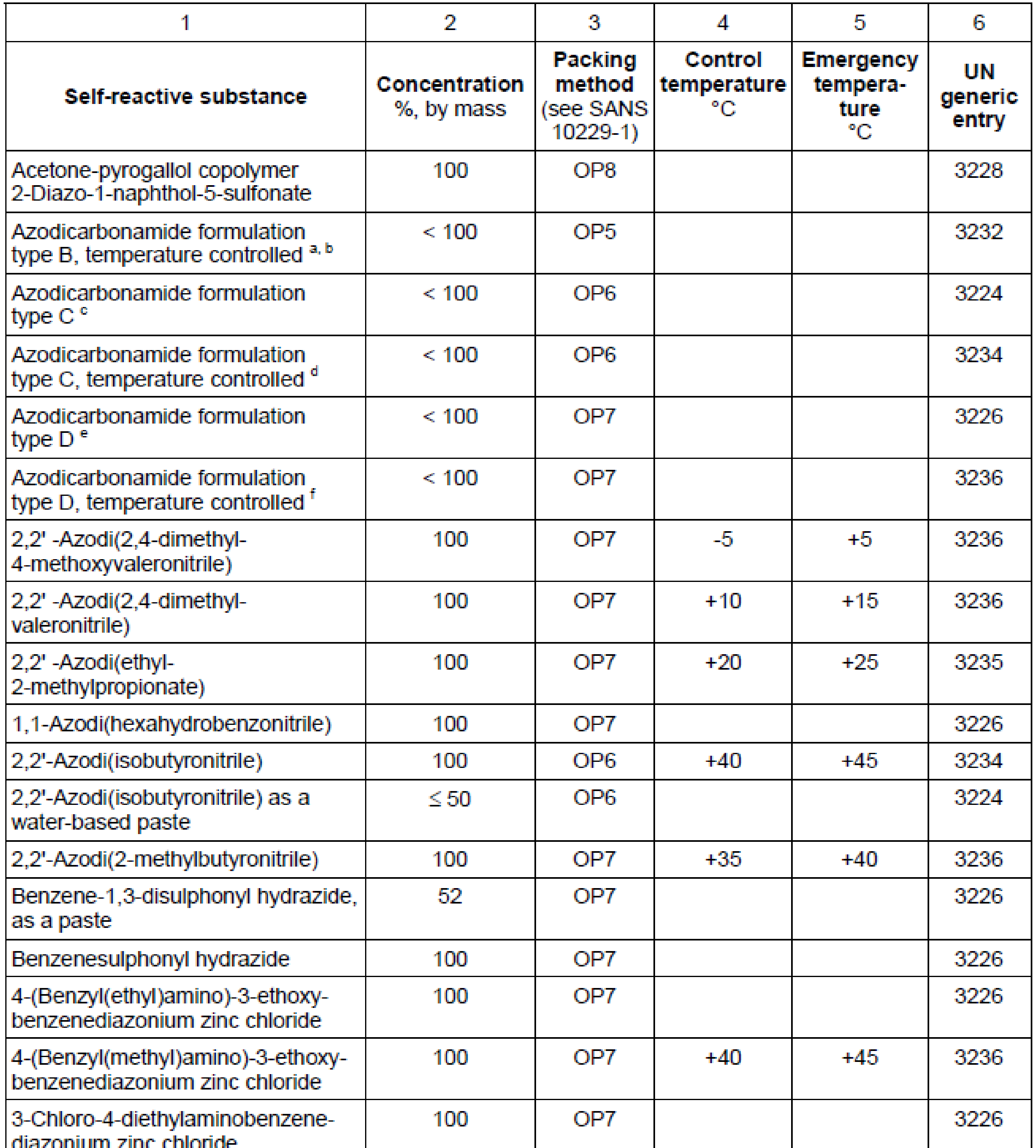
10.1.2.3.6 Samples of self-reactive substances or formulations of self-reactive substances not listed in Table 6, for which a complete set of test results is not available and that are to be transported for further testing or evaluation, may be assigned to one of the appropriate entries for self-reactive substances type C, provided the following conditions are met:

a) the available data indicate that the sample would be no more dangerous than self-reactive substances type B;

b) the sample is packaged in accordance with packing method OP2 and the quantity per transport unit is limited to 10 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 7 — Currently assigned self-reactive substances in packaging



1	2	3	4	5	6
Self-reactive substance	**Concentration** %, by mass	**Packing method** (see SANS 10229-1)	**Control temperature** °C	**Emergency temperature** °C	**UN generic entry**
Acetone-pyrogallol copolymer 2-Diazo-1-naphthol-5-sulfonate	100	OP8			3228
Azodicarbonamide formulation type B, temperature controlled [a, b]	< 100	OP5			3232
Azodicarbonamide formulation type C [c]	< 100	OP6			3224
Azodicarbonamide formulation type C, temperature controlled [d]	< 100	OP6			3234
Azodicarbonamide formulation type D [e]	< 100	OP7			3226
Azodicarbonamide formulation type D, temperature controlled [f]	< 100	OP7			3236
2,2' -Azodi(2,4-dimethyl-4-methoxyvaleronitrile)	100	OP7	-5	+5	3236
2,2' -Azodi(2,4-dimethyl-valeronitrile)	100	OP7	+10	+15	3236
2,2' -Azodi(ethyl-2-methylpropionate)	100	OP7	+20	+25	3235
1,1-Azodi(hexahydrobenzonitrile)	100	OP7			3226
2,2'-Azodi(isobutyronitrile)	100	OP6	+40	+45	3234
2,2'-Azodi(isobutyronitrile) as a water-based paste	≤ 50	OP6			3224
2,2'-Azodi(2-methylbutyronitrile)	100	OP7	+35	+40	3236
Benzene-1,3-disulphonyl hydrazide, as a paste	52	OP7			3226
Benzenesulphonyl hydrazide	100	OP7			3226
4-(Benzyl(ethyl)amino)-3-ethoxy-benzenediazonium zinc chloride	100	OP7			3226
4-(Benzyl(methyl)amino)-3-ethoxy-benzenediazonium zinc chloride	100	OP7	+40	+45	3236
3-Chloro-4-diethylaminobenzene-diazonium zinc chloride	100	OP7			3226

Table 7 (continued)

1	2	3	4	5	6
Self-reactive substance	**Concentration** %, by mass	**Packing method** (see SANS 10229-1)	**Control temperature** °C	**Emergency tempera-ture** °C	**UN generic entry**
2,5-Diethoxy-4-morpholino-benzenediazonium zinc chloride	66	OP7	+40	+45	3236
2,5-Diethoxy-4-morpholino-benzenediazonium tetrafluoroborate	100	OP7	+30	+35	3236
2,5-Diethoxy-4-(4-morpholinyl)-benzenediazonium sulfate	100	OP7			3226
2,5-Diethoxy-4-(phenylsulfonyl)-benzenediazonium zinc chloride	67	OP7	+40	+45	3236
Diethyleneglycol bis (allyl carbonate) *and* Di-isopropylperoxy-dicarbonate	≥ 88 *and* ≤ 12	OP8	−10	0	3237
2,5-Dimethoxy-4-(4-methyl-phenylsulphonyl)benzene-diazonium zinc chloride	79	OP7	+40	+45	3236
4-(Dimethylamino)-benzene-diazonium trichlorozincate (-1)	100	OP8			3228
4-Dimethylamino-6-(2-dimethyl-aminoethoxy) toluene-2-diazonium zinc chloride	100	OP7	+40	+45	3236
N,N'-Dinitroso-N,N'-dimethyl terephthalamide, as a paste	72	OP6			3224
N,N'-Dinitrosopentamethylene-tetramine	82	OP6			3224
Diphenyloxide-4,4'-disulfonyl-hydrazide [h]	100	OP7			3226
4-Dipropylaminobenzene-diazonium zinc chloride	100	OP7			3226
2-(N,N-ethoxycarbonyl-phenylamino)-3-methoxy-4-(N-methyl-N-cyclohexylamino benzenediazonium zinc chloride	63 – 92	OP7	+40	+45	3236

1	2	3	4	5	6
Self-reactive substance	**Concentration** %, by mass	**Packing method** (see SANS 10229-1)	**Control temperature** °C	**Emergency temperature** °C	**UN generic entry**
3-(2-Hydroxyethoxy)-4-(pyrrolidin-1-yl)benzene diazonium zinc chloride	100	OP7	+40	+45	3236
2-(N,N-Methylaminoethyl-carbonyl)-4-(3,4-dimethyl-phenylsulphonyl)benzene-diazonium hydrogen sulfate	96	OP7	+45	+50	3236
4-Methylbenzenesulfonyl-hydrazide	100	OP7			3226
3-Methyl-4-(pyrrolidin-1-yl) benzenediazonium tetrafluoro-borate	95	OP6	+45	+50	3234
4-Nitrosophenol	100	OP7	+35	+40	3236
Self-reactive liquid, sample [i]		OP2			3223
Self-reactive liquid, sample, temperature controlled [i]		OP2			3233
Self-reactive solid, sample [i]		OP2			3224
Self-reactive solid, sample, temperature controlled [i]		OP2			3234
Sodium 2-diazo-1-naphthol-4-sulfonate	100	OP7			3226
Sodium 2-diazo-1-naphthol-5-sulfonate	100	OP7			3226
Tetramine palladium (II) nitrate	100	OP6	+30	+35	3234

a Azodicarbonamide formulations that fulfil the criteria of 10.1.2.4.3. The control and emergency temperatures shall be determined by the procedure given in 10.1.2.5.
b "EXPLOSIVE" subsidiary risk label is required
c Azodicarbonamide formulations that fulfil the criteria of 10.1.2.4.4.
d Azodicarbonamide formulations that fulfil the criteria of 10.1.2.4.4. The control and emergency temperatures shall be determined by the procedure given in 10.1.2.5.
e Azodicarbonamide formulations that fulfil the criteria of 10.1.2.4.5.
f Azodicarbonamide formulations that fulfil the criteria of 10.1.2.4.5. The controltemperatures shall be determined by the procedure given in 10.1.2.5. and emergency
h With a compatible diluent having a boiling point of not less than 150 °C.
i See 10.1.2.6.
g This entry applies to mixtures of esters of 2-diazo-1-naphthol-4-sulfonic acid and 2-diazo-1-naphthol-5-sulfonic acid meeting the criteria of 10.1.2.4.5.

10.1.2.4 Types of self-reactive substances

10.1.2.4.1 General

Self-reactive substances are classified in seven types, in accordance with the degree of danger that they present. Figure 2 provides principles for classification of self-reactive substances.

This section refers only to those properties of self-reactive substances that are decisive for their classification. A flow chart, presenting the classification principles in the form of a graphically arranged scheme of questions concerning the decisive properties together with the possible answer, is given in Figure 2. These properties should be determined experimentally using the test methods and criteria given in the United Nations' Manual of Tests and Criteria.

10.1.2.4.2 Type A

A type A substance is any substance that can detonate or deflagrate rapidly when packaged for transport. Type A substances are prohibited from transport under the provisions of division 4.1 in such packaging.

10.1.2.4.3 Type B

A type B substance is any substance that has explosive properties and that, when packaged for transport, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in the package. Type B substances shall also bear an "Explosive" risk label.

Such a substance can be packaged in amounts of up to 25 kg, unless the maximum quantity has to be limited to a lower amount to preclude detonation or rapid deflagration of the package.

10.1.2.4.4 Type C

A type C substance is any substance that has explosive properties but that cannot detonate or deflagrate rapidly or undergo a thermal explosion when packaged for transport in packages with a capacity not exceeding 50 kg. Type C substances may be transported without an "Explosive" risk label.

10.1.2.4.5 Type D

A type D substance is any substance that, during laboratory testing and when packaged for transport,

a) detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement, or

b) does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement, or

c) does not detonate or deflagrate at all and shows a medium effect when heated under confinement.

Such a substance can be transported in packages with a capacity not exceeding 50 kg net mass.

10.1.2.4.6 Type E

A type E substance is any substance that, during laboratory testing, neither detonates nor deflagrates and shows little or no effect when heated under confinement.

Such a substance can be transported in packages with a capacity not exceeding 400 kg or 450 L.

10.1.2.4.7 Type F

A type F substance is any substance that, during laboratory testing, neither detonates in the cavitated state nor deflagrates, shows little or no effect when heated under confinement, and shows low or no explosive power. These substances may be transported in intermediate bulk containers (IBCs) that comply with ADR

10.1.2.4.8 Type G

A type G substance is any substance that, during laboratory testing, neither detonates in the cavitated state nor deflagrates, and shows no effect when heated under confinement and shows no explosive power. These substances may be exempted from classification as a self-reactive substance of division 4.1, provided that

a) the formulation is thermally stable (SADT of 60 °C to 75 °C for a 50 kg package), and

b) any diluent complies with the requirement given in 10.1.2.6.

NOTE If the formulation is not thermally stable or a diluent other than type A is used for desensitization, the formulation should be classified as "Self-reactive liquid (or solid), type F".

10.1.2.5 Temperature control requirements for self-reactive substances

Self-reactive substances shall be subject to temperature control in transport if their SADT is less than or equal to 55 °C. The test methods for determining the SADT are given in section 28, part II of the United Nations' Manual of tests and criteria.

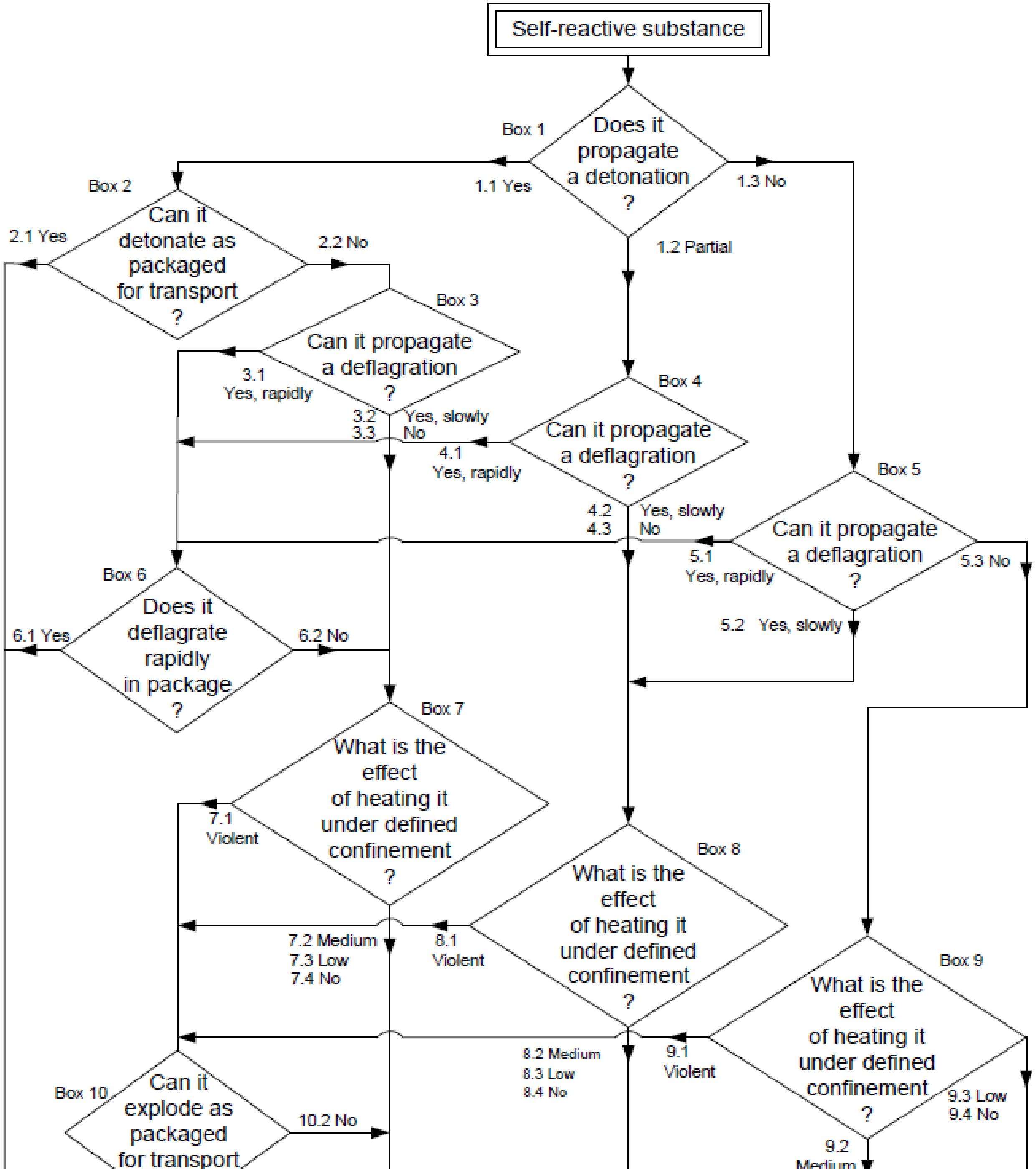
10.1.2.6 Desensitization of self-reactive substances

10.1.2.6.1 In order to ensure safety during transport, handling and storage, self-reactive substances can be desensitized by the use of a diluent. When a diluent is used (see 10.1.2.6.3 and 10.1.2.6.4), the self-reactive substance shall be tested with the diluent present, in the concentration and form to be used during transport, handling and storage.

10.1.2.6.2 A diluent that can allow a self-reactive substance to concentrate to a dangerous extent in the event of leakage from a package, shall not be used.

10.1.2.6.3 The diluent shall be compatible with the self-reactive substance. Compatible diluents are those solids or liquids which have no detrimental influence on the thermal stability and hazard type of the self-reactive substance.

10.1.2.6.4 A liquid diluent in a liquid formulation that requires temperature control shall have a boiling point of at least 60 °C and a closed-cup flash point of not less than 5 °C. The boiling point of the liquid diluent shall be at least 50 °C higher than the control temperature of the self-reactive substance.


Self-reactive substance
Box 1
Does it propagate a detonation ?
1.1 Yes
1.2 Partial
1.3 No
Box 2
Can it detonate as packaged for transport ?
2.1 Yes
2.2 No
Box 3
Can it propagate a deflagration ?
3.1 Yes, rapidly
3.2 Yes, slowly
3.3 No
Box 4
Can it propagate a deflagration ?
4.1 Yes, rapidly
4.2 Yes, slowly
4.3 No
Box 5
Can it propagate a deflagration ?
5.1 Yes, rapidly
5.2 Yes, slowly
5.3 No
Box 6
Does it deflagrate rapidly in package ?
6.1 Yes
6.2 No
Box 7
What is the effect of heating it under defined confinement ?
7.1 Violent
7.2 Medium
7.3 Low
7.4 No
Box 8
What is the effect of heating it under defined confinement ?
8.1 Violent
8.2 Medium
8.3 Low
8.4 No
Box 9
What is the effect of heating it under defined confinement ?
9.1 Violent
9.2 Medium
9.3 Low
9.4 No
Box 10
Can it explode as packaged for transport
10.2 No

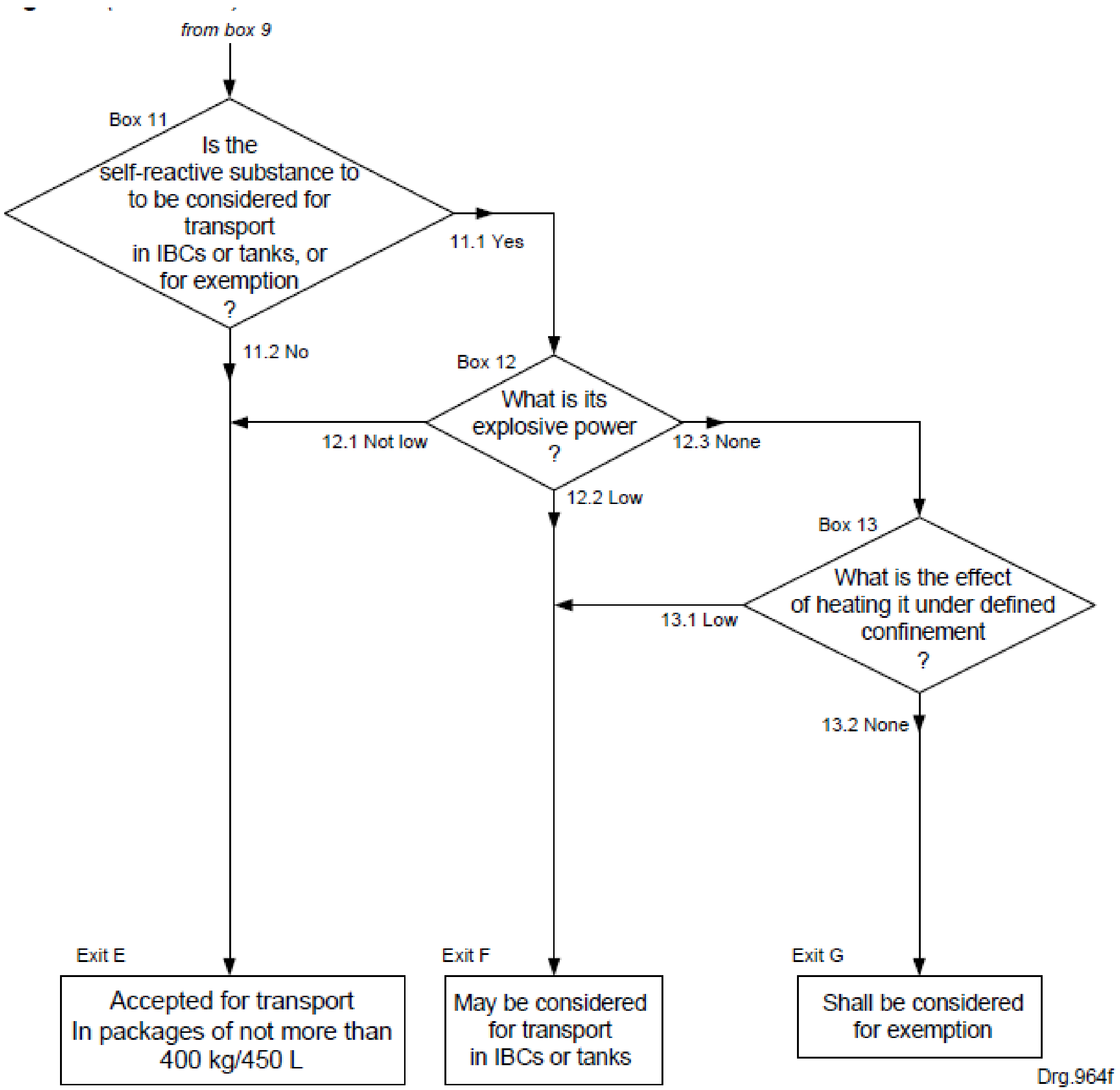

from box 9
Box 11
Is the self-reactive substance to to be considered for transport in IBCs or tanks, or for exemption ?
11.1 Yes
11.2 No
Box 12
What is its explosive power ?
12.1 Not low
12.2 Low
12.3 None
Box 13
What is the effect of heating it under defined confinement ?
13.1 Low
13.2 None
Exit E
Accepted for transport In packages of not more than 400 kg/450 L
Exit F
May be considered for transport in IBCs or tanks
Exit G
Shall be considered for exemption
Drg.964f

Figure 2 (concluded)

Figure 2 — Flow chart scheme for self-reactive substances

10.1.3 Solid desensitized explosives

10.1.3.1 Solid desensitized explosives are explosive substances that are wetted with water, or alcohols, or diluted with other substances, to form a homogeneous solid mixture to suppress their explosive properties. Solid desensitized explosives in B.2 and annex C are: UN 1310; UN 1320; UN 1321; UN 1322; UN 1336; UN 1337; UN 1344; UN 1347; UN 1348; UN 1349; UN 1354; UN 1355; UN 1356; UN 1357; UN 1517; UN 1571; UN 2555; UN 2556; UN 2557; UN 2852; UN 2907; UN 3317; UN 3319; UN 3344; UN 3364; UN 3365; UN 3366; UN 3367; UN 3368; UN 3369; UN 3370, UN 3376, UN 3380 and UN 3474.

10.1.3.2 Substances assigned to division 4.1 include

a) substances that have been provisionally accepted as explosives of class 1 in accordance with test series 1 and 2 in part I of the United Nations' Manual of tests and criteria, but have been exempted from class 1 by test series 6 in part I of the United Nations' Manual of tests and criteria,

b) substances that are not self-reactive substances of division 4.1, or

c) substances of class 5, for example UN 2956, UN 3241, UN 3242 and UN 3251.

10.2 Division 4.2: Substances liable to spontaneous combustion

10.2.1 General

Substances of division 4.2 are liable to spontaneous heating under normal conditions, or to heating when they come into contact with air, and are then liable to catch fire. Some of these substances can emit toxic gases when they are involved in a fire. Pyrophoric substances and self-heating substances are included in division 4.2.

10.2.2 Pyrophoric substances

10.2.2.1 Properties

Pyrophoric substances, including mixtures and solutions, are substances that, even in small quantities, ignite within 5 min of their coming into contact with air. These substances are the division 4.2 substances most liable to spontaneous combustion and shall be assigned to packing group I.

10.2.2.2 Test methods for pyrophoric substances

For classification purposes, pyrophoric substances shall be tested in accordance with the test methods given in A.4.2.1.

10.2.3 Self-heating substances

10.2.3.1 Properties

10.2.3.1.1 Self-heating substances are substances, other than pyrophoric substances, that on contact with air and without energy supply, are liable to self-heating. These substances will ignite only in large amounts (several kilograms) and after a long time (hours or days).

10.2.3.1.2 Self-heating of substances is caused by reaction of the substance with oxygen in the air and when the heat that develops is not conducted away rapidly enough to the surroundings. Spontaneous combustion occurs when the rate of heat production exceeds the rate of heat loss and the auto-ignition temperature is reached. Some substances can emit toxic gases when they are involved in a fire.

10.2.3.2 Classification of self-heating substances

10.2.3.2.1 A substance shall be classified as a self-heating substance of division 4.2 when the substance is tested in accordance with the test method given in A.4.2.2 and

a) a positive result is obtained in a test using a 25 mm specimen cube at 140 °C,

b) a positive result is obtained in a test using a 100 mm specimen cube at 140 °C and a negative result is obtained when using a 100 mm specimen cube at a temperature of 120 °C, and the substance is to be transported in packages with a capacity not exceeding 3 m3,

The standard must reside on a shared file server or intranet system and may only be used for

c) a positive result is obtained in a test using a 100 mm specimen cube at 140 °C and a negative result is obtained when using a 100 mm specimen cube at 100 °C, and the substance is to be transported in packages with a capacity exceeding 450 L, and

d) a positive result is obtained in a test using a 100 mm specimen cube at 140 °C and a positive result is obtained with a 100 mm specimen cube at 100 °C.

NOTE With the exception of type G, self-reactive substances that also give positive results for self-heating properties, are classified in division 4.1 and not in division 4.2.

10.2.3.2.2 A substance shall not be classified as a self-heating substance of division 4.2 if

a) a negative result is obtained in a test when using a 100 mm specimen cube at 140 °C,

b) a positive result is obtained in a test when using a 100 mm specimen cube at 140 °C and a negative result is obtained when using a 25 mm specimen cube at 140 °C, and with the additional test at 120 °C, provided that the substance is to be transported in packages with a capacity not exceeding 3 m^3, and
c) a positive result is obtained in a test when using a 100 mm specimen cube at 140 °C and a negative result is obtained when using a 25 mm specimen cube at 140 °C, and with the additional test at 100 °C, provided that the substance is to be transported in packages with a capacity not exceeding 450 L.

10.2.3.3 Assignment of packing groups

10.2.3.3.1 Packing group I

Packing group I is assigned to all pyrophoric substances in liquid and solid form (see also 10.2.2).

10.2.3.3.2 Packing group II

Packing group II is assigned to a self-heating substance if a positive result is obtained in a test using a 25 mm specimen cube at 140 °C.

10.2.3.3.3 Packing group III

Packing group III is assigned to a self-heating substance if

a) a positive result is obtained in a test using a 100 mm specimen cube at 140 °C and a negative result is obtained using a 25 mm specimen cube at 140 °C, and the substance is to be transported in packages with a capacity exceeding 3 m^3,

b) a positive result is obtained in a test using a 100 mm specimen cube at 140 °C and a negative result is obtained when using a 25 mm specimen cube at 140 °C, a positive result is obtained in the additional test using a 100 mm specimen cube at 120 °C, and the substance is to be transported in packages with a capacity exceeding 450 L, and

c) a positive result is obtained in a test using a 100 mm specimen cube at 140 °C and a negative result is obtained using a 25 mm specimen cube at 140 °C, and a positive result is obtained using a 100 mm specimen cube at 100 °C.

10.3 Division 4.3: Substances that, on contact with water, emit flammable gases

10.3.1 General

Certain substances, on contact with water, emit flammable gases that can form explosive mixtures with air. Such gas mixtures are easily ignited by all ordinary sources of ignition, for example naked flames, sparkling hand tools or unprotected light bulbs. The resulting blast wave and flames can endanger people and the environment.

NOTE Where the term "water-reactive" is used in this standard, it refers to substances that, on contact with water, emit flammable gases.

10.3.2 Classification of water-reactive substances

A substance shall be classified as a water-reactive substance of division 4.3 when the substance is tested in accordance with the test methods given in A.4.3 and the following results are obtained:

a) spontaneous ignition takes place at any step of the test procedure; or

b) there is an evolution of flammable gas at a rate exceeding 1 L/kg of the substance per hour.

10.3.3 Assignment of packing groups

10.3.3.1 Packing group I

Packing group I is assigned to a substance that reacts

a) violently with water at ambient temperature, with a general tendency for the gas evolved to ignite spontaneously, or

b) readily with water at ambient temperature at such a rate that the evolution of flammable gas is equal to or exceeds 10 L/kg of the substance in any 1 min.

10.3.3.2 Packing group II

Packing group II is assigned to a substance that

a) reacts readily with water at ambient temperature at such a rate that the evolution of flammable gas is equal to or exceeds 20 L/kg of the substance under test per hour, and

b) does not meet the criteria for packing group I.

10.3.3.3 Packing group III

Packing group III is assigned to a substance that

a) reacts slowly with water at ambient temperature at such a rate that the evolution of flammable gas is equal to or exceeds 1 L/kg of the substance under test per hour, and

b) does not meet the criteria for packing groups I or II.

10.4 Organometallic substances

Depending on their properties, organometallic substances can be classified in division 4.2 or division 4.3, as appropriate, in accordance with the scheme given in Figure 3.

a) If applicable and testing is relevant, taking into account reactivity properties, division 6.1 and class 8 properties should be considered according to the precedence of hazard table 19.

b) Test methods N.1 to N.5 can be found in part III, section 33 of the United Nations' Manual of tests and criteria.

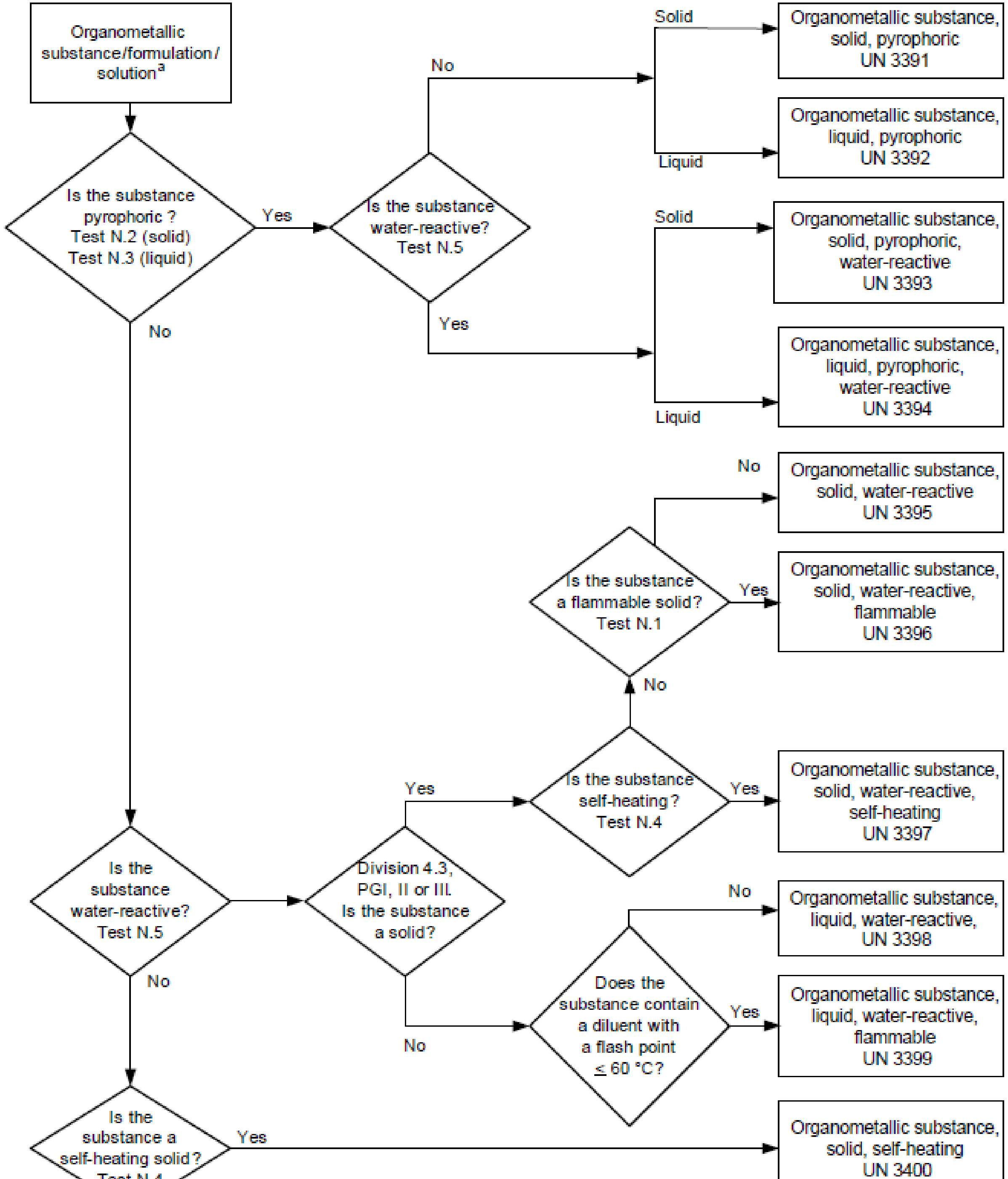

Organometallic substance/formulation/ solution[a]
Is the substance pyrophoric ? Test N.2 (solid) Test N.3 (liquid)
Yes
No
Is the substance water-reactive? Test N.5
No
Yes
Solid
Liquid
Organometallic substance, solid, pyrophoric UN 3391
Organometallic substance, liquid, pyrophoric UN 3392
Solid
Liquid
Organometallic substance, solid, pyrophoric, water-reactive UN 3393
Organometallic substance, liquid, pyrophoric, water-reactive UN 3394
No
Organometallic substance, solid, water-reactive UN 3395
Is the substance a flammable solid? Test N.1
Yes
Organometallic substance, solid, water-reactive, flammable UN 3396
No
Is the substance self-heating? Test N.4
Yes
Organometallic substance, solid, water-reactive, self-heating UN 3397
Is the substance water-reactive? Test N.5
No
Division 4.3, PGI, II or III. Is the substance a solid?
Yes
No
No
Organometallic substance, liquid, water-reactive, UN 3398
Does the substance contain a diluent with a flash point ≤ 60 °C?
Yes
Organometallic substance, liquid, water-reactive, flammable UN 3399
Is the substance a self-heating solid? Test N.4
Yes
Organometallic substance, solid, self-heating UN 3400

Figure 3 — Classification scheme for organometallic substances

11 Class 5: Oxidizing substances and organic peroxides

11.1 Division 5.1: Oxidizing substances

11.1.1 General

11.1.1.1 Although oxidizing substances are not necessarily combustible, they can, either by yielding oxygen or by similar processes, cause or contribute to, the combustion of other materials with which they come into contact.

11.1.1.2 Depending on the amount and nature of combustible impurities they might contain, certain oxidizing substances are sensitive to impact, friction or a rise in temperature.

11.1.1.3 Some mixtures of oxidizing substances and combustible material are so readily ignited that friction or impact can cause ignition. Such a mixture can burn with explosive force.

11.1.1.4 There will be a violent reaction between most oxidizing substances and strong liquid acids, resulting in the emission of highly toxic gases. Such gases can also be emitted when certain oxidizing substances are involved in a fire.

11.1.1.5 For oxidizing substances that have other risks, for example toxicity or corrosiveness, the precedence of hazards in accordance with clause 21 and table 17 shall be complied with.

11.1.2 Oxidizing solids

11.1.2.1 Classification of oxidizing solids

11.1.2.1.1 A solid substance is classified as an oxidizing substance of division 5.1 on the basis of its potential to increase the burning rate or burning intensity of a combustible substance when the two are thoroughly mixed. For classification purposes oxidizing solids shall be tested in accordance with the test method given in A.5.1.1

11.1.2.1.2 Tests are conducted on the substance to be evaluated mixed with dry fibrous cellulose in mixing ratios of 1:1 (by mass) and 4:1 (by mass), of specimen to cellulose. The burning characteristics of the test mixture are compared with the standard 2:3 (by mass), 3:2 (by mass) and 3:7 (by mass) mixtures, respectively, of potassium bromate to cellulose.

11.1.2.1.3 The test results are assessed on the basis of

a) the comparison of the mean burning time of the specimen with that of the standard mixtures, and

b) whether the mixture of specimen and cellulose ignites and burns.

11.1.2.1.4 A solid substance is classified as an oxidizing substance of division 5.1 when the test mixtures of 1:1 (by mass) or 4:1 (by mass) specimen-to-cellulose ratio exhibit a mean burning time equal to or less than that of the standard mixtures (see 11.1.2.1.2).

11.1.2.1.5 A solid substance is not regarded as an oxidizing substance of division 5.1 if both the 1:1 (by mass) and 4:1 (by mass) mixtures of specimen and cellulose do not ignite and burn, or if the mixtures exhibit mean burning times exceeding the 3:7 (by mass) standard mixture of potassium

11.1.2.2 Assignment of packing groups

11.1.2.2.1 Packing group I

A solid substance is assigned to packing group I of division 5.1 if the 1:1 (by mass) or 4:1 (by mass) specimen-to-cellulose ratio exhibits a mean burning time less than that of the 3:2 (by mass) standard
potassium bromate-to-cellulose ratio.

11.1.2.2.2 Packing group II

A solid substance is assigned to packing group II of division 5.1 if the 1:1 (by mass) or 4:1 (by mass) specimen-to-cellulose ratio exhibits a mean burning time equal to or less than that of the 2:3 (by mass)standard potassium bromate-to-cellulose ratio; and the criteria for packing group I are not complied with.

11.1.2.2.3 Packing group III

A solid substance is assigned to packing group III of division 5.1 if the 1:1 (by mass) or 4:1 (by mass) specimen-to-cellulose ratio exhibits a mean burning time equal to or less than that of the 3:7 (by mass)standard potassium bromate-to-cellulose ratio; and the criteria for packing groups I and II are not complied with.

11.1.3 Oxidizing liquids

11.1.3.1 Classification of oxidizing liquids

11.1.3.1.1 A liquid substance is classified as an oxidizing liquid of division 5.1 on the basis of its potential to increase the burning rate or burning intensity of a combustible substance, or for spontaneous ignition to occur when the liquid and the combustible substance are thoroughly mixed. The test procedure is given in A.5.1.2.

11.1.3.1.2 A liquid substance is classified as an oxidizing substance of division 5.1 when the test mixture of 1:1 (by mass) of specimen to cellulose exhibits a mean pressure rise equal to or less than that of the standard 1:1 (by mass) mixture of 65 % nitric acid and cellulose.

11.1.3.1.3 A liquid substance is not regarded as an oxidizing substance of division 5.1 if the 1:1 (by mass) mixture of specimen and cellulose exhibits a pressure rise of less than 2 070 kPa gauge pressure, or if the mixture exhibits a mean pressure rise time exceeding that of the standard 1:1 (by mass) mixture of 65 % nitric acid and cellulose.

11.1.3.1.4 Tests are conducted on the substance to be evaluated mixed with fibrous cellulose in a mixing ratio of 1:1 (by mass) of specimen to cellulose and heated in a pressure vessel. The burning characteristics of the test mixture are compared with the standard 1:1 (by mass) mixture of 50 % perchloric acid, 40 % sodium chlorate or 65 % nitric acid to cellulose , as applicable (see also 11.1.3.2).

11.1.3.1.5 The test results are assessed on the basis of

a) the mean time taken for the pressure to rise from 690 kPa to 2 070 kPa gauge pressure in comparison with that of the standard mixture, and

b) whether the mixture of specimen and cellulose spontaneously ignites.

11.1.3.2 Assignment of packing groups

11.1.3.2.1 Packing group I

A liquid substance is assigned to packing group I of division 5.1 if

a) the 1:1 (by mass) mixture of specimen and cellulose ignites spontaneously, or

b) the mean pressure rise time of the 1:1 (by mass) mixture of specimen and cellulose is less than that of a 1:1 (by mass) mixture of 50 % perchloric acid and cellulose.

11.1.3.2.2 Packing group II

A liquid substance is assigned to packing group II of division 5.1 if the 1:1 (by mass) mixture of specimen and cellulose exhibits a mean pressure rise time equal to or less than that of a 1:1 (by mass) mixture of a 40 % aqueous sodium chlorate solution and cellulose, and the criteria for packing group I are not complied with.

11.1.3.2.3 Packing group III

A liquid substance is assigned to packing group III of division 5.1 if the 1:1 (by mass) mixture of specimen and cellulose exhibits a mean pressure rise time equal to or less than that of a 1:1 (by mass) mixture of 65 % nitric acid and cellulose, and the criteria for packing groups I and II are not complied with.

11.2 Division 5.2: Organic peroxides

11.2.1 General

11.2.1.1 Organic peroxides are thermally unstable substances that can undergo exothermic decomposition at normal or at elevated temperatures. The decomposition can be initiated by heat, friction, impact or contact with impurities, for example acids, heavy metal compounds and amines. The rate of decomposition increases with a rise in temperature and can vary with different formulations of the same organic peroxide.

11.2.1.2 Organic substances that contain the bivalent –O–O– structure can be considered derivatives of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by organic radicals, and are known as organic peroxides.

11.2.1.3 Most organic peroxides burn rapidly and decomposition of the substance can result in the evolution of harmful or flammable gases or vapours. For certain organic peroxides the temperature shall be controlled during transport. Some organic peroxides decompose explosively, particularly if confined (see also 11.2.2.1.2). This characteristic can be modified by the addition of diluents, or by the use of appropriate packaging (see table 8).

11.2.1.4 Contact of organic peroxides with the eyes and skin should be avoided since they can cause serious injury to the cornea even after brief contact, and they can be corrosive to the skin.

11.2.2 Classification of organic peroxides

11.2.2.1 General

11.2.2.1.1 An organic peroxide shall not be considered for classification in division 5.2 if it contains

a) 1,0 % (or less) of available oxygen derived from the organic peroxide and 1,0 % (or less) of hydrogen peroxide, or

b) 0,5 % (or less) of available oxygen derived from the organic peroxide and more than 1,0 %, but less than or equal to 7,0 % of hydrogen peroxide.

NOTE The percentage available oxygen content of an organic peroxide formulation is given by the formula

$$16 \times \Sigma(n_i \times \frac{c_i}{m_i})$$

where

n_i	is the number of per oxygen groups per molecule of organic peroxide *i*;
c_i	is the concentration in percentage by mass of organic peroxide *i*;
m_i	is the molecular mass of organic peroxide *i*.

11.2.2.1.2 An organic peroxide formulation shall be regarded as possessing explosive properties when, in laboratory testing, the formulation is liable to detonate, deflagrate rapidly, or show a violent effect when heated under confinement.

11.2.2.1.3 Organic peroxides are classified into seven types according to the degree of danger they present. The types of organic peroxide range from type A, (which may not be accepted for transport in the packaging in which they have been tested) to type G, which is not subject to the provisions for organic peroxides of division 5.2. The classification of type B to type F is directly related to the maximum quantity allowed in one packaging.

11.2.2.1.4 Organic peroxides permitted for transport are listed in Table 8. Organic peroxides permitted for transport in packaging are listed in packing instruction P520 DEAS 951:2019 those permitted for transport in IBCs are listed in packing instruction IBC520 and those permitted for transport in portable tanks are listed in tank instruction T23 Each entry for an organic peroxide specifies the

a) type of organic peroxide (see 11.2.3),

b) physical state (liquid or solid), and

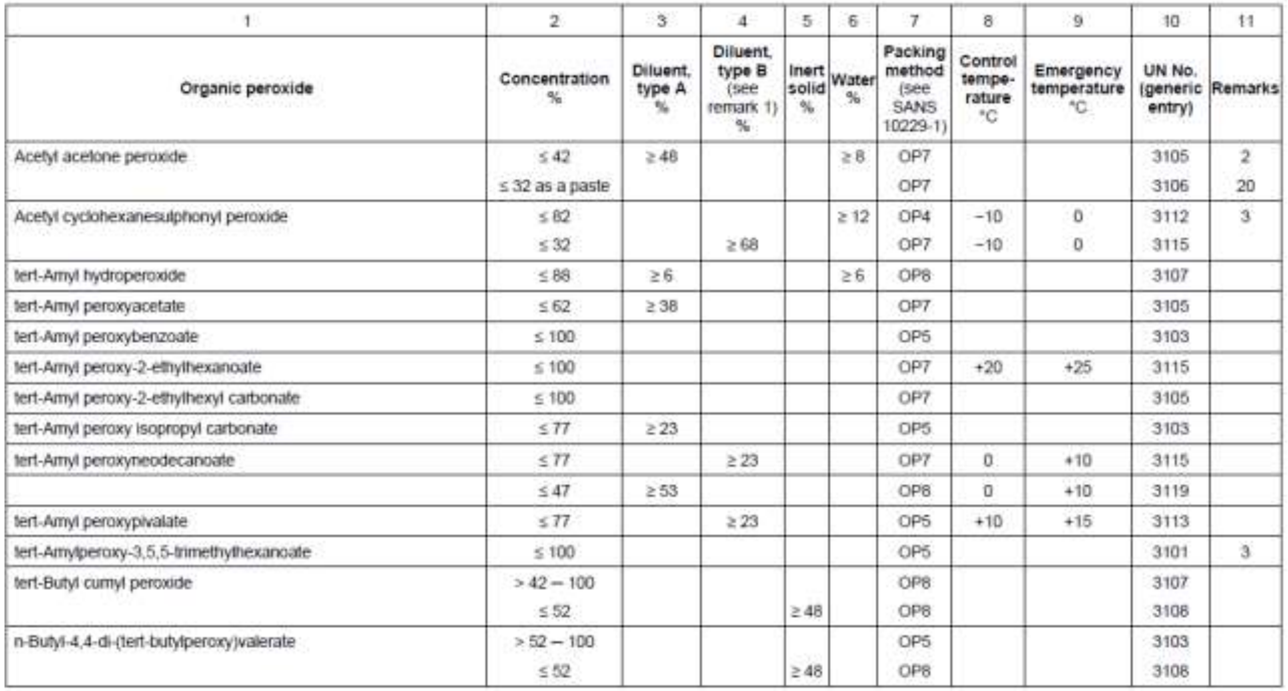
c) temperature control requirements, when required (see 11.2.4).

11.2.2.2 Mixtures of organic peroxides

Mixtures of organic peroxides can be classified under the generic entry of the most dangerous component and can be transported under the conditions of transport given for this type of peroxide (see 11.2.3). However, since two stable components can form a thermally less stable mixture, the SADT of the mixture shall be determined in accordance with the procedures described in part II of the United Nations' Manual of tests and criteria. If necessary, the control and emergency temperatures of the mixture can be derived from the SADT (see 11.2.4.4 and Table 8).

NOTE The test selected for the determination of the SADT should be conducted in such a way that it is representative of the size, material and package to be transported, handled or stored.

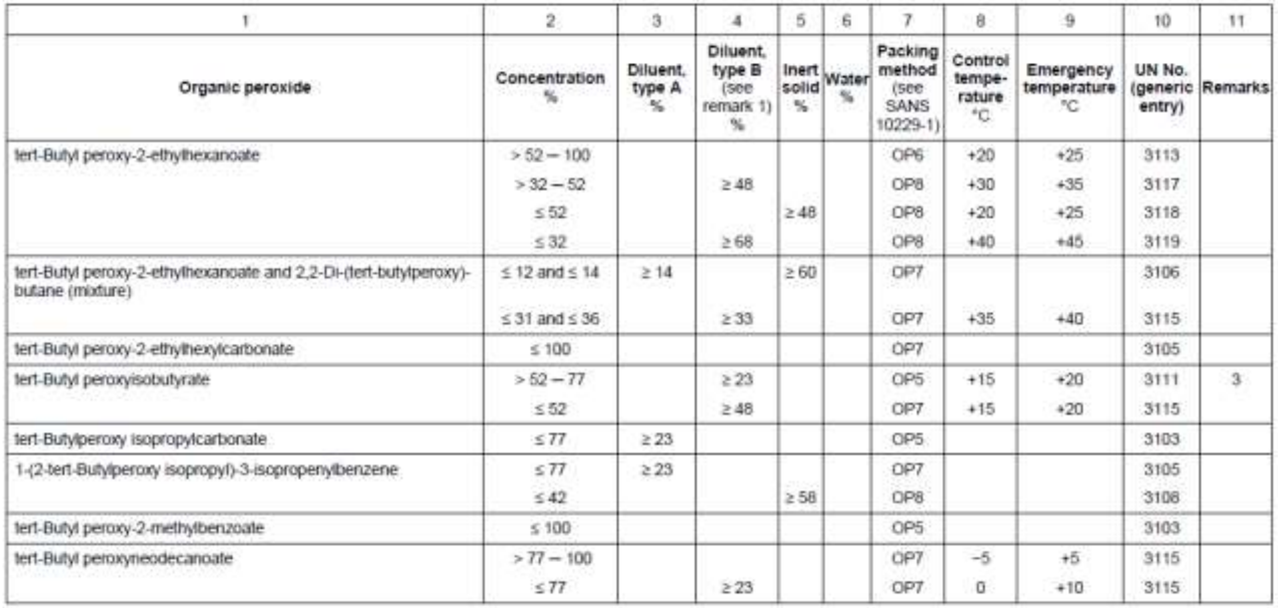
Table 8 — Classification and packaging of currently assigned organic peroxides



1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
Acetyl acetone peroxide	≤ 42	≥ 48			≥ 8	OP7			3105	2
	≤ 32 as a paste					OP7			3106	20
Acetyl cyclohexanesulphonyl peroxide	≤ 82				≥ 12	OP4	−10	0	3112	3
	≤ 32		≥ 68			OP7	−10	0	3115	
tert-Amyl hydroperoxide	≤ 88	≥ 6			≥ 6	OP8			3107	
tert-Amyl peroxyacetate	≤ 62	≥ 38				OP7			3105	
tert-Amyl peroxybenzoate	≤ 100					OP5			3103	
tert-Amyl peroxy-2-ethylhexanoate	≤ 100					OP7	+20	+25	3115	
tert-Amyl peroxy-2-ethylhexyl carbonate	≤ 100					OP7			3105	
tert-Amyl peroxy isopropyl carbonate	≤ 77	≥ 23				OP5			3103	
tert-Amyl peroxyneodecanoate	≤ 77		≥ 23			OP7	0	+10	3115	
	≤ 47	≥ 53				OP8	0	+10	3119	
tert-Amyl peroxypivalate	≤ 77		≥ 23			OP5	+10	+15	3113	
tert-Amylperoxy-3,5,5-trimethylhexanoate	≤ 100					OP5			3101	3
tert-Butyl cumyl peroxide	> 42 – 100					OP8			3107	
	≤ 52			≥ 48		OP8			3108	
n-Butyl-4,4-di-(tert-butylperoxy)valerate	> 52 – 100					OP5			3103	
	≤ 52			≥ 48		OP8			3108	

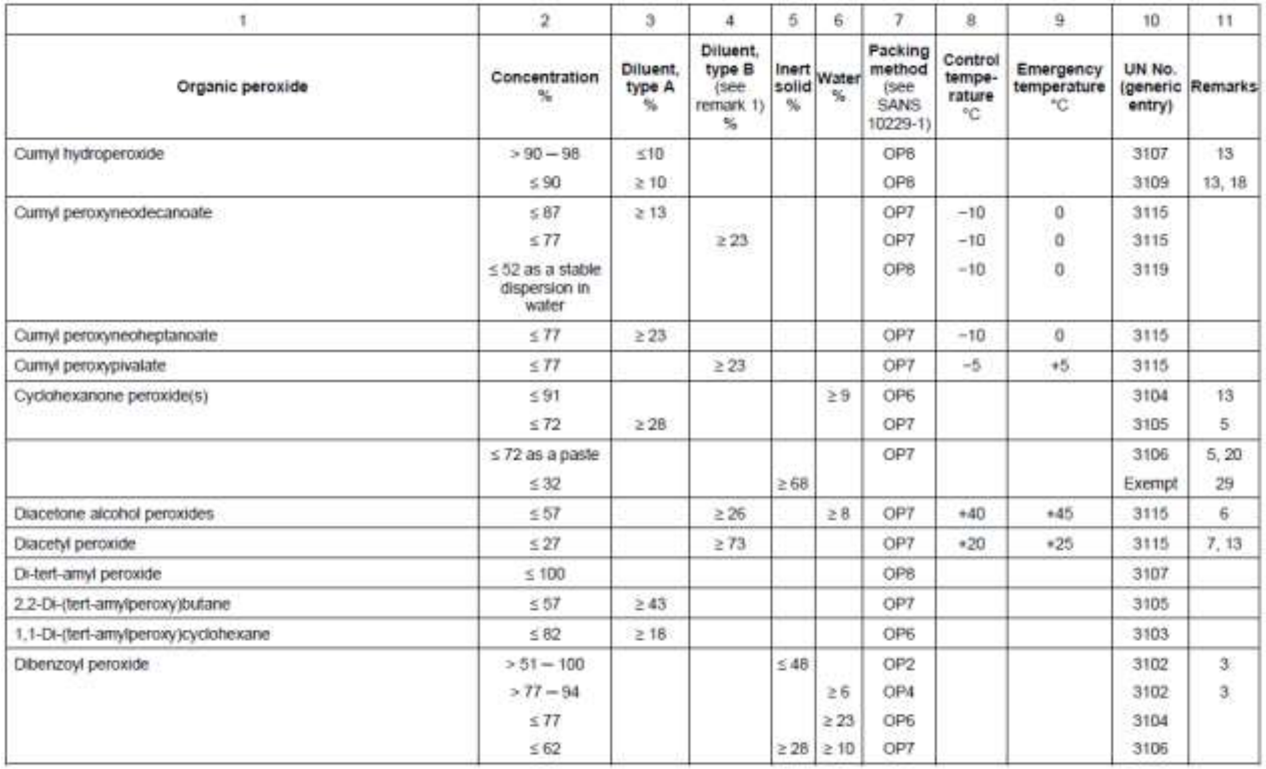
Table 8 (continued)

1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
tert-Butyl hydroperoxide	> 79 – 90				≥ 10	OP5			3103	13
	≤ 80	≥ 20				OP7			3105	4, 13
	≤ 79				> 14	OP8			3107	13, 23
	≤ 72				≥ 28	OP8			3109	13
tert-Butyl hydroperoxide and Di-tert-butylperoxide (mixture)	< 82 and > 9				≥ 7	OP5			3103	13
tert-Butyl monoperoxymaleate	> 52 – 100					OP5			3102	3
	≤ 52	≥ 48				OP6			3103	
	≤ 52			≥ 48		OP8			3108	
	≤ 52 as a paste					OP8			3108	
tert-Butyl peroxyacetate	> 52 – 77	≥ 23				OP5			3101	3
	> 32 – 52	≥ 48				OP6			3103	
	≤ 32		≥ 68			OP8			3109	
tert-Butyl peroxybenzoate	> 77–100					OP5			3103	
	> 52 – 77	≥ 23				OP7			3105	
	≤ 52			≥ 48		OP7			3106	
tert-Butyl peroxybutyl fumarate	≤ 52	≥ 48				OP7			3105	
tert-Butyl peroxycrotonate	≤ 77	≥ 23				OP7			3105	
tert-Butyl peroxydiethylacetate	≤ 100					OP5	+20	+25	3113	



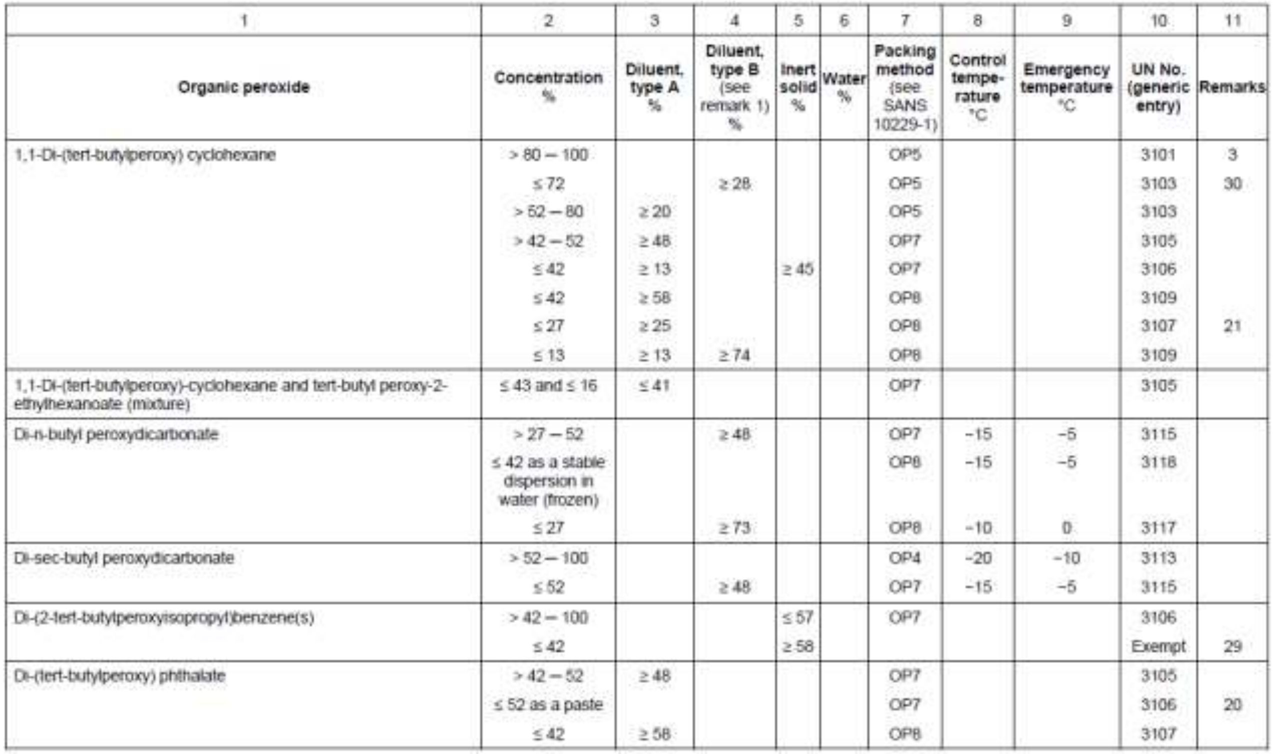
1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration %**	**Diluent, type A %**	**Diluent, type B** (see remark 1) %	**Inert solid %**	**Water %**	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
tert-Butyl peroxy-2-ethylhexanoate	> 52 – 100					OP6	+20	+25	3113	
	> 32 – 52		≥ 48			OP8	+30	+35	3117	
	≤ 52			≥ 48		OP8	+20	+25	3118	
	≤ 32		≥ 68			OP8	+40	+45	3119	
tert-Butyl peroxy-2-ethylhexanoate and 2,2-Di-(tert-butylperoxy)-butane (mixture)	≤ 12 and ≤ 14	≥ 14		≥ 60		OP7			3106	
	≤ 31 and ≤ 36		≥ 33			OP7	+35	+40	3115	
tert-Butyl peroxy-2-ethylhexylcarbonate	≤ 100					OP7			3105	
tert-Butyl peroxyisobutyrate	> 52 – 77		≥ 23			OP5	+15	+20	3111	3
	≤ 52		≥ 48			OP7	+15	+20	3115	
tert-Butylperoxy isopropylcarbonate	≤ 77	≥ 23				OP5			3103	
1-(2-tert-Butylperoxy isopropyl)-3-isopropenylbenzene	≤ 77	≥ 23				OP7			3105	
	≤ 42			≥ 58		OP8			3108	
tert-Butyl peroxy-2-methylbenzoate	≤ 100					OP5			3103	
tert-Butyl peroxyneodecanoate	> 77 – 100					OP7	−5	+5	3115	
	≤ 77		≥ 23			OP7	0	+10	3115	

1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
tert-Butyl peroxyneodecanoate *(continued)*	≤ 52 as a stable dispersion in water					OP8	0	+10	3119	
	≤ 42 as a stable dispersion in water (frozen)					OP8	0	+10	3119	
	≤ 32	≥ 68				OP8	0	+10	3119	
tert-Butyl peroxyneoheptanoate	≤ 77	≥ 23				OP7	0	+10	3115	
	≤ 42 as a stable dispersion in water					OP8	0	+10	3117	
tert-Butyl peroxypivalate	> 67 – 77	≥ 23				OP5	0	+10	3113	
	> 27 – 67		≥ 33			OP7	0	+10	3115	
	≤ 27		≥ 73			OP8	+30	+35	3119	
tert-Butylperoxy stearylcarbonate	≤ 100					OP7			3106	
tert-Butyl peroxy-3,5,5-trimethylhexanoate	> 32 – 100					OP7			3105	
	≤ 42			≥ 58		OP7			3106	
	≤ 32		≥ 68			OP8			3109	
3-Chloroperoxybenzoic acid	> 57 – 86			≥ 14		OP1			3102	3
	≤ 57			≥ 3	≥ 40	OP7			3106	
	≤ 77			≥ 6	≥ 17	OP7			3106	



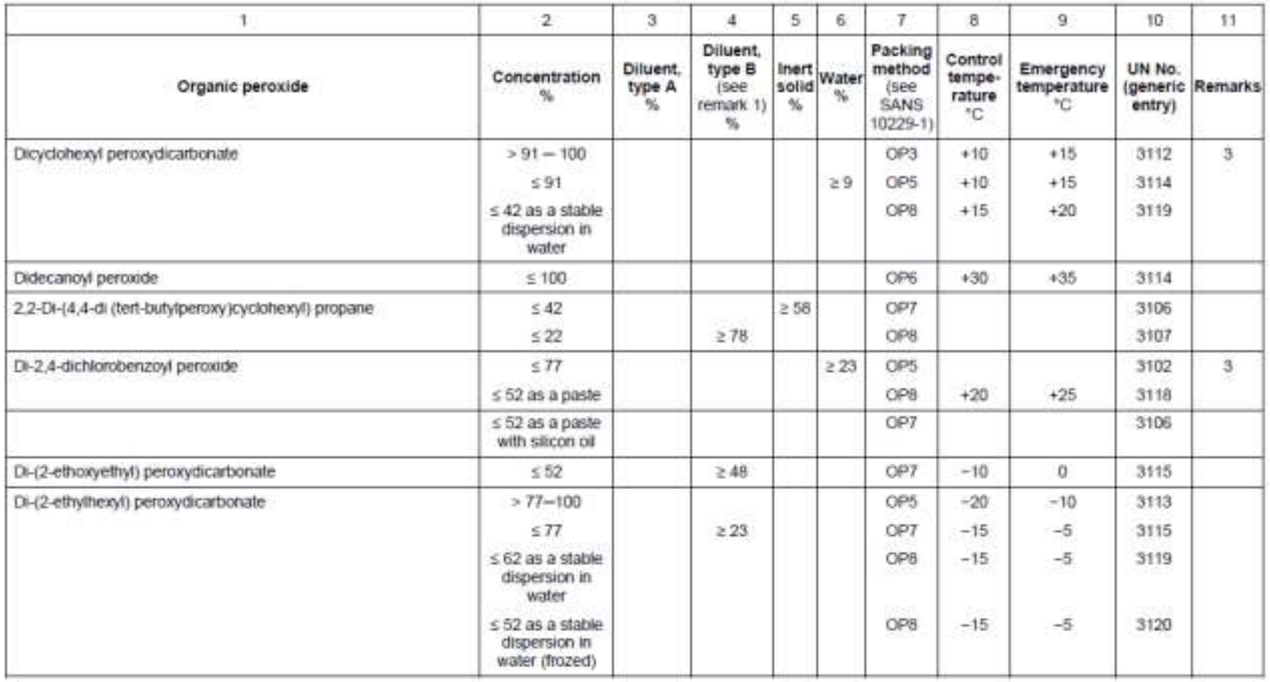
1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
Cumyl hydroperoxide	> 90 – 98	≤10				OP8			3107	13
	≤ 90	≥ 10				OP8			3109	13, 18
Cumyl peroxyneodecanoate	≤ 87	≥ 13				OP7	–10	0	3115	
	≤ 77		≥ 23			OP7	–10	0	3115	
	≤ 52 as a stable dispersion in water					OP8	–10	0	3119	
Cumyl peroxyneoheptanoate	≤ 77	≥ 23				OP7	–10	0	3115	
Cumyl peroxypivalate	≤ 77		≥ 23			OP7	–5	+5	3115	
Cyclohexanone peroxide(s)	≤ 91				≥ 9	OP6			3104	13
	≤ 72	≥ 28				OP7			3105	5
	≤ 72 as a paste					OP7			3106	5, 20
	≤ 32			≥ 68					Exempt	29
Diacetone alcohol peroxides	≤ 57		≥ 26		≥ 8	OP7	+40	+45	3115	6
Diacetyl peroxide	≤ 27		≥ 73			OP7	+20	+25	3115	7, 13
Di-tert-amyl peroxide	≤ 100					OP8			3107	
2,2-Di-(tert-amylperoxy)butane	≤ 57	≥ 43				OP7			3105	
1,1-Di-(tert-amylperoxy)cyclohexane	≤ 82	≥ 18				OP6			3103	
Dibenzoyl peroxide	> 51 – 100			≤ 48		OP2			3102	3
	> 77 – 94				≥ 6	OP4			3102	3
	≤ 77				≥ 23	OP6			3104	
	≤ 62			≥ 28	≥ 10	OP7			3106	

1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control temperature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
Dibenzoyl peroxide *(continued)*	> 52 – 62 as a paste					OP7			3106	20
	> 35 – 52			≥ 48		OP7			3106	
	> 36 – 42	≥ 18			≤ 40	OP8			3107	
	≤ 56,5 as a paste				≥ 15	OP8			3108	
	≤ 52 as a paste					OP8			3108	20
	≤ 42 as a stable dispersion in water					OP8			3109	
	≤ 35			≥ 65					Exempt	29
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	≤ 100					OP6	+30	+35	3114	
	≤ 42 as a stable dispersion in water					OP8	+30	+35	3119	
Di-tert-butyl peroxide	> 52 – 100					OP8			3107	
	≤ 52		≥ 48			OP8			3109	25
Di-tert-butyl peroxyazelate	≤ 52	≥ 48				OP7			3105	
2,2-Di-(tert-butylperoxy)butane	≤ 52	≥ 48				OP6			3103	
1,6-Di-(tert-butylperoxycarbonyloxy) hexane	≤ 72	≥ 28				OP5			3103	



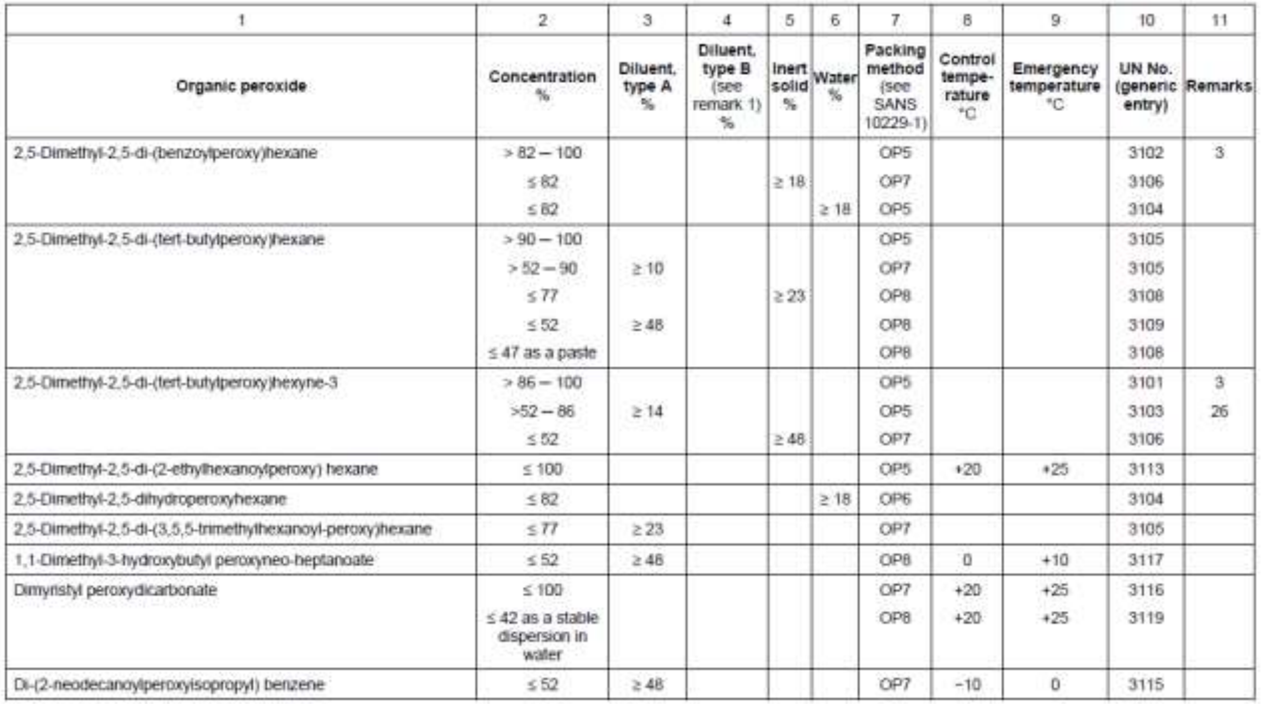
1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
1,1-Di-(tert-butylperoxy) cyclohexane	> 80 – 100					OP5			3101	3
	≤ 72		≥ 28			OP5			3103	30
	> 52 – 80	≥ 20				OP5			3103	
	> 42 – 52	≥ 48				OP7			3105	
	≤ 42	≥ 13		≥ 45		OP7			3106	
	≤ 42	≥ 58				OP8			3109	
	≤ 27	≥ 25				OP8			3107	21
	≤ 13	≥ 13	≥ 74			OP8			3109	
1,1-Di-(tert-butylperoxy)-cyclohexane and tert-butyl peroxy-2-ethylhexanoate (mixture)	≤ 43 and ≤ 16	≤ 41				OP7			3105	
Di-n-butyl peroxydicarbonate	> 27 – 52		≥ 48			OP7	−15	−5	3115	
	≤ 42 as a stable dispersion in water (frozen)					OP8	−15	−5	3118	
	≤ 27		≥ 73			OP8	−10	0	3117	
Di-sec-butyl peroxydicarbonate	> 52 – 100					OP4	−20	−10	3113	
	≤ 52		≥ 48			OP7	−15	−5	3115	
Di-(2-tert-butylperoxyisopropyl)benzene(s)	> 42 – 100			≤ 57		OP7			3106	
	≤ 42			≥ 58					Exempt	29
Di-(tert-butylperoxy) phthalate	> 42 – 52	≥ 48				OP7			3105	
	≤ 52 as a paste					OP7			3106	20
	≤ 42	≥ 58				OP8			3107	

1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
2,2-Di-(tert-butylperoxy)propane	≤ 52	≥ 48				OP7			3105	
	≤ 42	≥ 13		≥ 45		OP7			3106	
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	> 90 – 100					OP5			3101	3
	≤ 90		≥ 10			OP5			3103	30
	> 57 – 90	≥ 10				OP5			3103	
	≤ 77		≥ 23			OP5			3103	
	≤ 57			≥ 43		OP8			3110	
	≤ 57	≥ 43				OP8			3107	
	≤ 32	≥ 26	≥ 42			OP8			3107	
Dicetyl peroxydicarbonate	≤ 100					OP7	+30	+35	3116	
	≤ 42 as a stable dispersion in water					OP8	+30	+35	3119	
Di-4-chlorobenzoyl peroxide	≤ 77				≥ 23	OP5			3102	3
	≤ 52 as a paste					OP7			3106	20
	≤ 32			≥ 68					Exempt	29
Dicumyl peroxide	> 52 – 100			≤ 57		OP8			3110	12
	≤ 52			≥ 48					Exempt	29



1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
Dicyclohexyl peroxydicarbonate	> 91 – 100					OP3	+10	+15	3112	3
	≤ 91				≥ 9	OP5	+10	+15	3114	
	≤ 42 as a stable dispersion in water					OP8	+15	+20	3119	
Didecanoyl peroxide	≤ 100					OP6	+30	+35	3114	
2,2-Di-(4,4-di (tert-butylperoxy)cyclohexyl) propane	≤ 42			≥ 58		OP7			3106	
	≤ 22		≥ 78			OP8			3107	
Di-2,4-dichlorobenzoyl peroxide	≤ 77				≥ 23	OP5			3102	3
	≤ 52 as a paste					OP8	+20	+25	3118	
	≤ 52 as a paste with silicon oil					OP7			3106	
Di-(2-ethoxyethyl) peroxydicarbonate	≤ 52		≥ 48			OP7	−10	0	3115	
Di-(2-ethylhexyl) peroxydicarbonate	> 77–100					OP5	−20	−10	3113	
	≤ 77		≥ 23			OP7	−15	−5	3115	
	≤ 62 as a stable dispersion in water					OP8	−15	−5	3119	
	≤ 52 as a stable dispersion in water (frozed)					OP8	−15	−5	3120	

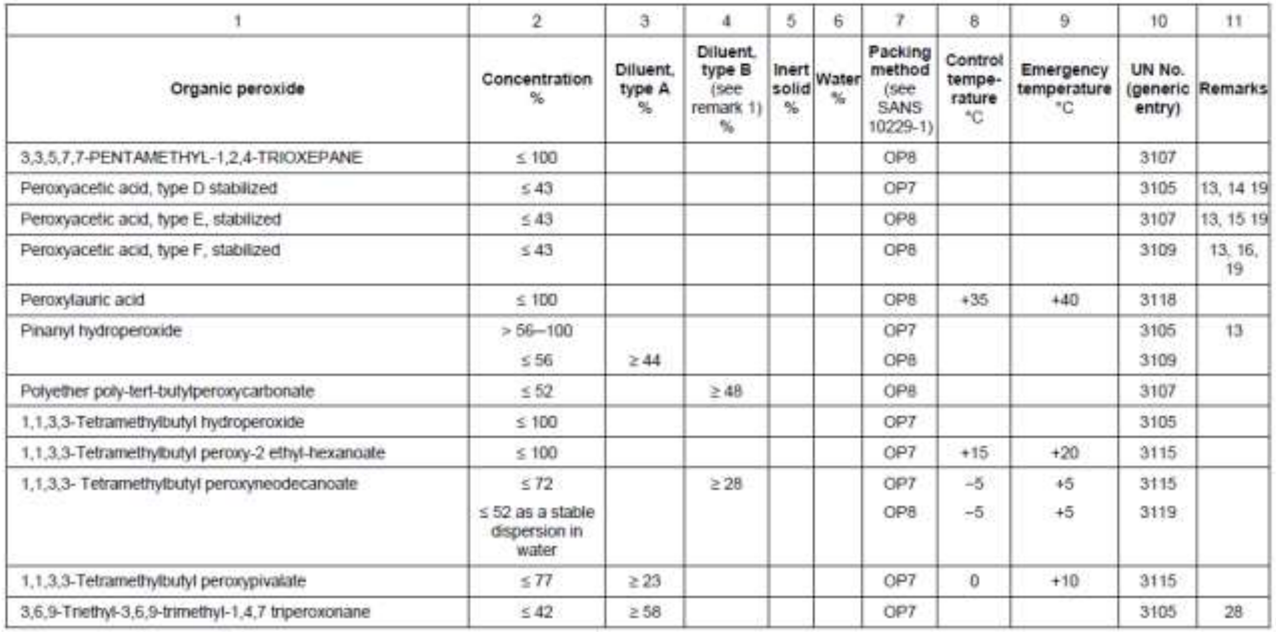
1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control temperature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
Di-(2-ethylhexyl) peroxydicarbonate *(continued)*	≤ 52 as a stable dispersion in water (frozen)					OP8	-15	-5	3120	
2,2-Dihydroperoxypropane	≤ 27			≥ 73		OP5			3102	3
Di-(1-hydroxycyclohexyl) peroxide	≤ 100					OP7			3106	
Diisobutyryl peroxide	> 32 – 52		≥ 48			OP5	−20	−10	3111	3
	≤ 32		≥ 68			OP7	−20	−10	3115	
Diisopropylbenzene dihydroperoxide	≤ 82	≥ 5			≥ 5	OP7			3106	24
Diisopropyl peroxydicarbonate	> 52–100					OP2	−15	−5	3112	3
	≤ 52		≥ 48			OP7	−20	−10	3115	
	≤ 28	≥ 72				OP7	−15	−5	3115	
Dilauroyl peroxide	≤ 100					OP7			3106	
	≤ 42 as a stable dispersion in water					OP8			3109	
Di-(3-methoxybutyl) peroxydicarbonate	≤ 52		≥ 48			OP7	−5	+5	3115	
Di-(2-methylbenzoyl) peroxide	≤ 87				≥ 13	OP5	+30	+35	3112	3
Di-(3-methylbenzoyl) peroxide and Benzoyl (3-methylbenzoyl) peroxide *plus* Dibenzoyl peroxide	≤ 20 and ≤ 18 and ≤ 4		≥ 58			OP7	+35	+40	3115	
Di-(4-methylbenzoyl) peroxide	≤ 52 as a paste with silicon oil					OP7			3106	



1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
2,5-Dimethyl-2,5-di-(benzoylperoxy)hexane	> 82 – 100					OP5			3102	3
	≤ 82			≥ 18		OP7			3106	
	≤ 82				≥ 18	OP5			3104	
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	> 90 – 100					OP5			3105	
	> 52 – 90	≥ 10				OP7			3105	
	≤ 77			≥ 23		OP8			3108	
	≤ 52	≥ 48				OP8			3109	
	≤ 47 as a paste					OP8			3108	
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexyne-3	> 86 – 100					OP5			3101	3
	>52 – 86	≥ 14				OP5			3103	26
	≤ 52			≥ 48		OP7			3106	
2,5-Dimethyl-2,5-di-(2-ethylhexanoylperoxy) hexane	≤ 100					OP5	+20	+25	3113	
2,5-Dimethyl-2,5-dihydroperoxyhexane	≤ 82				≥ 18	OP6			3104	
2,5-Dimethyl-2,5-di-(3,5,5-trimethylhexanoyl-peroxy)hexane	≤ 77	≥ 23				OP7			3105	
1,1-Dimethyl-3-hydroxybutyl peroxyneo-heptanoate	≤ 52	≥ 48				OP8	0	+10	3117	
Dimyristyl peroxydicarbonate	≤ 100					OP7	+20	+25	3116	
	≤ 42 as a stable dispersion in water					OP8	+20	+25	3119	
Di-(2-neodecanoylperoxyisopropyl) benzene	≤ 52	≥ 48				OP7	−10	0	3115	

1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
Di-n-nonanoyl peroxide	≤ 100					OP7	0	+10	3116	
Di-n-octanoyl peroxide	≤ 100					OP5	+10	+15	3114	
Di-(2-phenoxyethyl) peroxydicarbonate	> 85–100					OP5			3102	3
	≤ 85				≥ 15	OP7			3106	
Dipropionyl peroxide	≤ 27		≥ 73			OP8	+15	+20	3117	
Di-n-propyl peroxydicarbonate	≤ 100					OP3	−25	−15	3113	
	≤ 77		≥ 23			OP5	−20	−10	3113	
Disuccinic acid peroxide	> 72–100					OP4			3102	3, 17
	≤ 72				≥ 28	OP7	+10	+15	3116	
Di-(3,5,5-trimethylhexanoyl) peroxide	> 38–82	≥ 18				OP7	0	+10	3115	
	≤ 52 as a stable dispersion in water					OP8	+10	+15	3119	
	≤ 38	≥ 62				OP8	+20	+25	3119	
Ethyl 3,3-di-(tert-amylperoxy)butyrate	≤ 67	≥ 33				OP7			3105	
Ethyl 3,3-di-(tert-butylperoxy)butyrate	> 77 – 100					OP5			3103	
	≤ 77	≥ 23				OP7			3105	
	≤ 52			≥ 48		OP7			3106	
1-(2-Ethylhexanoylperoxy)-1,3-dimethylbutyl peroxypivalate	≤ 52	≥ 45	≥ 10			OP7	−20	−10	3115	

1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
tert-Hexyl peroxyneodecanoate	≤ 71	≥ 29				OP7	0	+10	3115	
tert-Hexyl peroxypivalate	≤ 72		≥ 28			OP7	+10	+15	3115	
3-Hydroxy-1,1-dimethylbutyl peroxyneodecanoate	≤ 77	≥ 23				OP7	−5	+5	3115	
	≤ 52	≥ 48				OP8	−5	+5	3117	
	≥ 52 as a stable dispersion in water					OP8	−5	+5	3119	
Isopropyl sec-butyl peroxydicarbonate and Di-sec-butyl peroxydicarbonate and Di-isopropyl peroxydicarbonate	≤ 32 + ≤ 15–18 ≤ 12–15	≥ 38				OP7	−20	−10	3115	
	≤ 52 and ≤ 28 and ≤ 22					OP5	−20	−10	3111	3
Isopropylcumyl hydroperoxide	≤ 72	≥ 28				OP8			3109	13
p-Menthyl hydroperoxide	> 72 – 100					OP7			3105	13
	≤ 72	≥ 28				OP8			3109	27
Methylcyclohexanone peroxide(s)	≤ 67		≥ 33			OP7	+35	+40	3115	
Methyl ethyl ketone peroxide(s)	See remark 8	≥ 48				OP5			3101	3, 8, 13
	See remark 9	≥ 55				OP7			3105	9
	See remark 10	≥ 60				OP8			3107	10
Methyl isobutyl ketone peroxide(s)	≤ 62	≥ 19				OP7			3105	22
Methyl isopropyl ketone peroxide(s)	See remark 31	≥ 70				OP8			3109	31
Organic peroxide, liquid, sample						OP2			3103	11
Organic peroxide, liquid, sample, temperature controlled						OP2			3113	11
Organic peroxide, solid, sample						OP2			3104	11
Organic peroxide, solid, sample, temperature controlled						OP2			3114	11



1	2	3	4	5	6	7	8	9	10	11
Organic peroxide	**Concentration** %	**Diluent, type A** %	**Diluent, type B** (see remark 1) %	**Inert solid** %	**Water** %	**Packing method** (see SANS 10229-1)	**Control tempe-rature** °C	**Emergency temperature** °C	**UN No. (generic entry)**	**Remarks**
3,3,5,7,7-PENTAMETHYL-1,2,4-TRIOXEPANE	≤ 100					OP8			3107	
Peroxyacetic acid, type D stabilized	≤ 43					OP7			3105	13, 14 19
Peroxyacetic acid, type E, stabilized	≤ 43					OP8			3107	13, 15 19
Peroxyacetic acid, type F, stabilized	≤ 43					OP8			3109	13, 16, 19
Peroxylauric acid	≤ 100					OP8	+35	+40	3118	
Pinanyl hydroperoxide	> 56–100					OP7			3105	13
	≤ 56	≥ 44				OP8			3109	
Polyether poly-tert-butylperoxycarbonate	≤ 52		≥ 48			OP8			3107	
1,1,3,3-Tetramethylbutyl hydroperoxide	≤ 100					OP7			3105	
1,1,3,3-Tetramethylbutyl peroxy-2 ethyl-hexanoate	≤ 100					OP7	+15	+20	3115	
1,1,3,3- Tetramethylbutyl peroxyneodecanoate	≤ 72		≥ 28			OP7	−5	+5	3115	
	≤ 52 as a stable dispersion in water					OP8	−5	+5	3119	
1,1,3,3-Tetramethylbutyl peroxypivalate	≤ 77	≥ 23				OP7	0	+10	3115	
3,6,9-Triethyl-3,6,9-trimethyl-1,4,7 triperoxonane	≤ 42	≥ 58				OP7			3105	28

11.2.2.3 Remarks to table 8

1 Diluent type B may always be replaced by diluent type A. The boiling point of diluent type B should be at least 60 °C higher than the SADT of the organic peroxide.

2 Available oxygen ≤ 4.7 %.

3 "EXPLOSIVE" subsidiary risk label required .

4 The diluent may be replaced by di-tert-butyl peroxide.

5 Available oxygen ≤ 9 %.

6 With ≤ 9 % hydrogen peroxide; available oxygen ≤ 10 %.

7 Only non-metallic packaging allowed.

8 Available oxygen > 10 % and ≤ 10,7 %, with or without water.

9 Available oxygen ≤ 10 %, with or without water.

10 Available oxygen ≤ 8,2 %, with or without water.

11 See 11.2.2.4.

12 Up to 2 000 kg per receptacle assigned to ORGANIC PEROXIDE TYPE F on the basis of large scale trials.

13 "CORROSIVE" subsidiary risk label required

14 Peroxyacetic acid formulations that meet the requirements of 11.2.3.5.

15 Peroxyacetic acid formulations that meet the requirements of 11.2.3.6.

16 Peroxyacetic acid formulations that meet the requirements of 11.2.3.7.

17 Addition of water to this organic peroxide will decrease its thermal stability.

18 No "CORROSIVE" subsidiary risk label required for concentrations below 80 %.

19 Mixtures with hydrogen peroxide, water and acid(s).

20 With diluent type A, with or without water.

21 With ≥ 25 % diluent type A, by mass, and the addition of ethylbenzene.

22 With ≥ 19 % diluent type A, by mass, and the addition of methyl isobutyl ketone.

23 With < 6 % di-tert-butyl peroxide.

24 With ≤ 8 % 1-isopropylhydroperoxy-4-isopropylhydroxybenzene.

25 Diluent type B with boiling point > 110 °C.

26 With a hydroperoxides content < 0,5 %.

27 "CORROSIVE" subsidiary risk label (see DEAS 951:2019 for concentrations > 56 %.

28 Available active oxygen ≤ 7,6 % in diluent type A with a 95 % boil-off point in the range of 200 °C to 260 °C.

29 Not subject to the requirements for an organic peroxide of division 5.2.

30 Diluent type B with boiling point > 130 °C.

31 Active oxygen ≤ 6,7 %.

11.2.2.4 New formulations of organic peroxides

Samples of new organic peroxides or new formulations of currently allocated organic peroxides that are not listed in table 8, for which complete test data are not available and that 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;

a) the available data indicate that

1) the substance would be less dangerous than "ORGANIC PEROXIDE TYPE B", and

2) the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation, and

b) the substance is packaged in accordance with packing method OP2A or OP2B (see packing instruction P520 in DEAS 951 :2019and the quantity per transport unit is limited to 10 kg.

11.2.3 Types of organic peroxides

11.2.3.1 General

Organic peroxides are classified in seven types, in accordance with the degree of danger that they present. Figure 4 provides principles for classification of organic peroxides.

This section refers only to those properties of organic peroxides that are decisive for their classification. A flow chart, presenting the classification principles in the form of a graphically arranged scheme of questions concerning the decisive properties together with the possible answer, is given in figure 4.

These properties should be determined experimentally using the test methods and criteria given in the United Nations' Manual of Tests and Criteria.

11.2.3.2 Type A

A type A organic peroxide formulation is one that can detonate or deflagrate rapidly when packaged for transport. Type A organic peroxides shall not be transported in that packaging under division 5.2 DEAS 951:2019

11.2.3.3 Type B

A type B organic peroxide formulation is one that has explosive properties and that, when packaged for transport, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in the package. Type B peroxides shall bear an "EXPLOSIVE" risk label.

Such an organic peroxide can be packaged in amounts of up to 25 kg, unless the maximum quantity has to be limited to a lower amount to preclude detonation or rapid deflagration in the package.

11.2.3.4 Type C

A type C organic peroxide formulation is one that has explosive properties but is so packaged for transport that it cannot detonate or deflagrate rapidly or undergo a thermal explosion. A type C organic peroxide can be transported without an "EXPLOSIVE" subsidiary risk label provided that the mass of the substance as packaged does not exceed 50 kg.

11.2.3.5 Type D

A type D organic peroxide formulation is one that, in laboratory testing and when packaged for transport,

a) detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement, or

b) does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement, or

c) does not detonate or deflagrate at all and shows a medium effect when heated under confinement. Such an organic peroxide substance can be transported in packages with a capacity not exceeding 50 kg net mass.

11.2.3.6 Type E

A type E organic peroxide formulation is one that, in laboratory testing, does not detonate or deflagrate and shows little or no effect when heated under confinement.

Such an organic peroxide can be transported in packages with a capacity not exceeding 400 kg or 450 L.

11.2.3.7 Type F

A type F organic peroxide formulation is one that, in laboratory testing, does not detonate or deflagrate, shows little or no effect when heated under confinement and shows low or no explosive power.

Such an organic peroxide can be transported in intermediate bulk containers

11.2.3.8 Type G

A type G organic peroxide formulation is one that, in laboratory testing, does not detonate or deflagrate, shows no effect when heated under confinement and shows no explosive power. A type G organic peroxide may be exempted from division 5.2, provided that the formulation is thermally stable, and diluent type A is used for the desensitization of a liquid formulation. However, division 5.2 applies if the formulation is not thermally stable and when a diluent other than diluent type A is used for desensitization.

NOTE An organic peroxide is thermally stable if the SADT is 60 °C or higher when it is transported in a 50 kg package.

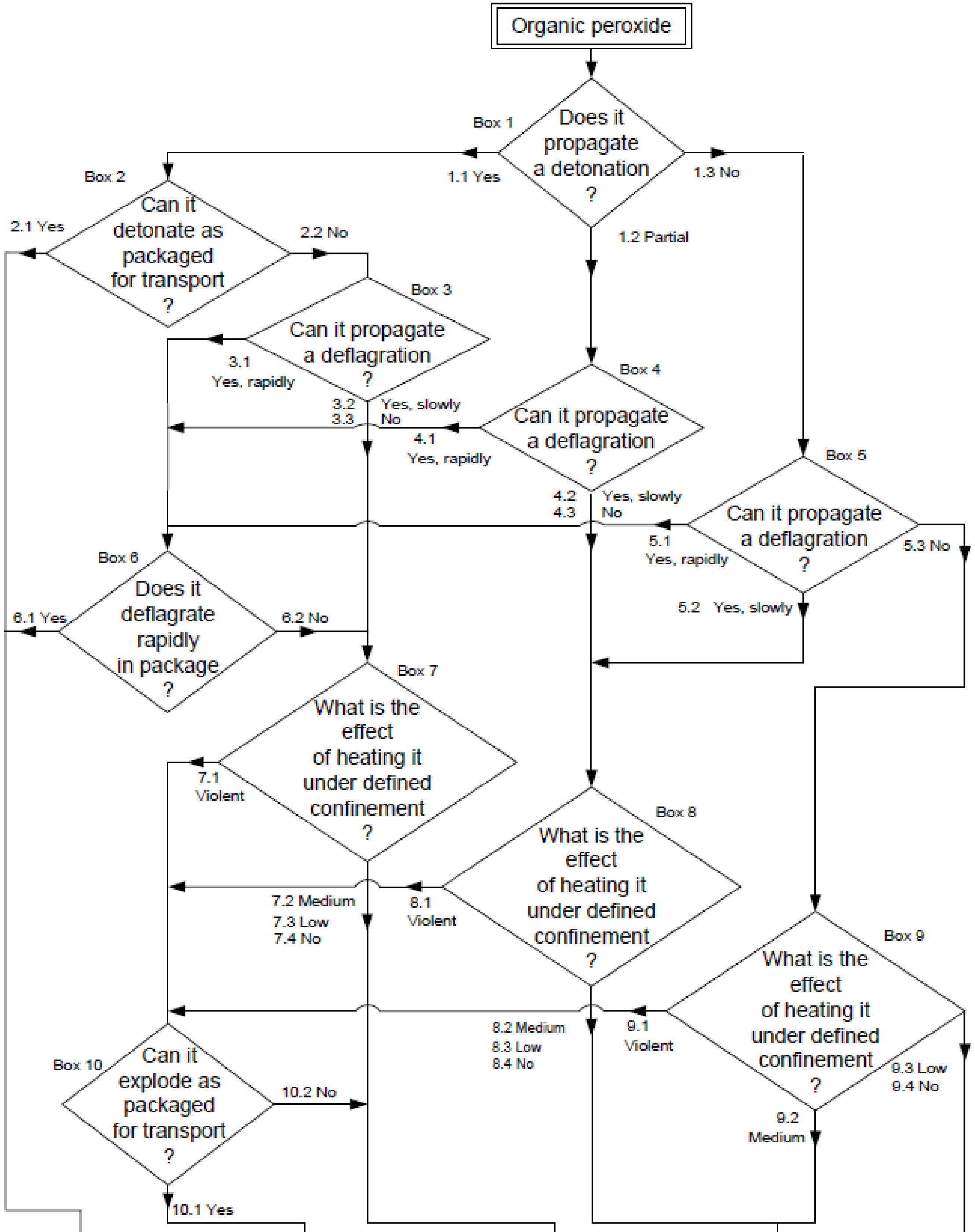

Organic peroxide
Box 1
Does it propagate a detonation ?
1.1 Yes
1.2 Partial
1.3 No
Box 2
Can it detonate as packaged for transport ?
2.1 Yes
2.2 No
Box 3
Can it propagate a deflagration ?
3.1 Yes, rapidly
3.2 Yes, slowly
3.3 No
Box 4
Can it propagate a deflagration ?
4.1 Yes, rapidly
4.2 Yes, slowly
4.3 No
Box 5
Can it propagate a deflagration ?
5.1 Yes, rapidly
5.2 Yes, slowly
5.3 No
Box 6
Does it deflagrate rapidly in package ?
6.1 Yes
6.2 No
Box 7
What is the effect of heating it under defined confinement ?
7.1 Violent
7.2 Medium
7.3 Low
7.4 No
Box 8
What is the effect of heating it under defined confinement ?
8.1 Violent
8.2 Medium
8.3 Low
8.4 No
Box 9
What is the effect of heating it under defined confinement ?
9.1 Violent
9.2 Medium
9.3 Low
9.4 No
Box 10
Can it explode as packaged for transport ?
10.1 Yes
10.2 No

Figure 4 (concluded)

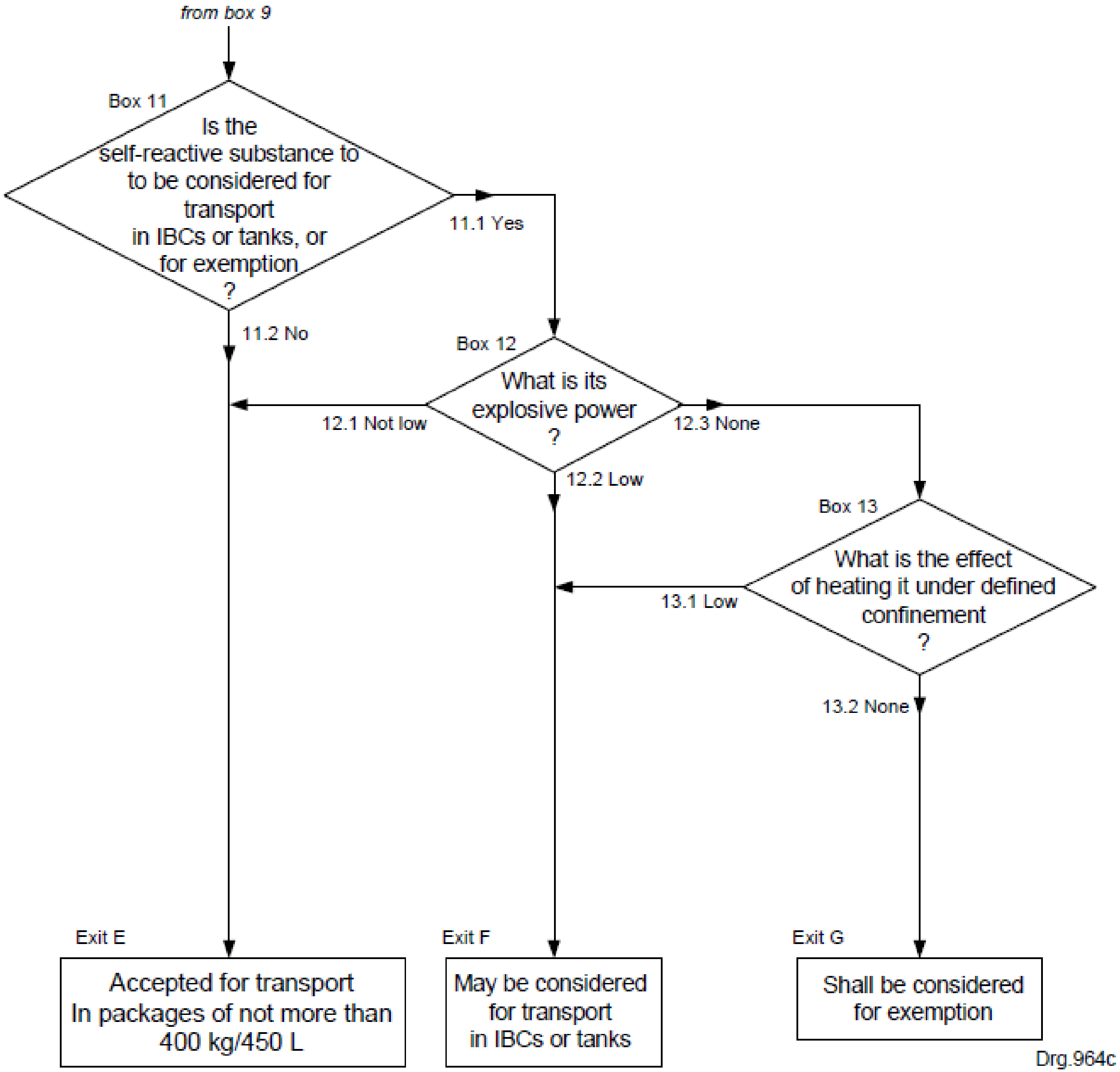

from box 9
Box 11
Is the self-reactive substance to to be considered for transport in IBCs or tanks, or for exemption ?
11.1 Yes
11.2 No
Box 12
What is its explosive power ?
12.1 Not low
12.2 Low
12.3 None
Box 13
What is the effect of heating it under defined confinement ?
13.1 Low
13.2 None
Exit E
Accepted for transport In packages of not more than 400 kg/450 L
Exit F
May be considered for transport in IBCs or tanks
Exit G
Shall be considered for exemption
Drg.964c

Figure 4 — Flow chart scheme for organic peroxides

11.2.4 Temperature control requirements for organic peroxides

11.2.4.1 General

All organic peroxides shall be protected from direct sunlight and from all sources of heat and shall be stored in adequately ventilated areas. Certain organic peroxides may be transported only under conditions where the temperature is controlled.

11.2.4.2 Control temperature

11.2.4.2.1 The control temperature is the maximum temperature at which an organic peroxide can be safely transported, handled or stored. The requirements for the temperature of certain substances are based on the assumption that the temperature in the immediate surroundings of a package shall not exceed 50 °C during transport and shall attain this temperature for only a relatively short time during each period of 24 h.

11.2.4.2.2 Temperature control could be required if an organic peroxide that is not normally temperature controlled, is subjected to a temperature exceeding 50 °C (see table 8).

11.2.4.2.3 The following organic peroxides shall be subjected to temperature control during transport:

a) type B and type C with SADTs equal to or less than 50 °C;

b) type D that shows

  1) a medium effect when heated under confinement (when tested in accordance with test series H in section 28, part II of the United Nations' Manual of tests and criteria) and with a SADT equal to or less than 50 °C, or

  2) a low or no effect when heated under confinement and with a SADT equal to or less than 45 °C; and

c) type E and type F with SADTs equal to or less than 45 °C.

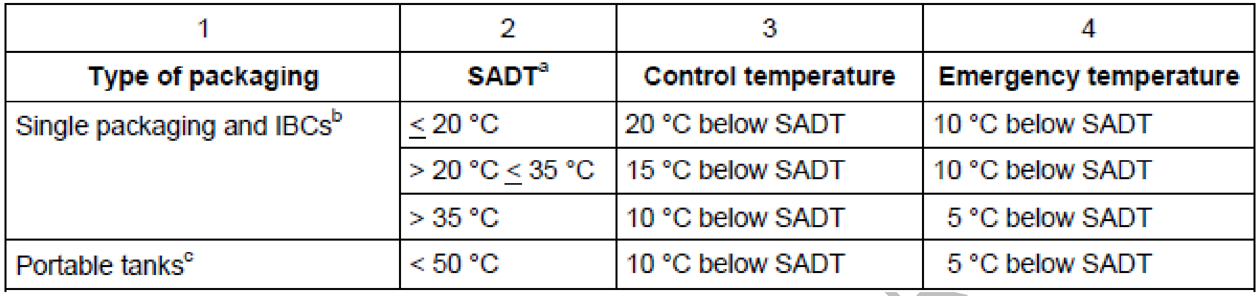
11.2.4.3 Emergency temperature

The emergency temperature is the temperature at which there is a loss of temperature control and emergency procedures are to be implemented (see table 9).

11.2.4.4 Self-accelerating decomposition temperature (SADT)

The SADT of a substance is the lowest temperature at which self-accelerating decomposition occurs in a package presented for transport, handling and storage. The SADT is the combined effect of ambient temperature, decomposition kinetics, package size and the heat of transfer properties of the substance and its packaging. The SADT of a substance shall be determined in order to ascertain whether the substance needs to be subjected to temperature control.

Table 9 — Derivation of control and emergency temperatures



1	2	3	4
Type of packaging	**SADT[a]**	**Control temperature**	**Emergency temperature**
Single packaging and IBCs[b]	≤ 20 °C	20 °C below SADT	10 °C below SADT
	> 20 °C ≤ 35 °C	15 °C below SADT	10 °C below SADT
	> 35 °C	10 °C below SADT	5 °C below SADT
Portable tanks[c]	< 50 °C	10 °C below SADT	5 °C below SADT

11.2.5 Test methods for organic peroxides

For classification purposes, organic peroxides shall be tested in accordance with

a) section 28, part II of the United Nations' Manual of tests and criteria – SADT and thermal stability, and

b) section 32.4, part III of the United Nations' Manual of tests and criteria – Flammability. Because organic peroxides can react vigorously when heated, it is recommended that the flash point be determined by using small sample sizes such as described in ISO 3679.

11.2.6 Desensitization of organic peroxides

11.2.6.1 In order to ensure safety during transport, handling and storage, organic peroxides can be desensitized by the use of diluent type A or diluent type B. Type A diluents can be used for the desensitization of all organic peroxides and self-reactive substances. Type B diluents can only be used for the desensitization of organic peroxides, provided that the boiling point of the diluent is at least 60 °C higher than the SADT (see 11.2.4.4) in a 50 kg package. When a diluent is used, the organic peroxide shall be tested with the diluent present, in the concentration and form to be used during transport, handling and storage.

NOTE A percentage of a substance stipulated in table 8 refers to the percentage by mass, rounded off to the nearest whole number.

11.2.6.2 A diluent that can allow an organic peroxide to concentrate to a dangerous extent in the event of leakage from a package shall not be used.

11.2.6.3 Diluents, other than diluents of type A or type B, can be added to an organic peroxide formulation, provided that they are compatible. However, if all or part of a type A or type B diluent is replaced by another diluent with different properties, the organic peroxide formulation shall be reassessed in accordance with the acceptance procedure for division 5.2.

11.2.6.4 A compatible diluent is that liquid or solid that has no detrimental influence on the thermal stability and hazard type of an organic peroxide formulation.

11.2.6.5 Water can only be used for the desensitization of an organic peroxide if it is shown in table 8 that the substance forms a stable dispersion in water.

12 Class 6: Toxic and infectious substances

12.1 Division 6.1: Toxic substances

12.1.1 General

12.1.1.1 Toxic substances are substances that are liable to cause death or injury or to harm human health if they are swallowed, inhaled, or come into contact with the skin.

12.1.1.2 Nearly all toxic substances emit toxic gases when involved in a fire or when heated to decomposition.

12.1.1.3 Some toxic substances also present other hazards, such as flammability.

12.1.1.4 A liquid toxic substance, or a liquid in which a toxic substance of division 6.1 is suspended or dissolved, and that has a closed-cup flash point of 60 °C (or lower) is, by definition, also a flammable liquid.

12.1.1.5 A substance specified as "stabilized" shall not be transported in an unstabilized condition.

12.1.1.6 A substance that complies with the criteria of class 8 (corrosives) and has an inhalation toxicity (LC_{50}) for dusts and mists, and is consequently assigned to packing group I, shall be accepted for allocation to division 6.1 if its oral and dermal toxicities are in the range of packing group I or packing group II. Otherwise the substance shall be allocated to class 8 (see also 12.1.4.3 and 14.2.2).

12.1.2 Acute toxicity

12.1.2.1 General

For the purposes of this standard, oral ingestion, dermal contact and inhalation of dusts, mists or vapours are the routes of exposure taken into account for determining the acute toxicity properties of a substance.

12.1.2.2 LD_{50} for acute oral toxicity

The LD_{50} for acute oral toxicity, in milligrams per kilogram of body mass, is a single dose of the substance that, when administered orally, is most likely to cause the death, within 14 d, of 50 % of both male and female young adult albino test rats. The number of animals tested shall be sufficient to give a statistically significant result and the test shall comply with good laboratory practice (GLP).

NOTE GLP generally refers to a system of management controls for laboratories and research organizations to ensure the generation of high quality and reliable test data as outlined in the OECD Principles of GLP.

12.1.2.3 LD50 for acute dermal toxicity

The LD50 for acute dermal toxicity, in milligrams per kilogram of body mass, is that dose of the substance that, when administered by continuous contact with the bare skin of both male and female albino test rabbits for 24 h, is most likely to cause the death, within 14 d, of 50 % of the animals tested.

The number of animals tested shall be sufficient to give a statistically significant result and the test shall comply with GLP.

12.1.2.4 LC50 for acute toxicity on inhalation

The LC50 for acute toxicity on inhalation, is that concentration of vapour, mist or dust that, when continuously inhaled by both male and female young adult albino test rats for 1 h, is most likely to cause the death, within 14 d, of 50 % of the animals tested. The number of animals tested shall be sufficient to give a statistically significant result and the test shall comply with GLP.

A solid substance shall be tested if at least 10 % (by mass) of its total mass is likely to occur as dust particles in a respirable range, i.e. the aerodynamic diameter of the particles available for inhalation shall not exceed 10 µm. A liquid substance shall be tested if a mist is likely to be generated in the case of leakage of the substance from the packaging during transport. If the substance under test is administered to the animals as dust or mist, more than 90 % (by mass) of the specimen particles shall be in the respirable range.

In the case of dusts and mists, the results obtained shall be expressed in milligrams per litre of air. In the case of vapours, the results obtained shall be expressed in millilitres per cubic metre of air (parts per million).

12.1.3 Classification of toxic substances

12.1.3.1 Substances are classified as toxic substances of division 6.1 based on human experience in instances of accidental poisoning and based on special properties possessed by an individual substance, such as liquid state, high volatility, any special likelihood of penetration, and special biological effects.

12.1.3.2 If no history of the poisoning of humans by a substance is available, the substance shall be classified on the basis of data obtained from animal tests.

12.1.3.3 When two or more routes of administering a substance exhibit different orders of toxicity, the highest degree of danger indicated by the animal tests shall be used for the classification of the substance.

12.1.4 Packing group assignment

12.1.4.1 Toxic substances (including pesticides) of division 6.1 are assigned to three packing groups in accordance with the degree of toxic hazard they pose during transport:

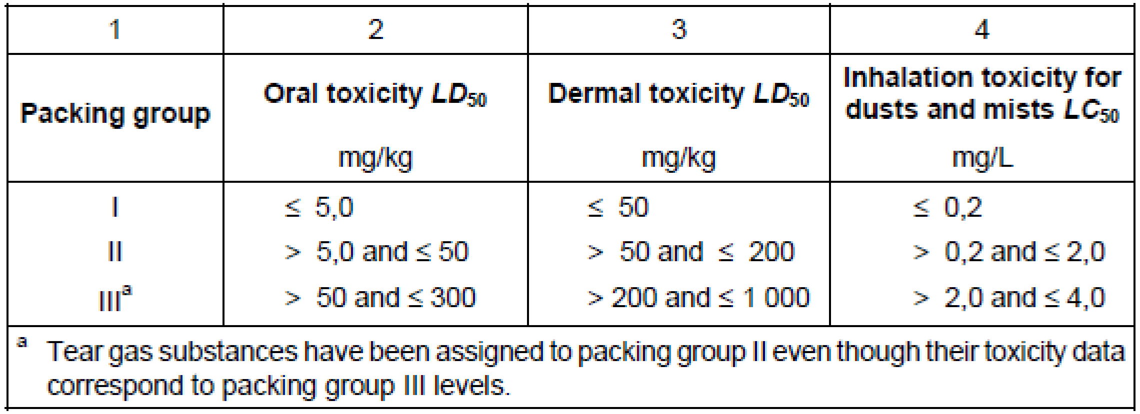
a) packing group I for substances and preparations that present a very severe toxicity risk;

b) packing group II for substances and preparations that present a serious toxicity risk; and

c) packing group III for substances and preparations that present a relatively low toxicity risk.

12.1.4.2 The packing group criteria for oral ingestion, dermal contact and inhalation of dusts and mists are given in table 10.

Table 10 — Packing group criteria based on oral ingestion, dermal contact and inhalation of dusts and mists



1	2	3	4
Packing group	**Oral toxicity *LD*$_{50}$** mg/kg	**Dermal toxicity *LD*$_{50}$** mg/kg	**Inhalation toxicity for dusts and mists *LC*$_{50}$** mg/L
I	≤ 5,0	≤ 50	≤ 0,2
II	> 5,0 and ≤ 50	> 50 and ≤ 200	> 0,2 and ≤ 2,0
III[a]	> 50 and ≤ 300	> 200 and ≤ 1 000	> 2,0 and ≤ 4,0

[a] Tear gas substances have been assigned to packing group II even though their toxicity data correspond to packing group III levels.

12.1.4.3 A substance that complies with the criteria of class 8, packing group I, and has an inhalation toxicity (LC_{50}) for dusts and mists, shall only be accepted for allocation to division 6.1 if its oral and dermal toxicities are in the range of packing group I or packing group II. Otherwise the substance shall be allocated to class 8 (see also 12.1.1.6 and 14.2.2).

12.1.4.4 The criteria for acute inhalation toxicity for dusts and mists are based on LC_{50} data relating to exposures of 1 h (see 12.1.2.4) and where such information is available it shall be used for the classification of a substance. However, where only LC_{50} data relating to exposures of 4 h are available, such values can be multiplied by four, as LC_{50} (4 h) x 4 is considered the equivalent of LC_{50} (1 h).

12.1.4.5 The criteria for acute inhalation toxicity for vapours are based on LC_{50} data relating to exposures of 1 h (see 12.1.4.6) and where such information is available it shall be used for the classification of a substance. However, where only LC_{50} data relating to exposures of 4 h are available, such values can be multiplied by two, as LC_{50} (4 h) x 2 is considered the equivalent of LC_{50} (1 h).

12.1.4.6 The packing group to which a liquid that emits toxic vapours shall be assigned can be determined as follows:

a) packing group I if V > 10 x LC_{50} and LC_{50} < 1 000 mL/m^3;

b) packing group II if V > LC_{50} and LC_{50} < 3 000 mL/m^3, and the liquid does not comply with the criteria for packing group I; or

c) packing group III if V > 0.2 x LC_{50} and LC_{50} < 5 000 mL/m3, and the liquid does not comply with the criteria for packing group I or packing group II.

NOTE V is the saturated vapour concentration of a liquid, in millilitres per cubic metre of air, at 20 °C, and at a standard pressure of 101,3 kPa.

12.1.4.7 The packing group criteria for substances that emit vapours which are toxic on inhalation, can also be expressed in graphical form (see figure 5) to facilitate classification. However, owing to approximations inherent in the use of graphs, substances falling on or near packing group borderlines shall be checked against numerical criteria.

12.1.4.8 Mixtures of liquids that are toxic by inhalation shall be assigned to packing groups by using the formulas given in 12.1.4.9 or by following the threshold toxicity tests given in A.6.

12.1.4.9 If the LC50 data are available for each toxic substance in a mixture of liquids, the packing group of such a mixture can be calculated as follows:

a) Determine the LC50 of the liquid mixture by using the following formula:

$$LC_{50}(\text{mixture}) = \frac{1}{\sum_{i=1}^{n}\left(\frac{f_i}{LC_{50i}}\right)}$$

Where,

LC_{50} (mixture) is the acute inhalation toxicity, in millilitres per cubic metre;

N is the number of toxic substances in the liquid mixture;

f_i is the mole fraction of the ith substance of the liquid;

LC_{50i} is the mean lethal concentration of the ith substance, in millimetres per cubic. metre.

b) Determine the volatility of each substance present in the liquid mixture by using the following formula:

$$V_i = \left(\frac{P_i \times 10^6}{101{,}3} \right)$$

where

Vi is the volatility of the ith substance in the liquid mixture;

Pi is the partial pressure of the ith substance, in kilopascals at 20 °C and at a pressure of 101,3 kPa.

c) Calculate the ratio of the volatility R to the LC_{50} of the liquid mixture by using the following formula:

$$R = \sum_{i=1}^{n} \left(\frac{V_i}{LC_{50i}} \right)$$

where

R is the ratio of the volatility of the i_{th} substance (V_i) to the acute inhalation toxicity of the i_{th} component (LC_{50i});

d) Assign a packing group for the liquid mixture by using the calculated values for LC_{50} (see 12.1.4.9(a)) and R (see 12.1.4.9 (c)) as follows:

1) packing group I: $R > 10$ and the LC_{50}(mixture) $< 1\ 000$ ml/m^3;

2) packing group II: $R > 1$ and the LC_{50}(mixture) $< 3\ 000$ ml/m^3 and the liquid mixture does not comply with the criteria for packing group I;

3) packing group III: $R > 0{,}2$ and the LC_{50}(mixture) $< 5\ 000$ ml/m^3 and the liquid mixture does not comply with the criteria for packing group I or packing group II.

12.1.4.10 If experimental data on the oral and dermal toxicities of a mixture are not available, the classification and packing group assignment can be calculated by means of the formulas given in 12.1.4.11 or 12.1.4.12, as applicable.

12.1.4.11 In the case of a preparation that contains only one active ingredient and the LD_{50} of that constituent is known, but reliable experimental data are unavailable on the oral and dermal toxicities of the actual mixtures intended for transport, the oral and dermal toxicities can be calculated by using the following formula:

$$LD_{50\mathrm{f}} = \frac{LD_{50\mathrm{a}}}{P_\mathrm{a}} \times 100$$

where

LD_{50f} is the LD_{50} value for the formulation;

LD_{50a} is the LD_{50} value for the active ingredient;

P_a is the percentage (by mass) of active ingredient in the formulation.

12.1.4.12 There are three possible approaches to determine the oral or dermal toxicities of a preparation that contains several active ingredients. The preferred method is to obtain reliable experimental data on the acute oral and dermal toxicities of the actual mixture intended for transport. If such reliable data are not available, either of the following methods can be used:

a) classify the formulation according to the most hazardous constituent of the mixture as if that constituent were present in the same concentration as the total concentration of all the active ingredients; or

b) apply the following formula:

$$\frac{C_\mathrm{a}}{T_\mathrm{a}} + \frac{C_\mathrm{b}}{T_\mathrm{b}} + \frac{C_\mathrm{z}}{T_\mathrm{z}} = \frac{100}{T_\mathrm{m}}$$

where

C is the concentrations of constituents a to z in the mixture, as a percentage (by mass);

T is the oral LD_{50} values of constituents a to z;

T_m is the oral LD_{50} value of the mixture.

NOTE The formula may also be used for dermal toxicities, provided that information is available on the same route of toxicity for all constituents. The use of this formula does not take into account any potentiation or protective phenomena.

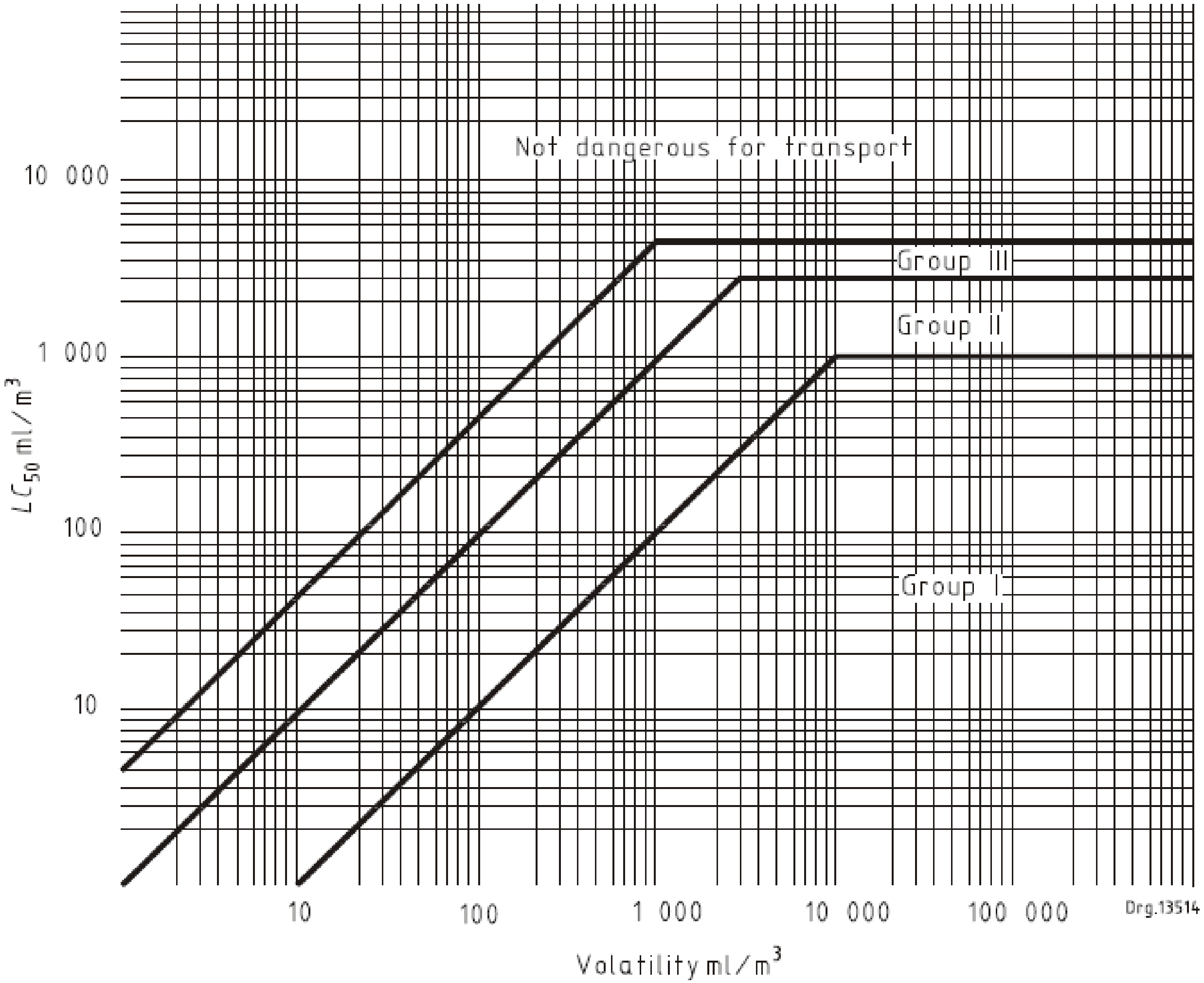

Not dangerous for transport
Group III
Group II
Group I
10 000
1 000
100
10
LC_{50} ml/m^3
10
100
1 000
10 000
100 000
Volatility ml/m^3
Drg.13514

Figure 5 — Packing group borderlines for vapour inhalation toxicity

12.1.5 Classification of pesticides

12.1.5.1 Pesticides and their preparations are classified in division 6.1 in accordance with the criteria given in 12.1.1 to 12.1.4.

12.1.5.2 Pesticides and preparations that are characterized by subsidiary risks shall be classified in accordance with the precedence of hazards (see table 19) and assigned the appropriate packing groups.

12.1.5.3 If the experimental oral or dermal LD_{50} value for a pesticide preparation is not known, but the LD50 values of its active ingredient(s) are known, the LD_{50} value of the preparation can be obtained by the application of the formulas given in 12.1.4.11 or 12.1.4.12.

12.1.5.4 The toxicity data for a number of common pesticides (technical) are given in annex E in accordance with The WHO recommended classification of pesticides by hazard and guidelines to classification.

This document can be used as a source of LD_{50} data for pesticides, but its classification system shall not be used for purposes of transport classification or assignment of packing groups. Pesticides intended for transport shall be classified in accordance with the requirements of this standard.

12.1.5.5 The proper shipping name used in the transport of a pesticide shall be selected on the basis of its active ingredient, physical state and any subsidiary risks it may exhibit.

12.2 Division 6.2: Infectious substances

12.2.1 General

Infectious substances are those substances known, or reasonably expected, to contain pathogens. Pathogens are micro-organisms such as bacteria, viruses, rickettsiae, parasites or fungi, and other agents such as prions, that are known or reasonably believed to cause infectious disease in animals or humans. However, infectious substances are only subject to the requirements of division 6.2 if they are capable of spreading disease in the event of exposure to them. They are not classified as infectious substances of division 6.2 if they are unlikely to cause human or animal disease.

For the purposes of this standard, the products given in 12.2.2 to 12.2.7 (inclusive) shall be considered infectious substances.

12.2.2 Biological products

12.2.2.1 Biological products are those products derived from living organisms that are manufactured and distributed in accordance with the requirements of the appropriate national authorities, which may have special licensing requirements and are used for the prevention, treatment , or diagnosis of diseases in humans or animals or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines.

12.2.3 Cultures

Cultures are the result of a process by which pathogens are intentionally propagated and do not include human or animal patient specimens (see 12.2.4).

12.2.4 Patient specimens

Patient specimens are those collected directly from humans or animals including but not limited to excreta secreta, blood and its components, tissue and tissue fluid swabs and body parts being transported for purposes such as research, diagnosis, investigational activities, disease treatment and prevention (see also 12.2.9).

12.2.5 Genetically modified micro-organisms and organisms pick from UN LATEST MODEL

12.2.5.1 For the purposes of this standard, genetically modified micro-organisms (GMMOs) and organisms of division 6.2 are divided into the following groups:

a) GMMOs and organisms that comply with the definition of an infectious substance (see 12.2.1) shall be assigned to UN 2814 or to UN 2900, as appropriate;

b) GMMOs and organisms that are known, or suspected, to be dangerous to humans, animals or the environment. Such substances shall be classified in division 6.2 and shall be transported in accordance with conditions specified by the competent authority; and

c) animals that contain, or are contaminated with, GMMOs and organisms that comply with the definition of an infectious substance. Such animals shall be transported in accordance with conditions specified by the competent authority.

12.2.5.2 GMMOs and organisms that do not comply with the definition of infectious substances, but that are capable of altering animals, plants or microbiological substances in a way that does not occur naturally in normal reproduction shall be classified in class 9 and assigned to UN 3245. However, the competent authority can authorize such substances for unconditional use in which case the requirements of this standard would not apply.

12.2.6 Medical or clinical waste

12.2.6.1Medical or clinical wastes containing Category A infectious substances shall be assigned to UN2814 or UN 2900 as appropriate. 12.2.6.3Medical or clinical wastes containing infectious substances in Category B shall be assigned to UN 3291.

12.2.6.4 Medical or clinical wastes which are reasonably believed to have a low probability of containing infectious substances shall be assigned to UN 3291.

12.2.6.5 For the assignment, international, regional or national waste catalogues may be taken into account. NOTE:The proper shipping name for UN 3291 is “CLINICAL WASTE, UNSPECIFIED, N.O.S.” or “(BIO) MEDICAL WASTE, N.O.S” or “REGULATED MEDICAL WASTE, N.O.S.”

12.2.6.6 Decontaminated medical or clinical wastes which previously contained infectious substances are not subject to these Regulations unless they meet the criteria for inclusion in another class.

12.2.7 Infected animals

12.2.7.1 Unless an infectious substance cannot be consigned by any other means, live animals shall not be used to consign such a substance. A live animal which has been intentionally infected and is known or suspected to contain an infectious substance shall only be transported under terms and conditions approved by the competent authority.

12.2.8 Classification of infectious substances

12.2.8.1. Definitions

For the purposes of these standard,Infectious substances are substances which are known or are reasonably expected to contain pathogens. Pathogens are defined as microorganisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

12.2.8.2 Biological products are those products derived from living organisms which are manufactured and distributed in accordance with the requirements of appropriate national authorities, which may have special licensing requirements, and are used either for prevention, treatment, or diagnosis of disease in humans or animals, or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines.

12.2.8.3 Cultures are the result of a process by which pathogens are intentionally propagated. This definition does not include human or animal patient specimens as defined in 2.6.3.1.4. 2.6.3.1.4 Patient specimens are those, collected directly from humans or animals, including, but not limited to, excreta, secreta, blood and its components, tissue and tissue fluid swabs, and body parts being transported for purposes such as research, diagnosis, investigational activities, disease treatment and prevention.

12.2.8.4 Medical or clinical wastes are wastes derived from the medical treatment of animals or humans or from bio-research.
2.6.3.2 Classification of infectious substances
12.2.8.5 Infectious substances shall be classified in Division 6.2 and assigned to UN 2814, UN 2900, UN3291 or UN 3373, as appropriate.
12.2.8.2 Infectious substances are divided into the following categories:
12.2.8.2 Category A: An infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals. Indicative examples of substances that meet these criteria are given in the table in this paragraph. NOTE: An exposure occurs when an infectious substance is released outside of the protective packaging, resulting in physical contact with humans or animals. (a) Infectious substances meeting these criteria which cause disease in humans or both in humans and animals shall be assigned to UN 2814. Infectious substances which cause disease only in animals shall be assigned to UN 2900. (b) Assignment to UN 2814 or UN 2900 shall be based on the known medical history and symptoms of the source human or animal, endemic local conditions, or professional judgement concerning individual circumstances of the source human or animal. NOTE 1:The proper shipping name for UN 2814 is INFECTIOUS SUBSTANCE, AFFECTING HUMANS. The proper shipping name for UN 2900 is INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only. NOTE 2:The following table is not exhaustive. Infectious substances, including new or emerging pathogens, which do not appear in the table but which meet the same criteria shall be assigned to Category A. In addition, if there is doubt as to whether or not a substance meets the criteria it shall be included in Category A.NOTE 3: In the following table, the microorganisms written in italics are bacteria, mycoplasmas, rickettsia or fungi. INDICATIVE EXAMPLES OF INFECTIOUS SUBSTANCES INCLUDED IN CATEGORY AIN ANY FORM UNLESS OTHERWISE INDICATED 12.2.8.2 (a))UN Number and Proper Shipping NameMicroorganismUN 2814Infectious substances affecting humansBacillus anthracis(cultures only)Brucella abortus(cultures only)Brucella melitensis(cultures only)Brucella suis(cultures only)Burkholderia mallei -Pseudomonas mallei –Glanders(cultures only)Burkholderia pseudomallei–Pseudomonas pseudomallei (cultures only)Chlamydia psittaci-avian strains (cultures only)Clostridium botulinum(cultures only)Coccidioides immitis(cultures only)Coxiella burnetii(cultures only)Crimean-Congo haemorrhagic fever virusDengue virus (cultures only)Eastern equine encephalitis virus (cultures only)Escherichia coli,verotoxigenic (cultures only)Ebola virusFlexal virusFrancisella tularensis(cultures only)Guanarito virusHantaan virusHantaviruses causing haemorrhagic fever with renal syndromeHendra virusHepatitis B virus (cultures only)HerpesB virus (cultures only)Human immunodeficiency virus (cultures only)Highly pathogenic avian influenza virus (cultures only)Japanese Encephalitis virus (cultures only)Junin virusKyasanur Forest disease virusLassa virusMachupo virusMarburg virusMonkeypox virusMycobacterium tuberculosis (cultures only)Nipah virusOmsk haemorrhagic fever virusPoliovirus (cultures only)Rabies virus (cultures only)Rickettsia prowazekii (cultures only)Rickettsia rickettsii(cultures only)Rift Valley fever virus (cultures only)Russian spring-summer encephalitis virus (cultures only)Sabia virusShigella dysenteriae type 1 (cultures only)Tick-

borne encephalitis virus (cultures only)Variola virusVenezuelan equine encephalitis virus (cultures only)West Nile virus (cultures only)Yellow fever virus (cultures only)Yersinia pestis(cultures only)
INDICATIVE EXAMPLES OF INFECTIOUS SUBSTANCES INCLUDED IN CATEGORY AIN ANY FORM UNLESS OTHERWISE INDICATED

12.2.8.2 (a))UN Number and Proper Shipping NameMicroorganismUN 2900Infectious substances affecting animals onlyAfrican swine fever virus (cultures only)Avian paramyxovirus Type 1 -Velogenic Newcastle disease virus (cultures only)Classical swine fever virus (cultures only)Foot and mouth disease virus (cultures only)Lumpy skin disease virus (cultures only)Mycoplasma mycoides-Contagious bovine pleuropneumonia (cultures only)Peste des petits ruminants virus (cultures only)Rinderpest virus (cultures only)Sheep-pox virus (cultures only)Goatpox virus (cultures only)Swine vesicular disease virus (cultures only)Vesicular stomatitis virus (cultures only)

12.2.8.2 Category B: An infectious substance which does not meet the criteria for inclusion in Category A. Infectious substances in Category B shall be assigned to UN 3373. NOTE:The proper shipping name of UN 3373 is “BIOLOGICAL SUBSTANCE, CATEGORY B”. 12.2.8.2 Exemptions2.6.3.2.3.1 Substances which do not contain infectious substances or substances which are unlikely to cause disease in humans or animals are not subject to these Regulations unless they meet the criteria for inclusion in another class.

12.2.8.2 Substances containing microorganisms which are non-pathogenic to humans or animals are not subject to these Regulations unless they meet the criteria for inclusion in another class.

12.2.8.2 Substances in a form that any present pathogens have been neutralized or inactivated such that they no longer pose a health risk are not subject to these Regulations unless they meet the criteria for inclusion in another class. NOTE:Medical equipment which has been drained of free liquid is deemed to meet the requirements of this paragraph and is not subject to these Regulations.

12.2.8.2 Environmental samples (including food and water samples) which are not considered to pose a significant risk of infection are not subject to these Regulations unless they meet the criteria for inclusion in another class.

12.2.8.2 Dried blood spots, collected by applying a drop of blood onto absorbent material, are not subject to these Regulations.

12.2.8.2 Faecal occult blood screening samples are not subject to these Regulations.

12.2.8.2 Blood or blood components which have been collected for the purposes of transfusion or for the preparation of blood products to be used for transfusion or transplantation and any tissues or organs intended for use in transplantation as well as samples drawn in connection with such purposes are not subject to these Regulations.

12.2.8.2 Human or animal specimens for which there is minimal likelihood that pathogens are present are not subject to these Regulations if the specimen is transported in a packaging which will prevent any leakage and which is marked with the words “Exempt human specimen” or “Exempt animal specimen”, as appropriate. The packaging should meet the following conditions: (a) The packaging should consist of three components: (i) a leak-proof primary receptacle(s); (ii) a leak-proof secondary packaging; and (iii) an outer packaging of adequate strength for its capacity, mass and intended use, and with at least one surface having minimum dimensions of 100 mm × 100 mm; (b) For liquids, absorbent material in sufficient quantity to absorb the entire contents should be placed between the primary receptacle(s) and the secondary packaging so that, during transport, any release or leak of a liquid substance will not reach the outer packaging and will not compromise the integrity of the cushioning material; (c) When multiple fragile primary receptacles are placed in a single secondary packaging, they should be either individually wrapped or separated to prevent contact between them. NOTE 1:An element of professional judgment is required to determine if a substance is exempt under this paragraph. That judgment should be based on the known medical history, symptoms and individual circumstances of the source, human or animal, and endemic local conditions. Examples of specimens which may be transported under this paragraph include the blood or urine tests to monitor cholesterol levels, blood glucose levels, hormone levels, or prostate specific antibodies (PSA); those required to monitor organ function such as heart, liver or kidney function for humans or animals with non-infectious diseases, or for therapeutic drug monitoring; those conducted for insurance or employment purposes and are intended to determine the presence of drugs or alcohol; pregnancy test; biopsies to detect cancer; and antibody detection in humans or animals in the absence of any concern for infection (e.g. evaluation of vaccine induced immunity, diagnosis of autoimmune disease, etc.). NOTE 2: For air transport, packagings for specimens exempted under this paragraph shall meet the conditions in (a) to (c).

12.2.8.2 Except for: (a) Medical waste (UN 3291); (b) Medical devices or equipment contaminated with or containing infectious substances in Category A (UN 2814 or UN 2900); and (c) Medical devices or equipment contaminated with or containing other dangerous goods that meet the definition of another hazard class, medical devices or equipment potentially contaminated with or containing infectious substances which are being transported for disinfection, cleaning, sterilization, repair, or equipment evaluation are not subject to the provisions of these Regulations if packed in packagings designed and constructed in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents. Packagings shall be designed to meet the construction requirements listed in 6.1.4 or 6.6.5. These packagings shall meet the general packing requirements of 4.1.1.1 and 4.1.1.2 and be capable of retaining the medical devices and equipment when dropped from a height of 1.2 m. For air transport, additional requirements may apply. The packagings shall be marked “USED MEDICAL DEVICE” or “USED MEDICAL EQUIPMENT”. When using overpacks, these shall be marked in the same way, except when the inscription remains visible.

12.2.8.2 Biological products

12.2.8.2 For the purposes of these Regulations, biological products are divided into the following groups: (a) those which are manufactured and packaged in accordance with the requirements of appropriate national authorities and transported for the purposes of final packaging or distribution, and use for personal health care by medical professionals or individuals. Substances in this group are not subject to these Regulations; (b) those which do not fall under paragraph (a) and are known or reasonably believed to contain infectious substances and which meet the criteria for inclusion in Category A or Category B. Substances in this group shall be assigned to UN 2814, UN 2900 or UN 3373, as appropriate. NOTE:Some licensed biological products may present a biohazard only in certain parts of the world. In that case, competent authorities may require these biological products to be in compliance with local requirements for infectious substances or may impose other restrictions.

2.6.3.4 Genetically modified microorganisms and organisms

2.6.3.4.1Genetically modified microorganisms not meeting the definition of infectious substance shall be classified according to Chapter 2.9. 2.6.3.5 Medical or clinical wastes

2.6.3.5.1Medical or clinical wastes containing Category A infectious substances shall be assigned to UN2814 or UN 2900 as appropriate. Medical or clinical wastes containing infectious substances in Category B shall be assigned to UN 3291. 2.6.3.5.2 Medical or clinical wastes which are reasonably believed to have a low probability of containing infectious substances shall be assigned to UN 3291. For the assignment, international, regional or national waste catalogues may be taken into account. NOTE:The proper shipping name for UN 3291 is “CLINICAL WASTE, UNSPECIFIED, N.O.S.” or “(BIO) MEDICAL WASTE, N.O.S” or “REGULATED MEDICAL WASTE, N.O.S.”.

2.6.3.5.3Decontaminated medical or clinical wastes which previously contained infectious substances are not subject to these Regulations unless they meet the criteria for inclusion in another class. 2.6.3.6 Infected animals
2.6.3.6.1 Unless an infectious substance cannot be consigned by any other means, live animals shall not be used to consign such a substance. A live animal which has been intentionally infected and is known or suspected to contain an infectious substance shall only be transported under terms and conditions approved by the competent author

Table 11 — Category A infectious substances

1	2
UN number and proper shipping name	**Micro-organism**[a]
UN 2814 INFECTIOUS SUBSTANCES, AFFECTING HUMANS	*Bacillus anthracis (cultures only)*
	Brucella abortus (cultures only)
	Brucella melitensis (cultures only)
	Brucella suis (cultures only)
	Burkholderia mallei – Pseudomonas mallei – Glanders *(cultures only)*
	Burkholderia pseudomallei – Pseudomonas pseudomallei (cultures only)
	Chlamydia psittaci – avian strains (cultures only)
	Clostridium botulinum (cultures only)
	Coccidioides immitis (cultures only)
	Coxiella burnetii (cultures only)
	Crimean-Congo haemorrhagic fever virus
	Dengue virus (cultures only)
	Eastern equine encephalitis virus (cultures only)
	Escherichia coli, verotoxigenic (cultures only)
	Ebola virus
	Flexal virus
	Guanarito virus
	Hantaan virus
	Hantaviruses causing haemorrhagic fever with renal syndrome
	Hendra virus
	Hepatitis B virus (cultures only)
	Herpes B virus (cultures only)
	Human immunodeficiency virus (cultures only)
	Highly pathogenic avian influenza virus (cultures only)
	Japanese Encephalitis virus (cultures only)
	Junin virus
	Kyasanur Forest disease virus
	Lassa virus
	Machupo virus
	Marburg virus
	Monkeypox virus
	Mycobacterium tuberculosis (cultures only)
	Nipah virus
	Omsk haemorrhagic fever virus
	Omsk haemorrhagic fever virus
	Poliovirus (cultures only)
	Rabies virus (cultures only)
	Rickettsia prowazekii (cultures only)

Table 11 (concluded)

1	2
UN number and proper shipping name	**Micro-organism**[a]
	Variola virus
UN 2900 INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only	Venezuelan equine encephalitis virus (cultures only)
	West Nile virus (cultures only)
	Yellow fever virus (cultures only)
	Yersinia pestis (cultures only)
	Lumpy skin disease virus (cultures only)
	Mycoplasma mycoides – Contagious bovine pleuropneumonia (cultures only)
	Peste des petits ruminants virus (cultures only)
	Rinderpest virus (cultures only)
	Sheep-pox virus (cultures only)
	Goatpox virus (cultures only)
	Swine vesicular disease virus (cultures only)
	Vesicular stomatitis virus (cultures only)

[a] The micro-organisms in italics are bacteria, mycoplasmas, tickettsia or fungi.

.3 Division 6.2 - Infectious substances 2.6.3.1 DefinitionsFor the purposes of these Regulations: 2.6.3.1.1 Infectious substances are substances which are known or are reasonably expected to contain pathogens. Pathogens are defined as microorganisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

2.6.3.1.2 Biological products are those products derived from living organisms which are manufactured and distributed in accordance with the requirements of appropriate national authorities, which may have special licensing requirements, and are used either for prevention, treatment, or diagnosis of disease in humans or animals, or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines. 2.6.3.1.3Cultures are the result of a process by which pathogens are intentionally propagated. This definition does not include human or animal patient specimens as defined in 2.6.3.1.4. 2.6.3.1.4 Patient specimens are those, collected directly from humans or animals, including, but not limited to, excreta, secreta, blood and its components, tissue and tissue fluid swabs, and body parts being transported for purposes such as research, diagnosis, investigational activities, disease treatment and prevention.2.6.3.1.5 Deleted.2.6.3.1.6 Medical or clinical wastes are wastes derived from the medical treatment of animals or humans or from bio-research. 2.6.3.2 Classification of infectious substances2.6.3.2.1 Infectious substances shall be classified in Division 6.2 and assigned to UN 2814, UN 2900, UN3291 or UN 3373, as appropriate. 2.6.3.2.2 Infectious substances are divided into the following categories:2.6.3.2.2.1 Category A: An infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals. Indicative examples of substances that meet these criteria are given in the table in this paragraph. NOTE:An exposure occurs when an infectious substance is released outside of the protective packaging, resulting in physical contact with humans or animals. (a) Infectious substances meeting these criteria which cause disease in humans or both in humans and animals shall be assigned to UN 2814. Infectious substances which cause disease only in animals shall be assigned to UN 2900. (b) Assignment to UN 2814 or UN 2900 shall be based on the known medical history and symptoms of the source human or animal, endemic local conditions, or professional judgement concerning individual circumstances of the source human or animal.NOTE 1:The proper shipping name for UN 2814 is INFECTIOUS SUBSTANCE, AFFECTING HUMANS. The proper shipping name for UN 2900 is INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only. NOTE 2:The following table is not exhaustive. Infectious substances, including new or emerging pathogens, which do not appear in the table but which meet the same criteria shall be assigned to Category A. In addition, if there is doubt as to whether or not a substance meets the criteria it shall be included in

Category A.NOTE 3: In the following table, the microorganisms written in italics are bacteria, mycoplasmas, rickettsia or fungi. Copyright © United Nations, 2017. All rights reserved
- 129 - INDICATIVE EXAMPLES OF INFECTIOUS SUBSTANCES INCLUDED IN CATEGORY AIN ANY FORM UNLESS OTHERWISE INDICATED (2.6.3.2.2.1 (a))UN Number and Proper Shipping NameMicroorganismUN 2814Infectious substances affecting humansBacillus anthracis(cultures only)Brucella abortus(cultures only)Brucella melitensis(cultures only)Brucella suis(cultures only)Burkholderia mallei - Pseudomonas mallei –Glanders(cultures only)Burkholderia pseudomallei–Pseudomonas pseudomallei (cultures only)Chlamydia psittaci- avian strains (cultures only)Clostridium botulinum(cultures only)Coccidioides immitis(cultures only)Coxiella burnetii(cultures only)Crimean- Congo haemorrhagic fever virusDengue virus (cultures only)Eastern equine encephalitis virus (cultures only)Escherichia coli,verotoxigenic (cultures only)Ebola virusFlexal virusFrancisella tularensis(cultures only)Guanarito virusHantaan virusHantaviruses causing haemorrhagic fever with renal syndromeHendra virusHepatitis B virus (cultures only)HerpesB virus (cultures only)Human immunodeficiency virus (cultures only)Highly pathogenic avian influenza virus (cultures only)Japanese Encephalitis virus (cultures only)Junin virusKyasanur Forest disease virusLassa virusMachupo virusMarburg virusMonkeypox virusMycobacterium tuberculosis (cultures only)Nipah virusOmsk haemorrhagic fever virusPoliovirus (cultures only)Rabies virus (cultures only)Rickettsia prowazekii (cultures only)Rickettsia rickettsii(cultures only)Rift Valley fever virus (cultures only)Russian spring-summer encephalitis virus (cultures only)Sabia virusShigella dysenteriae type 1 (cultures only)Tick-borne encephalitis virus (cultures only)Variola virusVenezuelan equine encephalitis virus (cultures only)West Nile virus (cultures only)Yellow fever virus (cultures only)Yersinia pestis(cultures only)

INDICATIVE EXAMPLES OF INFECTIOUS SUBSTANCES INCLUDED IN CATEGORY AIN ANY FORM UNLESS OTHERWISE INDICATED (2.6.3.2.2.1 (a))UN Number and Proper Shipping NameMicroorganismUN 2900Infectious substances affecting animals onlyAfrican swine fever virus (cultures only)Avian paramyxovirus Type 1 -Velogenic Newcastle disease virus (cultures only)Classical swine fever virus (cultures only)Foot and mouth disease virus (cultures only)Lumpy skin disease virus (cultures only)Mycoplasma mycoides- Contagious bovine pleuropneumonia (cultures only)Peste des petits ruminants virus (cultures only)Rinderpest virus (cultures only)Sheep-pox virus (cultures only)Goatpox virus (cultures only)Swine vesicular disease virus (cultures only)Vesicular stomatitis virus (cultures only)2.6.3.2.2.2 Category B: An infectious substance which does not meet the criteria for inclusion in Category A. Infectious substances in Category B shall be assigned to UN 3373. NOTE:The proper shipping name of UN 3373 is “BIOLOGICAL SUBSTANCE, CATEGORY B”. 2.6.3.2.3 Exemptions2.6.3.2.3.1 Substances which do not contain infectious substances or substances which are unlikely to cause disease in humans or animals are not subject to these Regulations unless they meet the criteria for inclusion in another class. 2.6.3.2.3.2 Substances containing microorganisms which are non-pathogenic to humans or animals are not subject to these Regulations unless they meet the criteria for inclusion in another class. 2.6.3.2.3.3 Substances in a form that any present pathogens have been neutralized or inactivated such that they no longer pose a health risk are not subject to these Regulations unless they meet the criteria for inclusion in another class.

NOTE:Medical equipment which has been drained of free liquid is deemed to meet the requirements of this paragraph and is not subject to these Regulations. 2.6.3.2.3.4 Environmental samples (including food and water samples) which are not considered to pose a significant risk of infection are not subject to these Regulations unless they meet the criteria for inclusion in another class. 2.6.3.2.3.5 Dried blood spots, collected by applying a drop of blood onto absorbent material, are not subject to these Regulations. 2.6.3.2.3.6 Faecal occult blood screening samples are not subject to these Regulations. 2.6.3.2.3.7 Blood or blood components which have been collected for the purposes of transfusion or for the preparation of blood products to be used for transfusion or transplantation and any tissues or organs intended for use in transplantation as well as samples drawn in connection with such purposes are not subject to these Regulations. 2.6.3.2.3.8 Human or animal specimens for which there is minimal likelihood that pathogens are present are not subject to these Regulations if the specimen is transported in a packaging which will prevent any

- leakage and which is marked with the words “Exempt human specimen” or “Exempt animal specimen”, as appropriate. The packaging should meet the following conditions: (a) The packaging should consist of three components: (i) a leak-proof primary receptacle(s); (ii) a leak-proof secondary packaging; and (iii) an outer packaging of adequate strength for its capacity, mass and intended use, and with at least one surface having minimum dimensions of 100 mm × 100 mm; (b) For liquids, absorbent material in sufficient quantity to absorb the entire contents should be placed between the primary receptacle(s) and the secondary packaging so that, during transport, any release or leak of a liquid substance will not reach the outer packaging and will not compromise the integrity of the cushioning material; (c) When multiple fragile primary receptacles are placed in a single secondary packaging, they should be either individually wrapped or separated to prevent contact between them. NOTE 1:An element of professional judgment is required to determine if a substance is exempt under this paragraph. That judgment should be based on the known medical history, symptoms and individual circumstances of the source, human or animal, and endemic local conditions. Examples of specimens which may be transported under this paragraph include the blood or urine tests to monitor cholesterol levels, blood glucose levels, hormone levels, or prostate specific antibodies (PSA); those required to monitor organ function such as heart, liver or kidney function for humans or animals with non-infectious diseases, or for therapeutic drug monitoring; those conducted for insurance or employment purposes and are intended to determine the presence of drugs or alcohol; pregnancy test; biopsies to detect cancer; and antibody detection in humans or animals in the absence of any concern for infection (e.g. evaluation of vaccine induced immunity, diagnosis of autoimmune disease, etc.). NOTE 2: For air transport, packagings for specimens exempted under this paragraph shall meet the conditions in (a) to (c). 2.6.3.2.3.9 Except for: (a) Medical waste (UN 3291); (b) Medical devices or equipment contaminated with or containing infectious substances in Category A (UN 2814 or UN 2900); and (c) Medical devices or equipment contaminated with or containing other dangerous goods that meet the definition of another hazard class, medical devices or equipment potentially contaminated with or containing infectious substances which are being transported for disinfection, cleaning, sterilization, repair, or equipment evaluation are not subject to the provisions of these Regulations if packed in packagings designed and constructed in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents. Packagings shall be designed to meet the construction requirements listed in 6.1.4 or 6.6.5. These packagings shall meet the general packing requirements of 4.1.1.1 and 4.1.1.2 and be capable of retaining the medical devices and equipment when dropped from a height of 1.2 m. For air transport, additional requirements may apply. The packagings shall be marked “USED MEDICAL DEVICE” or “USED MEDICAL EQUIPMENT”. When using overpacks, these shall be marked in the same way, except when the inscription remains visible.

2.6.3.3 Biological products2.6.3.3.1 For the purposes of these Regulations, biological products are divided into the following groups: (a) those which are manufactured and packaged in accordance with the requirements of appropriate national authorities and transported for the purposes of final packaging or distribution, and use for personal health care by medical professionals or individuals. Substances in this group are not subject to these Regulations; (b) those which do not fall under paragraph (a) and are known or reasonably believed to contain infectious substances and which meet the criteria for inclusion in Category A or Category B. Substances in this group shall be assigned to UN 2814, UN 2900 or UN 3373, as appropriate. NOTE:Some licensed biological products may present a biohazard only in certain parts of the world. In that case, competent authorities may require these biological products to be in compliance with local requirements for infectious substances or may impose other restrictions.2.6.3.4 Genetically modified microorganisms and organisms2.6.3.4.1Genetically modified microorganisms not meeting the definition of infectious substance shall be classified according to Chapter 2.9. 2.6.3.5 Medical or clinical wastes2.6.3.5.1Medical or clinical wastes containing Category A infectious substances shall be assigned to UN2814 or UN 2900 as appropriate. Medical or clinical wastes containing infectious substances in Category B shall be assigned to UN 3291. 2.6.3.5.2 Medical or clinical wastes which are reasonably believed to have a low probability of containing infectious substances shall be assigned to UN 3291. For the assignment, international, regional or national waste catalogues may be taken into account. NOTE:The proper shipping name for UN 3291 is “CLINICAL WASTE, UNSPECIFIED, N.O.S.” or “(BIO) MEDICAL WASTE, N.O.S” or “REGULATED MEDICAL WASTE, N.O.S.”.2.6.3.5.3Decontaminated medical or clinical wastes which previously contained infectious substances are not subject to these Regulations unless they meet the criteria for inclusion in another class. 2.6.3.6 Infected animals2.6.3.6.1 Unless an infectious substance cannot be consigned by any other means, live animals shall not be used to consign such a substance. A live animal which has been intentionally infected and is known or suspected to contain an infectious substance shall only be transported under terms and conditions approved by the competent author

13 Class 7: Radioactive material

13.1 General

13.1.1 All radioactive substances are dangerous because the ionizing radiation emitted by them can damage body tissue and this can result, for example, in cancer or in birth defects.

13.1.2 There is no threshold for the harmful effects of ionizing radiation.

13.1.3 A background of natural ionizing radiation from cosmic and terrestrial sources is always present and it is impossible to avoid being irradiated by these sources.

13.1.4 Irradiation by the electromagnetic component of the ionizing radiation from radioactive material cannot be reduced to zero.

13.1.5 Statutory control over radioactive substances is intended to limit the irradiation that people undergo as a result of activities that involve radioactive substances to levels as low as reasonably achievable, and not exceeding set limits for members of the public and for occupationally exposed persons.

13.1.6 Internationally, radioactive material is regarded as any material that contains radionuclides, where both the activity concentration and the total activity in the consignment exceed the values given in D.1 or in table 12.

13.1.7 For the purposes of this standard, the following radioactive materials are not included in class 7:

a) radioactive material that is an integral part of the means of transport;

b) radioactive material moved within an establishment that is subject to appropriate safety regulations in force in the establishment and where the movement does not involve public roads and railways;

c) radioactive material implanted or incorporated into a person or live animal for diagnosis or treatment;

d) radioactive material in consumer products that have received regulatory approval, following their sale to the end user;

e) natural material and ore that contain naturally occurring radionuclides that are not intended to be processed for use of these radionuclides, provided the activity concentration of the material does not exceed 10 times the value given in D.1; and

f) non-radioactive solid objects with radioactive substances present on any surfaces (contaminants) in quantities not exceeding the 0,4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0,04 Bq/cm^2 for all other alpha emitters.

NOTE Contamination that can be removed from a surface during routine conditions of transport is referred to as "non-fixed contamination". All non-fixed contaminations are referred to as "fixed contamination".

b) source material shall be any substance that contains

1) uranium, expressed as U3O8, in excess of 3 kg and 0.5 % of the mass of the substance, or

2) thorium, expressed as ThO2, in excess of 3 kg and 0.5 % of the mass of the substance, or

3) uranium, depleted in the uranium-235 (U-235) nuclide, in excess of 3 kg;

c) special nuclear material shall be any substance in a quantity such that it consists of, or contains more than 0.5 g of

1) uranium-235 (U-235), or

2) uranium enriched in its U-235 nuclide, or

3) any trans-uranium element; and

d) at the discretion of the National Nuclear Regulator (NNR), activities that involve radioactive material intended for transport can be conducted without being subject to the requirements for obtaining nuclear authorization from the NNR (see 13.2.2.2), provided that

1) the specific activity of the radionuclides in the material involved does not exceed 100 Bq/g, or

2) the total radioactivity involved in a year does not exceed 10 kBq, or

3) the radiation dose does not exceed 1 mSv per year.

13.2.1.3 The Hazardous Substances Act defines a group IV hazardous substance as radioactive material outside a nuclear installation that does not form part of, nor is used, nor is intended to be used, in the nuclear fuel cycle, and that has

a) an activity concentration exceeding 100 Bq/g and a total activity exceeding 4 kBq, or

b) an activity concentration not exceeding 100 Bq/g and a total activity not exceeding 4 kBq, and is used, or is intended to be used for medical, scientific, agricultural, commercial or industrial purposes, and such radioactive material together with any radioactive waste that evolves from it, has been declared a group IV hazardous substance

13.2.2 Authorities responsible for the control of radioactive material

13.2.2.1 General

The authorities given in 13.2.2.2 to 13.2.2.4 (inclusive) are responsible for the control of radioactive material and shall be consulted for information regarding this material and matters pertaining to it.

13.2.2.2 Radiation Protection Board (RPB)

The Radiation Protection Board is a statutory body established under the Act of parliament, the Radiation Protection Act, Cap 243, Laws of Kenya as the national competent authority with the responsibility for protecting the health and safety of people and the environment from the harmful effects of ionizing radiation. It regulates the use of ionizing radiation, exportation, importation, distribution and possession of radiation sources. The Board operates under two subsidiary legislations;

a) The Radiation Protection (standards) Regulations – LN. 54/1986

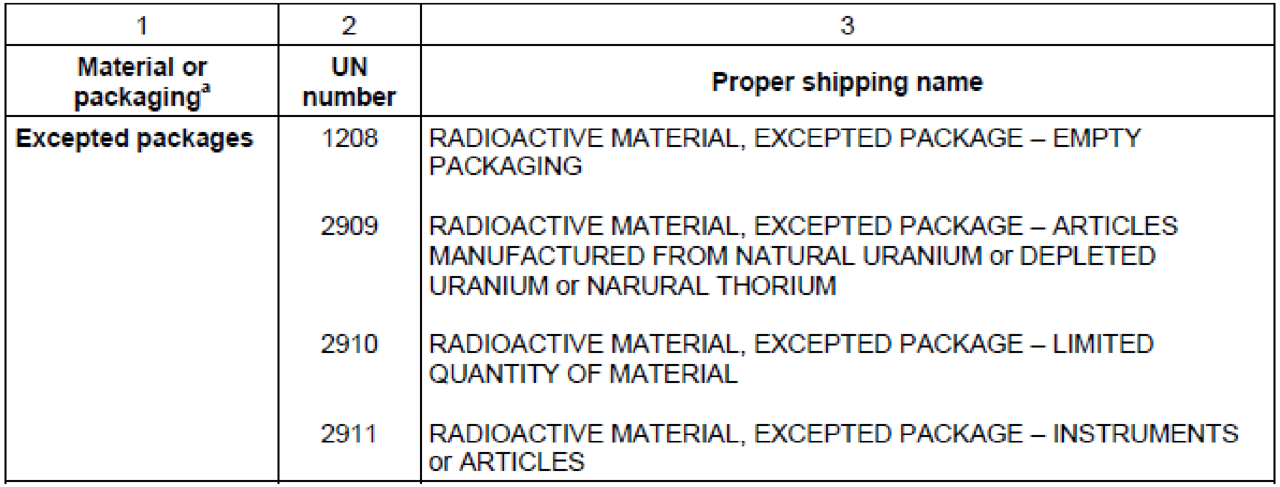
b) The Radiation Protection (structural requirements and inspection of buildings) Regulations LN. 55/1986

13.3 Classification of radioactive material

13.3.1 General

Radioactive material shall be assigned to one of the UN numbers given in table 12, depending on the activity level of the radionuclides contained in a package, the fissile or non-fissile properties of these radionuclides, the type of package intended for transport and the nature or form of the contents of the package, or special arrangements governing the transport operation (see 13.3.11).

Table 12 — Assignment of UN numbers



1	2	3
Material or packaging[a]	**UN number**	**Proper shipping name**
Excepted packages	1208	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – EMPTY PACKAGING
	2909	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NARURAL THORIUM
	2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – LIMITED QUANTITY OF MATERIAL
	2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – INSTRUMENTS or ARTICLES

T able 12 (concluded)

1	2	3
Material or packaging[a]	**UN number**	**Proper shipping name**
Low specific activity radioactive material	2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile-excepted
	3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), non-fissile or fissile-excepted
	3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), non-fissile or fissile-excepted
	3324	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE
	3325	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), FISSILE
Surface contaminated objects	2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), non-fissile or fissile-excepted
	3326	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), FISSILE
Type A packages	2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non-fissile or fissile excepted
	3327	RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE, non-special form
	3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non-fissile or fissile-excepted
	3333	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE
Type B(U) packages	2916	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, non-fissile or fissile-excepted
	3328	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE
Type B(M) packages	2917	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, non-fissile or fissile-excepted
	3329	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, FISSILE
Type C packages	3323	RADIOACTIVE MATERIAL, TYPE C PACKAGE, non-fissile or fissile-excepted
	3330	RADIOACTIVE MATERIAL, TYPE C PACKAGE, FISSILE

13.3.2 Fissile material

13.3.2.1 Fissile material is uranium-233 (U-233), uranium-235 (U-235), plutonium-239 (Pu-239), plutonium-241 (Pu-241), or any combination of these radionuclides.

13.3.2.2 The following radioactive materials are excepted from the definition of fissile material:

a) natural uranium or depleted uranium that has not been irradiated; and

b) natural uranium or depleted uranium that has been irradiated in thermal reactors only.

13.3.3 Low dispersible radioactive material

The term "low dispersible radioactive material" refers to a solid radioactive material, or a solid radioactive material sealed in a capsule that has limited dispersibility and is not in powder form.

13.3.4 Low specific activity (LSA) material

13.3.4.1 Radioactive material that, by its nature, has limited specific activity, or radioactive material to which limits of estimated average specific activity apply, is termed "low specific activity (LSA) material". External shielding materials that surround the LSA material shall not be considered when the estimated average specific activity is being determined. LSA material can be classified into three groups, LSA-I, LSA-II or LSA-III as given in 13.3.4.2 to 13.3.4.4.

13.3.4.2 LSA-I radioactive material comprises of:

a) uranium and thorium ores and concentrates of such ores, and other ores that contain naturally occurring radionuclides, which are intended to be processed for the use of these radionuclides,

b) solid unirradiated natural uranium or depleted uranium, or natural thorium, or their solid or liquid compounds or mixtures,

c) radioactive material for which the A2 value is unlimited, excluding fissile material in quantities not excepted in accordance with the requirements of DEAS 951:2019 for fissile material, or

d) other radioactive material in which the activity is distributed throughout the material and the estimated average specific activity does not exceed 30 times the value for the activity concentration as given in D.1 and table 13, excluding fissile material in quantities not excepted in accordance with the requirements of DEAS 951;2019 for fissile material.

13.3.4.3 LSA-II radioactive material comprises

a) water with a tritium concentration of up to 0.8 TBq/L, or

b) other radioactive material in which the activity is distributed throughout the material and the estimated average specific activity does not exceed 10^{-4} A2/g for solids and gases, and 10^{-5} A2/g for liquids.

13.3.4.4 LSA-III radioactive material comprises solids, for example consolidated wastes and activated materials, excluding powders, in which

a) the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent, such as concrete, bitumen or ceramic,

b) the radioactive material is relatively insoluble, or is intrinsically contained in a relatively insoluble matrix, so that, even under loss of packaging, the loss of radioactive material per package by leaching when placed in water for 7 days, would not exceed 0.1 A2, and

c) the estimated average specific activity of the solid, excluding any shielding material, does not exceed 2 × 10−3 A2/g.

13.3.5 Low-toxicity alpha emitters

Low-toxicity alpha emitters are natural or depleted uranium, natural thorium, (U-235, U-238, Th-228, Th-230 or Th-232) contained in ores or physical and chemical concentrates, or alpha emitters with a half-life of less less than 10 days.

13.3.6 Special form radioactive material

13.3.6.1 Special form radioactive material is either

a) an indispersible solid radioactive material, or

b) a sealed capsule that contains radioactive material and is so manufactured that it can only be opened by destroying the capsule.

13.3.6.2 Special form radioactive material shall have at least one dimension of not less than 5 mm.

13.3.7 Surface contaminated objects (SCOs)

13.3.7.1 A surface contaminated object (SCO) is a solid object that is not in itself radioactive, but that has radioactive material distributed on its surfaces. An SCO can be classified into two groups, i.e. SCO-I or SCO-II (see 13.3.7.2 and 13.3.7.3).

13.3.7.2 SCO-I is a solid object on which;

a) the non-fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2), does not exceed

1) 4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or

2) 0.4 Bq/cm^2 for all other alpha emitters, and

b) the fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2), does not exceed

  1) 4×10^4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or

  2) 4×10^3 Bq/cm^2 for all other alpha emitters, and

c) the non-fixed contamination plus the fixed contamination (see the note to 13.1.7(f)) on the inaccessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2), does not exceed;

1) 4×10^4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or

2) 4×10^3 Bq/cm^2 for all other alpha emitters.

13.3.7.3 SCO-II is a solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in 13.3.7.2, and on which

a) the non-fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2), does not exceed

  1) 400 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or

  2) 40 Bq/cm^2 for all other alpha emitters, and

b) the fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2), does not exceed

1) 8×10^5 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or

2) 8×10^4 Bq/cm^2 for all other alpha emitters, and

c) the non-fixed contamination plus the fixed contamination on the inaccessible surface, averaged over 300 m^2 (or the area of the surface if less than 300 cm^2), does not exceed

1) 8×10^5 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or

2) 8×10^4 Bq/cm^2 for all other alpha emitters.

13.3.8 Uranium hexafluoride

Uranium hexafluoride shall only be assigned to UN 2977, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE FISSILE, or UN 2978, RADIOACTIVE MATERIAL, URANUM HEXAFLUORIDE, non-fissile or fissile-excepted, UN 3507, URANIUM HEXAFLUORIDE, radioactive material, excepted package less than 0.1 kg per package non-fissile or fissile-excepted. (see also table 12).

13.3.9 Unirradiated thorium

Unirradited thorium is thorium that contains not more than 10^{-7} g of U-233 per gram of thorium-232.

13.3.10 Unirradiated uranium

Unirradiated uranium is uranium that contains not more than 2×10^3 Bq of plutonium per gram of U-235, not more than 9×10^6 of fission products per gram of U-235 and not more than 5×10^{-3} g of U-236 per gram of U-235.

13.3.11 Natural, depleted and enriched uranium

Natural, depleted and enriched uranium are as follows:

a) natural uranium — uranium (that could be chemically separated) that contains the naturally distribution of uranium isotopes (approximately 99. 28 % U-238 and 0.72 %, U-235, by mass),

b) depleted uranium — uranium that contains less U-235 than that of natural uranium, and

c) enriched uranium — uranium that contains more than 0.72 % U-235, by mass.

NOTE In all cases, a very small mass percentage of U-235 is present.

13.3.12 Special arrangements

Radioactive material shall be classified as transported under special arrangement when it does not meet all the requirements of this standard but has been approved by the competent authority.

13.4 Basic radionuclide values

13.4.1 Basic radionuclide values for individual radionuclides

13.4.1.1 The basic radionuclide values for individual radionuclides are listed in D.1. The determination of their basic radionuclide values shall require competent authority approval or, for international transport, multilateral approval. It is permissible to use the A2 value related to its solubility class as recommended by the International Commission on Radiological Protection, provided that the chemical form under both normal and accident conditions of transport is taken into consideration.

13.4.1.2 In the case of a radionuclide not listed in D.1, a single radionuclide decay chain in which the radionuclides are present in their naturally occurring proportions, and in which no daughter nuclide has a half-life either longer than 10 days, or longer than that of the parent nuclide, shall be regarded as a single radionuclide. Furthermore, the activity to be taken into account, and the A1 and A2 values to be applied, shall be those corresponding to the parent nuclide of that chain (also see 13.4.2.2).

13.4.2 Basic radionuclide values for unknown radionuclides or mixtures

13.4.2.1 The basic radionuclide values for unknown radionuclides or mixtures are given in table 13. Contrary to individual radionuclides (see 13.4.1.1), the basic radionuclide values for unknown radionuclides or mixtures can be used without obtaining competent authority approval.

13.4.2.2 In the case of radioactive decay chains in which any daughter nuclide has a half-life either longer than 10 days or a half-life exceeding that of the parent nuclide, the parent and such daughter nuclides shall be considered mixtures of different nuclides.

Table 13 — Basic radionuclide values for unknown radionuclides or mixtures

1	2	3	4	5
Radioactive contents	**A_1** TBq	**A_2** TBq	**Activity concentration for exempt material** Bq/g	**Activity limits for exempt consignments** Bq
Only beta or gamma emitting nuclides are known to be present	0,1	0,02	1×10^1	1×10^4
Only alpha emitting nuclides are known to be present	0,2	9×10^{-5}	1×10^{-1}	1×10^3
Neutron emitting nuclides are known to be present or no relevant data are available	1×10^{-3}	9×10^{-5}	1×10^{-1}	1×10^3

13.4.2.3 In the case of material that contains mixtures of known radionuclides (see D.1), the A1 or A2 value for the material can be derived by applying the following formula:

$$A_m = \frac{1}{\sum_i \frac{g_{(i)}}{A_{(i)}}}$$

where

A_m is the derived value of A_1 or A_2 for the material that contains a mixture of radionuclides, in becquerels;

$g_{(i)}$ is the fraction of the activity of radionuclide *i* in the mixture;

$A_{(i)}$ is the appropriate value of A_1 or A_2 for the radionuclide *i*, in becquerels.

A_m is the derived value of A_1 or A_2 for the material that contains a mixture of radionuclides, in becquerels;

13.4.2.4 When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides can be grouped. Groups can be based on the total alpha activity and the total beta or gamma activity when these are known, using the lowest radionuclide values for the alpha emitters or the beta or gamma emitters, respectively.

14 Class 8: Corrosive substances

14.1 General

Corrosive substances are solids or liquids that, by chemical action, severely damage living tissue. The leakage of such a substance from its packaging can also damage, or even destroy, other cargo or the means of transport.

14.2 Volatility and toxicity of corrosive substances

14.2.1 Many corrosive substances are sufficiently volatile to emit vapours that irritate the nose and eyes. When decomposed at very high temperatures, certain corrosive substances can emit toxic gases. In addition to acting destructively when in contact with the skin or with mucous membranes, some corrosive substances of class 8 are toxic. Poisoning can result if they are swallowed or if their vapours are inhaled, and some of them can even penetrate the skin.

14.2.2 A substance or preparation that complies with the criteria of class 8 and has an inhalation toxicity (LC_{50}) for dusts and mists in the range of packing group I, but toxicity through ingestion or dermal contact in the range of packing group III, shall be allocated to class 8 (see also 12.1.1.6 and 12.1.4.3).

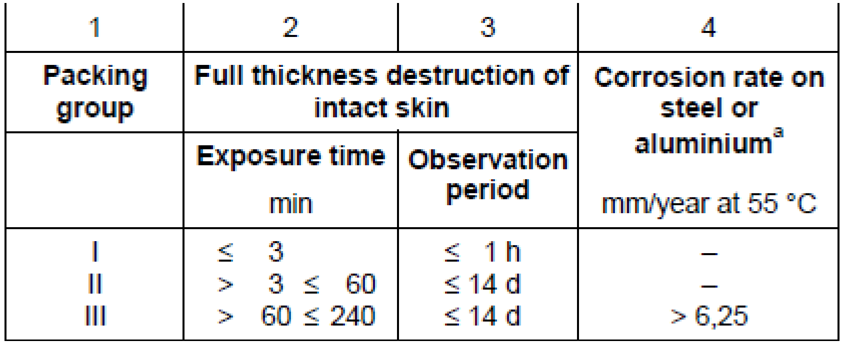
14.2.3 All substances in class 8 have a more or less destructive effect on materials such as metals and textiles. Many substances in this class become corrosive only after having reacted with water or with moisture in the air. The reaction between water and many substances of class 8 is accompanied by the emission of irritating and corrosive gases. Such gases usually become visible as fumes in the air.

14.3 Packing group criteria for corrosive substances

14.3.1 The allocation of corrosive substances to packing groups has been based on experience and on additional factors such as inhalation risk, reactivity with water and the formation of dangerous decomposition products. Substances, including mixtures, are classified on the basis of the length of time of contact necessary to produce full thickness destruction of human skin tissue (see 14.3.2 and table 14). Substances that do not cause full thickness destruction of the intact skin shall still be considered corrosive owing to their potential to corrode metal surfaces.

14.3.2 In assigning the packing group to a substance, account shall be taken of human experience in instances of accidental exposure. In the absence of human experience, the packing group shall be determined by a test conducted on the healthy intact skin of an animal in accordance with OECD Test Guideline 404 or 435. If full thickness destruction of healthy intact skin is not caused, a corrosion rate test on steel or aluminium surfaces can be performed (see section 37, part III of the United Nations' Manual of tests and criteria).

Table 14 — Packing groups for corrosives



1	2	3	4
Packing group	**Full thickness destruction of intact skin**		**Corrosion rate on steel or aluminium**[a] mm/year at 55 °C
	Exposure time min	**Observation period**	
I	≤ 3	≤ 1 h	–
II	> 3 ≤ 60	≤ 14 d	–
III	> 60 ≤ 240	≤ 14 d	> 6,25

15 Class 9: Miscellaneous dangerous substances and articles, including environmentally hazardous substances pick from UN document as is

15.1 General

They are substances and articles which during transport present a danger not covered by other classes.

The following substances are included in class 9:

a) liquids or solids that has anaesthetic, noxious or other similar properties that could cause extreme annoyance or discomfort to humans and animals;

b) magnetized material that, when packaged as for transport, has a magnetic field strength of 0.159 A/m or more at a distance of 2.1 m from any point on the surface of the assembled package;

c) miscellaneous substances and articles, for example, asbestos, dry ice, life-saving appliances (for example, air bags and seatbelt pretentioners), internal combustion engines, polymeric beads, battery-powered vehicles, lithium batteries, electric wheelchairs and zinc dithionite;

d) substances at elevated temperature, i.e. liquids that are transported at a temperature of not less than 100 °C and solids that are transported at a temperature of not less than 240 °C;

e) environmentally hazardous substances (see 15.2) and waste; and

f) GMMOs or GMOs that do not meet the definition of infectious substances of division 6.2 (see 12.2), but that are capable of altering animals, plants or microbiological substances in a way not normally the result of natural reproduction. They shall be assigned to UN 3245.

NOTE GMMOs or GMOs are not subject to the requirements of this standard when authorized for use by the national authorities of the Governments of the countries of origin, transit and destination.

15.2 Environmentally hazardous substances

15.2.1 General

15.2.1.1 For the purposes of this standard, environmentally hazardous substances are considered in terms of aquatic organisms that live in water and the aquatic ecosystem of which they are part. It does not include aquatic pollutants for which there may be a need to consider effects beyond the aquatic environment, for example the impact on human health. The basis of the identification of hazard is the aquatic toxicity of the substance or mixture, although this might be modified by further information on degradation and bioaccumulation behaviour.

15.2.1.2 While the classification procedure is intended to apply to all substances and mixtures, special guidance is needed for metals and poorly water-soluble inorganic compounds.

15.2.1.3 The basic elements used for the classification of environmentally hazardous substances as hazardous to the aquatic environment are:

a) acute aquatic toxicity (see 15.2.1.5);

b) bioaccumulation (see 15.2.1.6);

c) degradation (abiotic or biotic) for organic chemicals (see 15.2.1.7 and 15.2.1.8); and

d) chronic aquatic toxicity (see 15.2.1.9).

15.2.1.4 The toxicity data on freshwater species and marine species are considered equivalent data for the classification of substances and mixtures as hazardous to the aquatic environment. The relevant test methods set out in the OECD Test Guidelines shall be used for the classification of a substance or a mixture in accordance with the principles of GLP. Where such data are not available, classification shall be based on the best available data.

NOTE The competent authority may approve other test methods, for example, ASTM methods, if adequate justification has been provided.

15.2.1.5 The acute toxicity shall be determined by exposing the following aquatic species to the test substance:

a) a fish population (see OECD Test Guideline 203);

b) a crustacea species (daphnia or water flea) (see OECD Test Guideline 202); or

c) an algal species (or other water plants) (see OECD Test Guideline 201).

NOTE These species are considered surrogates for all aquatic organisms and data on other species such as *Lemna* may also be considered if the test methodology is suitable.

15.2.1.6 The potential for bioaccumulation can be determined by using the octanol/water partition coefficient, usually reported as a log K_{ow} and determined in accordance with OECD Test Guideline 107 or OECD Test Guideline 117. While this represents a potential to bio-accumulate, a bio-concentration factor (BCF), determined experimentally in accordance with OECD Test Guideline 305, provides a better measure and should be used in preference when available.

15.2.1.7 Environmental degradation could be biotic or abiotic, for example, hydrolysis. Biodegradation in fresh water shall be determined by means of OECD Test Guideline 301 (A-F). A pass level is regarded as indicative of rapid degradation in most aquatic environments. However, OECD Test Guideline 306 is more suitable for the marine environment. Where such data are not available, a substance or mixture is considered readily degradable if the ratio BOD_5/COD is greater than 0.5. Abiotic degradation such as hydrolysis, primary degradation, both abiotic and biotic, degradation in non-aquatic media and proven rapid degradation in the environment may all be taken into account in defining rapid degradability.

NOTE BOD_5 is the biochemical oxygen demand over a period of 5 days.

15.2.1.8 A substance is considered rapidly degradable in the aquatic environment if the following criteria are met:

a) if, in a 28 days biodegradation study, the following levels of degradation are achieved:

  1) tests based on dissolved organic carbon: 70 %; and

  2) tests based on oxygen depletion or carbon dioxide generation: 60 % of the theoretical maxima.

These levels of biodegradation shall be achieved within 10 days of the start of degradation, which is taken as the point at which 10 % of the substance has been degraded; or

b) the ratio BOD_5/COD is equal to or greater than 0.5 (in cases where only BOD and COD data are available); or

c) other convincing scientific evidence is available to demonstrate that the substance or mixture can be degraded biotically or abiotically (or both) in the aquatic environment to a level above 70 % within a 28 days period.

15.2.1.9 Chronic toxicity data are less available than acute toxicity data and the range of testing procedures for chronic toxicity is less standardized. However, data generated in accordance with OECD Test Guidelines 201, 210 and 211 are acceptable. The “no observed effect concentrations” (NOECs) or other equivalent $L(E)C_x$ shall be used.

15.2.2 Classification criteria for substances

15.2.2.1 General

A substance shall be classified as an “environmentally hazardous substance (aquatic environment)”, if it satisfies the criteria for acute category 1 and chronic categories 1 or 2 in accordance with 15.2.2.2 and 15.2.2.3.

15.2.2.2 Acute toxicity

A substance hazardous to the environment shall be assigned to acute category 1 if the following requirements are met:

a) 96 h LC_{50} (for fish) ≤ 1 mg/l; or

b) 48 h EC_{50} (for crustacea) ≤ 1 mg/l; or

c) 72 h or 96 h ErC_{50} (for algae or other aquatic plants) ≤ 1 mg/l (or any combination of these).

15.2.2.3 Chronic toxicity

A substance hazardous to the environment shall be assigned to chronic category 1 or chronic category 2 if the requirements given in table 15 are met.

Table 15 — Classification criteria for chronic categories 1 and 2 toxicity

1	2
Non-repidly degradable substances for which there are adequate chronic toxicity data available	
Chronic categories	**Classification criteria**
1	Chronic NOEC or EC_x (for fish) ≤ 0,1 mg/L; or Chronic NOEC or EC_x (for crustacean) ≤ 0,1 mg/L; or Chronic NOEC or EC_x (for algae or other aquatic plants) ≤ 0,1 mg/L (or any combination of these)
2	Chronic NOEC or EC_x (for fish) ≤ 1 mg/L; or Chronic NOEC or EC_x (for crustacean) ≤ 1 mg/L; or Chronic NOEC or EC_x (for algae or other aquatic plants) ≤ 1 mg/L (or any combination of these)
Repidly degradable substances for which there are adequate chronic toxicity data available	
Chronic categories	**Classification criteria**
1	Chronic NOEC or EC_x (for fish) ≤ 0,1 mg/L; or Chronic NOEC or EC_x (for crustacean) ≤ 0,01 mg/L; or Chronic NOEC or EC_x (for algae or other aquatic plants) ≤ 0,1 mg/L (or any combination of these)
2	Chronic NOEC or EC_x (for fish) ≤ 0,1 mg/L; or Chronic NOEC or EC_x (for crustacean) ≤ 0,1 mg/L; or Chronic NOEC or EC_x (for algae or other aquatic plants) ≤ 0,1 mg/L (or any combination of these)
Substance for which adequate chronic toxic data are not available	
Chronic categories	**Classification criteria**
1	96 h LC_{50} (for fish) ≤ 1 mg/L; or
	48 h EC_{50} (for crustacea) ≤ 1 mg/L; or
	72 h or 96 h ErC_{50} (for algae or other aquatic plants) ≤ 1 mg/L and the substance is not rapidly degradable; or the experimentally determined BCF ≥ 500 (or if absence of log K_{ow} ≥ 4) (or any combination of these).
2	96 h LC_{50} (for fish) >1 to ≤ 10 mg/L; or
	48 h EC_{50} (for crustacea) >1 to ≤ 10 mg/L; or
	72 h or 96 h ErC_{50} (for algae or other aquatic plants) >1 to ≤ 10 mg/L and the substance is not rapidly degradable; or the experimentally determined BCF ≥ 500 (or if absence of log K_{ow} ≥ 4) (or any combination of these).

15.2.3 Classification criteria for mixtures

15.2.3.1 General

15.2.3.1.1 Mixtures are assigned to the same classification categories as for substances, i.e. acute category 1, and chronic categories 1 and 2.

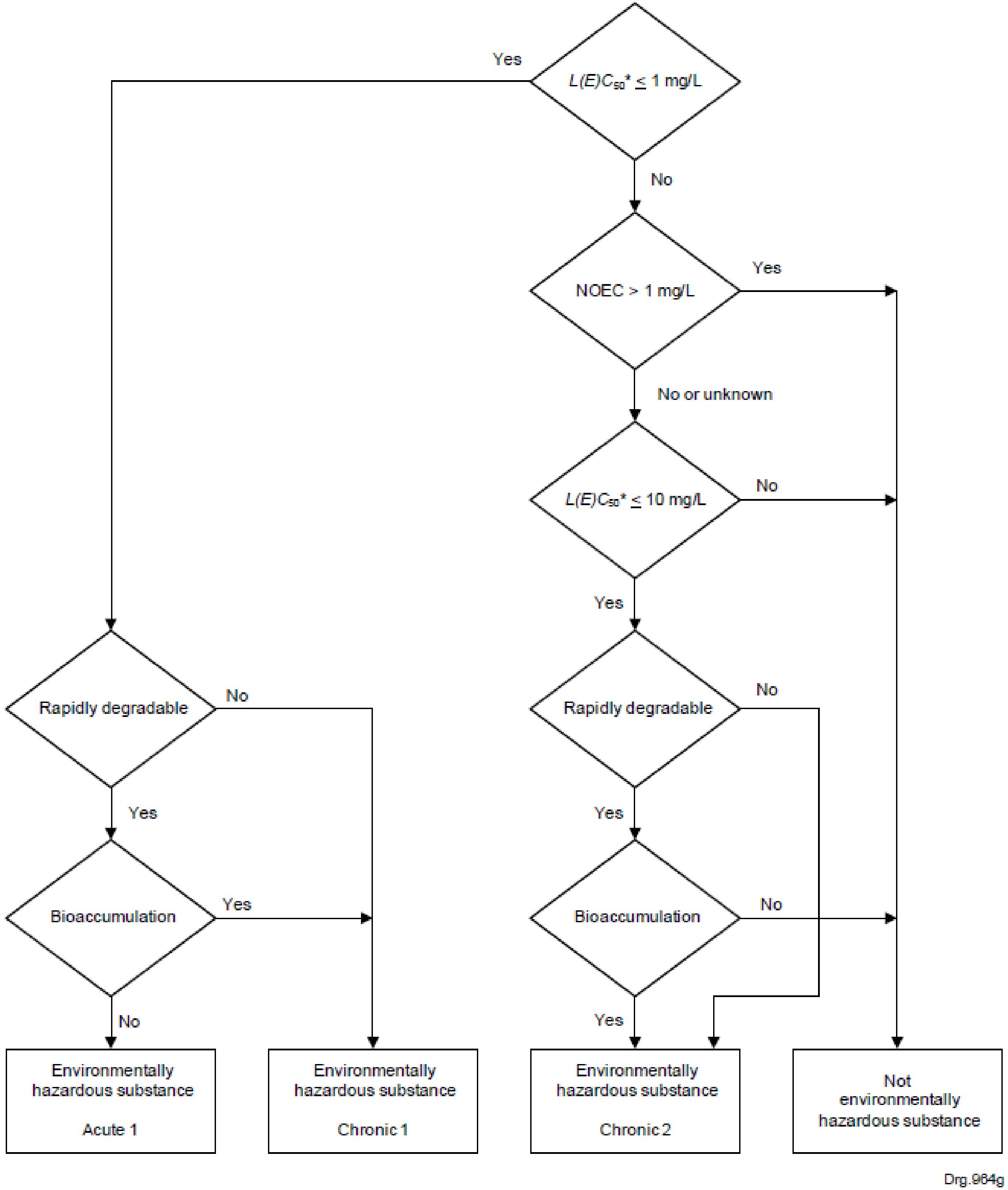
15.2.3.1.2 The “relevant components” of a mixture are those substances present in the mixture at a concentration equal to or greater than 1 % (by mass), unless there is a presumption (for example, in the case of highly toxic components) that a component present at less than 1 % (by mass), is still relevant for classification of the mixture for aquatic environmental hazards.

15.2.3.1.3 The approach for the classification of mixtures as hazardous to the aquatic environmental is tiered and is dependent upon the type of information available for the mixture itself and for its components (see figures 6 and 7). Elements of the tiered approach include:

a) classification based on tested mixtures;

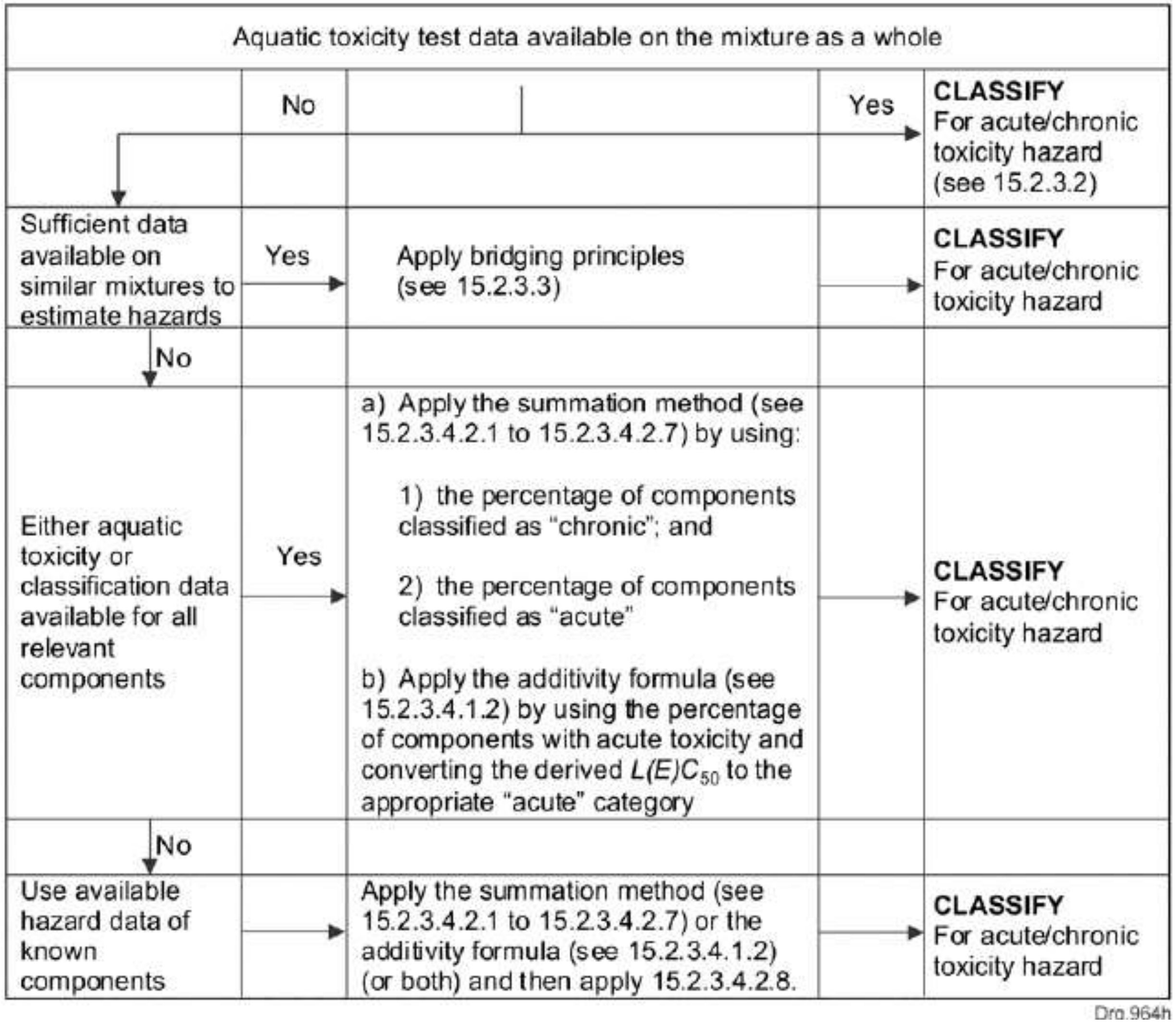
b) classification based on bridging principles (see 15.2.3.3); and

c) the use of “summation of classified components” (see 15.2.3.4.2)” or an “additivity formula” (see15.2.3.4.1.2) (or both).



* Lowest value of 96 h LC_{50}, 48 h EC_{50} or 72 h or 96 h ErC_{50}, as appropriate

Figure 6 — Scheme of procedure for the classification of an environmentally hazardous substance or mixture



Aquatic toxicity test data available on the mixture as a whole

CLASSIFY For acute/chronic toxicity hazard (see 15.2.3.2)

Sufficient data available on similar mixtures to estimate hazards

Apply bridging principles (see 15.2.3.3)

CLASSIFY For acute/chronic toxicity hazard

Either aquatic toxicity or classification data available for all relevant components

a) Apply the summation method (see 15.2.3.4.2.1 to 15.2.3.4.2.7) by using:

1) the percentage of components classified as "chronic"; and

2) the percentage of components classified as "acute"

b) Apply the additivity formula (see 15.2.3.4.1.2) by using the percentage of components with acute toxicity and converting the derived $L(E)C_{50}$ to the appropriate "acute" category

CLASSIFY For acute/chronic toxicity hazard

Use available hazard data of known components

Apply the summation method (see 15.2.3.4.2.1 to 15.2.3.4.2.7) or the additivity formula (see 15.2.3.4.1.2) (or both) and then apply 15.2.3.4.2.8.

CLASSIFY For acute/chronic toxicity hazard

Figure 7 — Tiered approach to classification of mixtures for acute and chronic aquatic environmental hazards

15.2.3.2 Classification of mixtures when data are available for the complete mixture

15.2.3.2.1 When a mixture as a whole has been tested to determine its aquatic toxicity, it shall be classified in accordance with the acute toxicity criteria that have been agreed on for substances, based on the data for fish, crustacea and algae/plants. It is not possible to use LC50 or EC50 data for the classification of a mixture as a whole for chronic toxicity since both toxicity data and environmental fate data are needed. At present no degradability and bioaccumulation data are available for mixtures as a whole. Furthermore, it is not possible to apply the criteria for chronic classification because the data from degradability and bio-accumulation tests of mixtures cannot be interpreted; they are meaningful only for single substances.

15.2.3.2.2 The acute toxicity test data (LC50 or EC50) for a mixture as a whole as well as information with respect to the classification of components for chronic toxicity, for example, NOEC if available, shall be used for the classification of a mixture as indicated in 15.2.3.2.3 to 15.2.3.2.6.

15.2.3.2.3 A mixture with an experimental L(E)C50 (LC50 or EC50) value equal to or less than 1 mg/L and an NOEC of the tested mixture equal to or less than 1,0 mg/L, or unknown, shall be classified as:

a) acute category 1; or

b) chronic categories 1 or 2 by means of the summation methods (see 15.2.3.4.2.4 to 15.2.3.4.2.7); or

c) no need for chronic classification if the mixture is not classified as chronic category 1.

15.2.3.2.4 A mixture with an experimental L(E)C50 (LC50 or EC50) value equal to or less than 1 mg/L and an NOEC greater than 1,0 mg/L shall be classified as:

a) acute category 1; or

b) chronic category 1 by means of the summation methods (see 15.2.3.4.2.4 to 15.2.3.4.2.7); or

c) no need for chronic classification if the mixture is not classified as chronic category 1.

15.2.3.2.5 A mixture with an experimental L(E)C50 (LC50 or EC50) value greater than 1 mg/L, or above the water solubility, and an NOEC equal to or less than 1,0 mg/L, or unknown, shall be classified as:

a) no need to classify for acute toxicity; or

b) chronic category 2 by means of the summation methods (see 15.2.3.4.2.4 to 15.2.3.4.2.7); or

c) no need to classify for chronic toxicity if the mixture is not classified as chronic category 2.

15.2.3.2.6 A mixture with an experimental L(E)C50 (LC50 or EC50) greater than 1 mg/L, or above the water solubility, and an NOEC of greater than 1,0 mg/L need not be classified for acute or chronic toxicity.

15.2.3.3 Bridging principles for the classification of mixtures when data are not available for the complete mixture

15.2.3.3.1 General

Where the mixture itself has not been tested to determine its aquatic environmental hazard but there are sufficient data on the individual components and similar tested mixtures to adequately characterize the hazards of the mixture, these data shall be used in accordance with the bridging principles given in 15.2.3.3.2 to 15.2.3.3.6. This ensures that the available data are used to the greatest extent possible in characterizing the hazards of the mixture without the necessity for additional animal testing.

15.2.3.3.2 Dilution

15.2.3.3.2.1 If a mixture is formed by diluting another classified mixture or a substance with a component that has an equivalent or lower aquatic hazard classification than the least toxic original component and that is not expected to affect the aquatic hazards of other components, then the new mixture shall be classified as equivalent to the original mixture or substance.

15.2.3.3.2.2 If a mixture is formed by diluting another classified mixture or a substance with water or another non-toxic material, the toxicity of the new mixture shall be calculated from the original mixture or substance.

15.2.3.3.3 Batching

The aquatic hazard classification of one production batch of a complex mixture is assumed to be substantially equivalent to that of another production batch of the same commercial product and produced by, or under the control of, the same manufacturer, unless there is reason to believe there is significant variation such that the aquatic hazard classification of the batch has changed. If the latter occurs, a new classification is necessary.

15.2.3.3.4 Concentration of mixtures classified as acute category 1 and chronic category 1

If a mixture is classified as acute category 1 or chronic category 1 (or both), and components of the mixture are classified as acute category 1 or chronic 1 (or both) are further concentrated, the more concentrated mixture shall be classified with the same hazard category as the original mixture without additional testing.

15.2.3.3.5 Interpolation within one toxicity category

In the case of two mixtures with identical ingredients where mixture A and mixture B are in the same classification category and mixture C contains the same toxicologically active components but at concentrations intermediate to those in mixture A and mixture B, then mixture C shall be in the same category as mixture A and mixture B.

NOTE The identity of the components is the same in all three mixtures.

15.2.3.3.6 Substantially similar mixtures

In the case of two mixtures (A + B) and (C + B) where

a) the concentration of component B is the same in both mixtures,

b) the concentration of component A equals that of component C,

c) the classification of component A and component C are available and are the same, i.e. they are in the same hazard category and are not expected to affect the aquatic toxicity of B, and

d) mixture (A + B) has already been classified by testing, then there shall be no need to test mixture (C + B) and both mixtures shall be classified in the same hazard category.

15.2.3.4 Classification of mixtures when data are available for all components or only for some components

15.2.3.4.1 General

15.2.3.4.1.1 The classification of a mixture is based on summation of the classification of its components. Therefore, the percentage of components classified as “acute” or “chronic” feeds straight into the summation method (see 15.2.3.4.2).

15.2.3.4.1.2 A mixture is often a combination of components that are classified as acute category 1 and chronic category 1 or chronic category 2 (or both), and components for which test data are available. When toxicity data are available for more than one component in the mixture, the combined toxicity of those components shall be calculated by using the additivity formula shown below. The calculated toxicity shall be used to assign an acute hazard category to that portion of the mixture for subsequent use in applying the summation method.

$$\frac{\sum C_i}{L(E)C_{50m}} = \sum_n \frac{C_i}{L(E)C_{50i}}$$

where

C_i is the concentration of component “i” in percentage by mass;

$L(E)C50_i$ is the LC50 or EC50 for component “i” in milligrams per litre;

n is the number of components, and “i” is running from 1 to n;

$L(E)C50_m$ is the L(E)C50 of the part of the mixture with test data.

15.2.3.4.1.3 When the additivity formula is applied to a part of a mixture, the toxicity of this part of the mixture shall be calculated by using the toxicity values for each substance that relates to the same species (fish, daphnia or algae). The highest toxicity (lowest value) obtained, i.e. the most sensitive of the three species, shall be used for classification. However, when toxicity data for each component are not available in the same species, the toxicity value of each component shall be selected in the same manner that toxicity values are selected for the classification of substances, i.e. the higher toxicity (from the most sensitive test organism) shall be used. The calculated acute toxicity shall then be used to classify this part of the mixture as acute category 1 by using the same criteria as described for substances in 15.2.2.

15.2.3.4.1.4 If a mixture is classified by more than one method, then the method yielding the more conservative result shall be used.

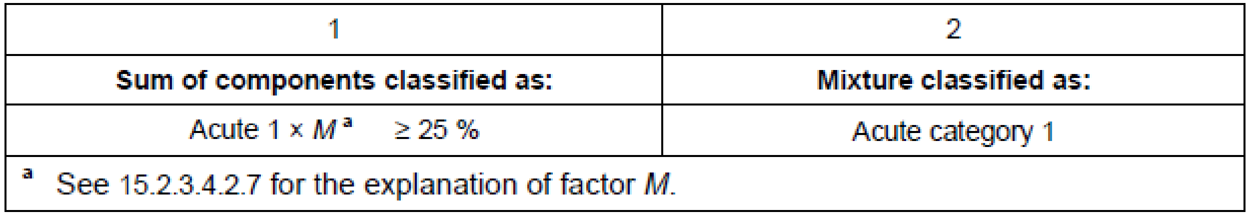
15.2.3.4.2 Summation method

15.2.3.4.2.1 In general, a more severe classification for a mixture overrides a less severe classification, for example, a classification of chronic category 1 overrides a classification of chronic category 2. As a consequence, the classification is completed if the results of the classification procedure indicate chronic category 1. A more severe classification than chronic category 1 is not possible and therefore no further classification procedure is necessary.

15.2.3.4.2.2 All components of a mixture classified as acute category 1 shall be taken into account for the classification of a mixture. If the sum of these components is greater than 25 %, the mixture shall be classified as acute category 1. If the result of the calculation (see 15.2.3.4.1.2) shows a classification of the mixture as acute category 1, the classification process is complete.

15.2.3.4.2.3 The classification of a mixture for acute hazards to the aquatic environment, based on the summation of the classified components, is given in table 16.

Table 16 — Classification of mixtures for acute hazards to the aquatic environment, based on the summation of classified components



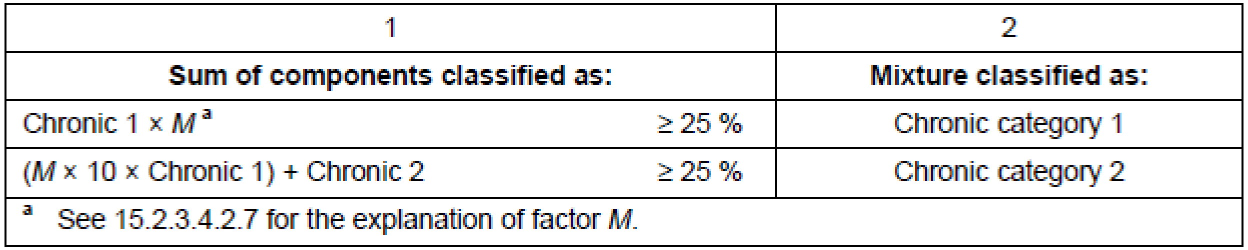
1	2
Sum of components classified as:	**Mixture classified as:**
Acute 1 × *M* [a] ≥ 25 %	Acute category 1

[a] See 15.2.3.4.2.7 for the explanation of factor *M*.

15.2.3.4.2.5 In cases where a mixture is not classified as chronic category 1, classification of the mixture as chronic caregory 2 shall be considered. A mixture shall be classified as chronic category 2 if 10 times the sum of all components classified as chronic category 1, plus the sum of all components classified as chronic category 2 is equal to or greater than 25 %. The classification process is completed when the result of the calculation shows a classification of chronic category 2.

15.2.3.4.2.6 The classification of a mixture for chronic hazards to the aquatic environment, based on the summation of the classified components, is given in table 17.

Table 17 — Classification of a mixture for chronic hazards, based on summation of classified components



1		2
Sum of components classified as:		**Mixture classified as:**
Chronic 1 × M [a]	≥ 25 %	Chronic category 1
(M × 10 × Chronic 1) + Chronic 2	≥ 25 %	Chronic category 2

[a] See 15.2.3.4.2.7 for the explanation of factor M.

15.2.3.4.2.7 Components of a mixture classified as acute category 1 and with toxicities well below 1 mg/L might influence the toxicity of the mixture and shall be given increased weight in applying the summation of classification approach. When a mixture contains components classified as acute category 1 or chronic category 1, the tiered approach (see 15.2.3.1.3 and figure 7) shall be applied using a weighted sum by multiplying the concentrations of acute category 1 components by a factor, instead of merely adding up the percentages. This means that the concentration of “Acute 1” in column 1 of table 16 and the concentration of “Chronic 1” in column 1 of table 17 are multiplied by the appropriate multiplying factor given in table 18. Therefore, in order to apply the summation method, the correct value of the factor M shall be used for the classification of a mixture that contains acute category 1 or chronic category 1 (or both) components.

Alternatively, the additivity formula (see 15.2.3.4.1.2) may be used when toxicity data are available for all highly toxic components in the mixture and there is convincing evidence that all other components, including those for which specific acute toxicity data are not available, are of low or no toxicity and do not significantly contribute to the aquatic environmental hazard of the mixture.

Table 18 — Multiplication factors for highly toxic components of mixtures

1	2
Toxicity $L(E)C_{50}$	**Multiplication factor** (*M*)
$0,1 < L(E)C_{50} \leq 1$	1
$0,01 < L(E)C_{50} \leq 0,1$	10
$0,001 < L(E)C_{50} \leq 0,01$	100
$0,0001 < L(E)C_{50} \leq 0,001$	1 000
$0,00001 < L(E)C_{50} \leq 0,0001$	10 000
(continue in factor 10 intervals)	

15.2.3.4.2.8 When no usable information on the acute or the chronic (or both) aquatic hazard is available for one or more components, the mixture cannot be attributed a definitive hazard category or categories. In such a case, classification shall be based on the known components only and with the additional statement “x percent of the mixture consists of a component or components of unknown hazards to the aquatic environment”.

15.2.3.5 Substances or mixtures dangerous to the aquatic environment not otherwise classified

15.2.3.5.1 Substances or mixtures dangerous to the aquatic environment not otherwise classified under classes 2 to 6 and class 8, shall be designated:

a) UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. or

b) UN 3082 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.

15.2.3.5.2 Environmentally hazardous substances (UN 3077 and UN 3082), shall be assigned to packing group III.

16 Classification of dangerous substances and goods not listed in this standard

16.1 General

16.1.1 B.2 and annex C list the dangerous goods most commonly transported, but these lists are not exhaustive. It is intended that the lists cover, as far as practical, all dangerous substances of commercial importance.

16.1.2 A generic or N.O.S. entry can be used for a substance or an article that is not specifically named in this standard. The dangerous properties of the substance or article should first be determined and then it should be classified in accordance with class definitions and test criteria that cover all the subsidiary risks inherent in the substance.

16.1.3 Classification is necessary for the selection of the N.O.S. entry and the corresponding identification number that most accurately describes the substance within its class and subsidiary risk category. A substance should therefore be classified under the more accurate description rather than under a general description, for example, a flammable liquid of class 3 that is known to be an aldehydeshall be classified as Aldehydes N.O.S. (UN 1989) rather than as Flammable liquids N.O.S. (UN 1993).

16.2 Suspected explosives and substances prohibited from transport

16.2.1 Any substance or article that has or is suspected of having explosive characteristics shall first be considered for inclusion in class 1.

16.2.2 If there is any doubt about classification, packing group or UN number, the competent authority shall be consulted.

16.2.3 B.2 and annex C do not include goods that are so dangerous that their transport is prohibited.
Such goods can only be transported with special authorization. Unless otherwise specified by this
standard, any substance or article that is liable to explode, react dangerously, produce a flame or dangerous evolution of heat, or dangerous emission of toxic, corrosive or flammable gases or vapours under normal conditions of transport, is prohibited from transport.

16.3 Collective entries for response action

16.3.1 Practical considerations prohibit the listing of all dangerous goods by name in this standard. A generic or N.O.S. classification shall therefore be used (see 16.1, 16.2 and clause 17).

16.3.2 Because of the highly generic nature of some of these collective entries, neither the entry itself nor its corresponding UN number provides sufficient information about such dangerous goods to ensure that appropriate response action is initiated in the event of an incident. For this reason it is considered necessary to supplement the generic or N.O.S. entry with the technical name of the substance and the applicable packing group.

16.3.3 The technical name shall be shown in parentheses immediately after the proper shipping name, unless, in the case of a controlled substance, a national law or international convention prohibits its disclosure. For explosives of class I, the dangerous goods description may be supplemented by additional descriptive text to indicate commercial or military names. The technical name shall be a recognized chemical or other name currently used in scientific and technical handbooks, journals and texts. Trade names shall not be used for this purpose. In the case of pesticides, only ISO approved names, or names in The WHO recommended classification of pesticides by hazard and guidelines to classification, or the name(s) of the active substance(s) may be used.

Examples of a proper shipping name supplemented with the technical name of the goods for N.O.S. entries are:

a) UN 2902 PESTICIDE, LIQUID, TOXIC, N.O.S. (drazoxolon); and

b) UN 3394 ORGANOMETALLIC SUBSTANCE, LIQUID, PYROPHORIC, WATER-REACTIVE (trimethyl-gallium). of solutions and mixtures

17 Classification of mixture or solution

17.1 A mixture or solution that contains both a dangerous substance identified by name in this standard (see B.2 and annex C) and one or more non-dangerous substance(s), shall be assigned the UN number and the proper shipping name of the dangerous substance, unless

a) the mixture or solution is specifically identified by name in this standard, or

b) the entry in this standard specifically indicates that it applies only to the pure substance, or

c) the class or division, physical state or packing group of the solution or mixture is different from that of the dangerous substance, or

d) there is significant change in the measures to be taken in emergencies.

17.2 In the case of a mixture or solution for which 17.1(b) to (d) apply, the mixture or solution shall be treated as a dangerous substance and the appropriate N.O.S. entry shall be used, including its packaging and labelling requirements.

17.3 If a mixture or solution presents more than one hazard, see clause 21 and table 19.

17.4 To each mixture and each solution relevant to clause 21, the qualifying word "solution" or "mixture", as appropriate, shall be added for correct classification.

17.5 The technical names of not more than two of the constituents that predominantly contribute to the hazards of the mixture shall be shown, excluding controlled substances when their disclosure is prohibited by national law or international convention (see also 16.3.3). If the classification shows a subsidiary risk, one of the two technical names shall be that of the constituent that compels the use of a label indicating the subsidiary risk.

18 Classification of waste

18.1 Waste of dangerous goods shall be classified in accordance with the requirements of the appropriate class or division, considering their hazards and the criteria of this standard.

18.2 Waste of dangerous goods (other than radioactive waste) shall be classified either as a single entry or as a suitable collective entry, preceded by the word "waste".

18.3 Waste not otherwise subject to the requirements of this standard, but covered by the Basel Convention, can be transported under class 9.

19 Classification of empty containers

Empty containers that have not been cleaned and containers that are not gas-free shall be classified in accordance with the class and the packing group of the dangerous substances they contained.

20 Transport of samples

20.1 When the hazard class of a substance is uncertain and it is intended for transport for further testing, a tentative hazard class, a proper shipping name and a UN number shall be assigned on the basis of the consignor's knowledge of the substance and the application of

a) the classification criteria of this standard, and

b) the precedence of hazard characteristics given in clause 21 and table 19.

20.2 The proper shipping name used shall be supplemented with the word "sample", for example "FLAMMABLE LIQUID, N.O.S. Sample". In certain cases, where a specific proper shipping name is provided for a sample of a substance considered to meet certain classification criteria, for example, GAS SAMPLE, NON-PRESSURIZED, FLAMMABLE, that proper shipping name shall be used. In the case where an N.O.S. entry is used, the proper shipping name need not be supplemented with the technical name as required by Special Provision 274 (see B.1).

20.3 A sample of a substance shall be classified in accordance with the requirements applicable to the tentative assigned proper shipping name, provided that the sample:

a) is not considered to be prohibited from transport (see 16.2.3);

b) is not considered to comply with the requirements of an explosive of class 1, an infectious substance of division 6.2 and a radioactive material of class 7;

c) is a self-reactive substance or an organic peroxide, not listed in table 7 or table 8 respectively, but available data indicate that the substance can be assigned to one of the appropriate entries for a type C self-reactive substance (see 10.1.2.4.4) or a type C organic peroxide (see 11.2.3.4);

d) is transported in a combination packaging (seeDEAS 951:2019 with a net mass per package not exceeding 2,5 kg; and

e)is not packaged with other goods.

21 Precedence of hazards

NOTE See table 19.

21.1 If a substance, mixture or solution is not specifically listed by name in this standard, table 17 shall be used to determine the class of a substance, mixture or solution that has more than one hazard characteristic.

21.2 In the case of goods that present multiple risks and that are not specifically listed by name, the most stringent packing group allocated to the respective hazards of the goods takes precedence over other packing groups, irrespective of the precedence given in table 19.

21.3 The precedence information given in table 19 indicates which of the hazards should be regarded as the primary risk. The class that appears at the intersection of the horizontal line and vertical column is the primary risk and the remaining class is the subsidiary risk. The packing groups for all of the risks associated with the substance, mixture or solution shall be determined by reference to the appropriate criteria (see also 21.2).

21.4 The precedence of hazard characteristics of the following substances, goods and articles is not given in table 19, since these primary risks always take precedence:

a) explosive substances and articles of class 1;

b) gases of class 2;

c) liquid desensitized explosives of class 3;

d) self-reactive substances and desensitized explosives of division 4.1;

e) pyrophoric substances of division 4.2;

f) organic peroxides of division 5.2;

g) toxic substances of division 6.1 with a packing group I inhalation toxicity (see 12.1.4.3 to 12.1.4.9 and 14.2.2);

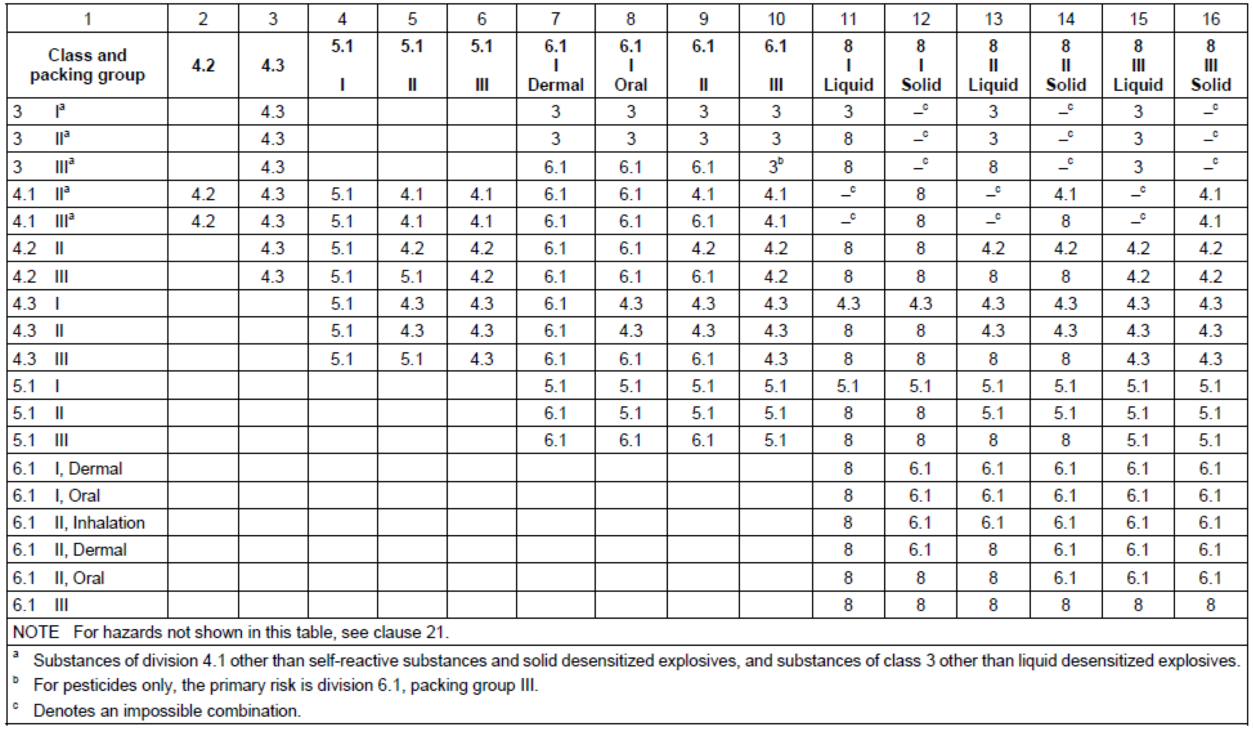
h) infectious substances of division 6.2; and

i) radioactive material of class 7.

21.5 Apart from exempted radioactive material in excepted packages (see DEAS 951:2019 where the other dangerous properties take precedence, radioactive material that presents other dangerous properties as well, shall always be classified in class 7, and the subsidiary risk shall also be identified.

For radioactive material in excepted packages, special provision 290 shall apply (see B.1).

Table 19 — Precedence of hazards



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Class and packing group	**4.2**	**4.3**	**5.1** **I**	**5.1** **II**	**5.1** **III**	**6.1** **I** **Dermal**	**6.1** **I** **Oral**	**6.1** **II**	**6.1** **III**	**8** **I** **Liquid**	**8** **I** **Solid**	**8** **II** **Liquid**	**8** **II** **Solid**	**8** **III** **Liquid**	**8** **III** **Solid**
3 I[a]		4.3				3	3	3	3	3	–[c]	3	–[c]	3	–[c]
3 II[a]		4.3				3	3	3	3	8	–[c]	3	–[c]	3	–[c]
3 III[a]		4.3				6.1	6.1	6.1	3[b]	8	–[c]	8	–[c]	3	–[c]
4.1 II[a]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	–[c]	8	–[c]	4.1	–[c]	4.1
4.1 III[a]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	–[c]	8	–[c]	8	–[c]	4.1
4.2 II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	8	8	4.2	4.2	4.2	4.2
4.2 III		4.3	5.1	5.1	4.2	6.1	6.1	6.1	4.2	8	8	8	8	4.2	4.2
4.3 I			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3 II			5.1	4.3	4.3	6.1	4.3	4.3	4.3	8	8	4.3	4.3	4.3	4.3
4.3 III			5.1	5.1	4.3	6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1 I						5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1 II						6.1	5.1	5.1	5.1	8	8	5.1	5.1	5.1	5.1
5.1 III						6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1 I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1 I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1 II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1 II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1 II, Oral										8	8	8	6.1	6.1	6.1
6.1 III										8	8	8	8	8	8

NOTE For hazards not shown in this table, see clause 21.

[a] Substances of division 4.1 other than self-reactive substances and solid desensitized explosives, and substances of class 3 other than liquid desensitized explosives.

[b] For pesticides only, the primary risk is division 6.1, packing group III.

[c] Denotes an impossible combination.

4 Identification of dangerous goods

This section provides the means for identification of dangerous goods through;

a) Dangerous goods list (numerical and alphabetical) ,

b) special provisions and exemptions;

c) test methods and

d) List for radionuclides.

e) Alphabetical list of pesticides

f) List of generic or N.O.S

g) Glossary of terms for explosives

4.1 Alphabetical list of dangerous goods

Refer to Annex C attached separately as DEAS 949 SUPPLEMENT.

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4.2
Special provisions relating to articles or substances and numerical list of dangerous goods

Refer to Annex B.

4.3 Test methods for the classification of dangerous goods.

Refer to Annex A

4.4 Alphabetical list of basic radionuclide values for individual radionuclides and notes to the annex D

Refer to Annex D. attached separately as DEAS 949 SUPPLEMENT.

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4.5

ALPHABETICAL LIST OF PESTICIDES (TECHNICAL):TOXICITYANDNOTES TO THE ANNEX E.

Refer to Annex E. attached separately as DEAS 949 SUPPLEMENT.

4.6 List of generic or N.O.S. proper shipping names

Refer to Annex F. attached separately as DEAS 949 SUPPLEMENT.

4.7 Glossary of terms for explosives
Refer to Annex G
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Annex A
(normative)

Test methods for the classification of dangerous goods

A.1 Test methods for explosives of class 1

Explosives substances and articles of class 1 are tested for identification and classification in accordance with the requirements of part I of the United Nations' Manual of tests and criteria (see also 7.5.3 and 7.5.4).

A.2 Test methods for aerosols, and gases and gas mixtures of class 2

A.2.1 Test methods for aerosols

A.2.1.1 The chemical heat of combustion shall be determined by one of the following methods:

a) ASTM D240; or

b) ISO 13943 (parts 86.1 to 86.3); or

c) NFPA 30B.

A.2.1.2 The following tests shall be performed in accordance with section 31, part III of the United Nations’ Manual of tests and criteria:

a) ignition distance test;

b) enclosed space test; and

c) foam flammability test.

A.2.2 Test methods for gases and gas mixtures, See 8.2.1, 8.4.2 and 8.4.5 of this standard.

A.3 Test methods for flammable liquids of class 3

A.3.1 Tests for flash point

A.3.1.1 General

The flash point is not an exact physical constant for a given liquid. It depends to some extent on the construction of the test apparatus used and on the testing procedure. Flash point data should therefore specify the name of the test apparatus.

A.3.1.2 Non-viscous flammable liquids

One of the following closed-cup methods shall be used:

a) the Abel apparatus, specified in ISO 13736; or

b) the Pensky-Martens apparatus (close-cup method) specified in ISO 2719 (identical with ASTM D93 and IP 34).

A.3.1.3 Viscous flammable liquids

The closed-cup flash point of viscous flammable substances can be determined in accordance with ISO 1523.

Where the temperature of the flash point is too low for the use of water in the water bath, the following modifications should be made:

a) use ethylene glycol in the water bath;

b) where appropriate, a refrigerator can be used to cool the specimen and apparatus to below the temperature required by the method for the expected flash point. For lower temperatures, the sample and equipment should be cooled to a suitable temperature, for example, by slowly adding solid carbon dioxide to the ethylene glycol. The specimen should be cooled similarly in a separate container of ethylene glycol; and

c) in order to obtain reliable results, the rate of the temperature rise for the specimen during testing should not be exceeded. Depending on the size of the water bath and the amount of ethylene glycol it contains, it could be necessary to partially insulate the water bath to achieve a sufficiently slow rate of temperature rise.

A.3.2 Test for initial boiling point

Any of the following test methods shall be used:

a) ISO 3924;

b) ISO 4626;

c) ISO 3405;

d) ASTM D86-07a; or

e) ASTM D1070-05

A.3.3 Viscosity test

Carry out the viscosity test at 23 °C, using the ISO standard cup with a jet of diameter 4 mm (see ISO 2431). If the flow time exceeds 100 s, carry out a second test, using the ISO standard cup but so modified as to be able to take a jet of diameter 6 mm.

A.3.4 Solvent separation test

A.3.4.1 Applicability

The test is used to determine the extent of solvent separation in viscous liquids such as paints, enamels, varnishes, lacquers, adhesives and polishes with a flash point of less than 23 °C.

A.3.4.2 Apparatus

A stoppered 100 mL measuring cylinder, of height approximately 250 mm and of uniform internal diameter of approximately 30 mm over the calibrated section.

A.3.4.3 Procedure

Stir the viscous substance to obtain a uniform consistency and fill the cylinder to the 100 mL mark. Insert the stopper and leave undisturbed for 24 h. After this period, measure the height of the upper separated layer and express this as a percentage of the sample.

A.3.4.4 Acceptance criteria

If less than 3 % of the clear solvent separates out, the substance may be considered for inclusion in packing group III (see 9.4.1 and 9.4.2).

A.3.5 Test for combustibility

The combustibility test is used to determine whether a substance sustains combustion when heated to a temperature of 60,5 °C or 75 °C, and when exposed to a flame. Carry out the combustibility test in accordance with ISO 9038, taking the following amendments into account:

a) heat the combustibility tester to a temperature of 60,5 °C ± 1 °C instead of 55 °C ± 1 °C; and

b) repeat the procedure at a temperature of 75 °C ± 1 °C with a new test specimen if sustained combustion does not occur at a temperature of 60,5 °C ± 1 °C.

A.4 Test methods for substances of class 4

A.4.1 Division 4.1: Test methods for readily combustible solids and solids that can cause, or contribute to, fire through friction

A.4.1.1 Preliminary screening test

A.4.1.1.1 Shape the substance, in its commercial form, into an unbroken strip of dimensions approximately 250 mm × 20 mm × 10 mm, on a cool, impervious base plate of low thermal conductivity.

A.4.1.1.2 Use a gas burner to apply a flame of temperature at least 1 000 °C and of diameter at least 5 mm, to one end of the strip. Note the time that elapses from the moment of application of the flame until the substance ignites, or stop the test after 2 min (5 min for metal powders and alloys).

A.4.1.1.3 If combustion propagates along 200 mm of the strip within 2 min (20 min for metal powders and alloys), carry out the burning rate test described in A.4.1.2.

A.4.1.1.4 If the substance does not ignite or propagate combustion, either by burning with a flame or by smouldering along 200 mm of the strip within the time limits stated in A.4.1.1.2 or A.4.1.1.3, the substance is not regarded as a flammable solid of division 4.1.

A.4.1.2 Burning rate test

A.4.1.2.1 In the case of commercial powdered or granular substances, loosely fill a mould of a triangular cross section of length 250 mm, depth 10 mm and width 20 mm, with the substance under test. Mount a metal sheet on each side of the mould in the longitudinal direction to act as two lateral limitations extending 2 mm beyond the upper edge of the mould.

A.4.1.2.2 Drop the mould three times from a height of 20 mm onto a solid surface. Remove the lateral limitations and place a cool, impervious base plate of low thermal conductivity on top of the mould. Invert and remove the mould to leave the substance under test in a pile of length 250 mm.

A.4.1.2.3 In the case of pastes, spread the substance on a non-combustible base plate in the form of a rope of length 250 mm and of cross-sectional area about 100 mm2.

A.4.1.2.4 Arrange the pile or rope across the draught in a fume cupboard. Ensure that the draught is not varied during the test and is sufficient to prevent fumes from escaping into the laboratory. A draught screen can be erected around the apparatus.

A.4.1.2.5 Add 1 mL of water to the pile or rope at a distance of approximately 35 mm beyond 180 mm from one of the ends, by applying the water dropwise over the shortest possible length of the pile or rope. Ensure that the entire cross section is wetted without loss of liquid from the sides. Alternatively, the water can be added to a hollow of depth up to 3 mm and of diameter 5 mm, on top of the pile or rope.

NOTE 1 If a wetting agent is necessary because plain water rolls off the sides of the pile or rope, ensure that the wetting agent is free from combustible diluents and that the total active matter in the wetting agent does not exceed 1 g/L.

NOTE 2 A wetted zone is not required for metal powders.

A.4.1.2.6 Ignite the pile or rope at the end, approximately 215 mm from the wetted zone, with a small flame or a hot wire of temperature at least 1 000 °C and of diameter at least 5 mm. In the case of a moisture-sensitive substance, carry out the test as quickly as possible after removal of the substance from its container.

A.4.1.2.7 When the pile or rope of powdered, granular or pasty substances has burned a distance of 80 mm, note the time of burning over the next 100 mm. Also note whether the wetted zone stops propagation of the flame for at least 4 min. Designate a packing group in accordance with the criteria given in A.4.1.3.1.

A.4.1.2.8 In the case of a metal powder, note the time of burning after ignition until the reaction has spread over the entire length of the specimen. Designate a packing group in accordance with the criteria given in A.4.1.3.2.

A.4.1.2.9 Unless a positive result is observed earlier, perform the test six times, each time using a clean, cool base plate.

A.4.1.3 Assignment of packing groups (tested in accordance with A.4.1.2)

A.4.1.3.1 Readily combustible solids other than metal powders

The packing groups for these substances are assigned as follows:

a) packing group II: burning time is less than 45 s and the wetted zone does not stop flame propagation for at least 4 min; or

b) packing group III: the burning time is less than 45 s and the wetted zone stops flame propagation for at least4 min.

A.4.1.3.2 Metal powders

The packing groups for these substances are assigned as follows:

a) packing group II: the zone of the reaction observed spreads over the entire length of the specimen in 5 min or less; or

b) packing group III: the zone of the reaction observed spreads over the entire length of the specimen in more than 5 min but in less than 10 min.

NOTE The packing group for a solid that can cause fire through friction is assigned by analogy with existing entries or in accordance with any appropriate special provision (see B.1).

A.4.2 Division 4.2: Test methods for substances liable to spontaneous combustion

A.4.2.1 Test methods for pyrophoric substances

A.4.2.1.1 Solid pyrophoric substances

A.4.2.1.1.1 Procedure

Pour 1 mL to 2 mL of the powdered substance under test from a height of approximately 1 m onto a noncombustible surface. Note whether the substance ignites either during the drop or within 5 min of settling. Unless a positive result is obtained, repeat this test five more times with different portions.
Edition 6

A.4.2.1.1.2 Assessment of results

Classify the solid substance in packing group I if the sample ignites in one of the tests.

A.4.2.1.2 Liquid pyrophoric substances

A.4.2.1.2.1 General

The pyrophoric property of a liquid is determined by its ability to

a) ignite when added to an inert carrier and exposed to air (see A.4.2.1.2.2), or

b) char or ignite a filter paper on contact with air (see A.4.2.1.2.3).

A.4.2.1.2.2 Procedure 1

Fill a porcelain cup of diameter approximately 100 mm to a height of about 5 mm with diatomaceous earth or silica gel at room temperature. Pour approximately 5 mL of the substance under test into the prepared porcelain cup and observe whether the substance ignites within 5 min. Unless a positive result is obtained, repeat this procedure five more times.

Follow procedure 2 (see A.4.2.1.2.3) if a negative result is obtained.

A.4.2.1.2.3 Procedure 2

Conduct the test at a temperature of 25 °C ± 2 °C and at a relative humidity of 50 % ± 5 %. With a syringe, transfer 0,5 mL of the liquid under test to an indented, dry, fine filter paper. Observe whether the filter paper ignites or chars within 5 min. Unless a positive result is obtained, repeat the test two more times with different portions of the liquid under test (use fresh filter paper each time).

A.4.2.1.2.4 Assessment of results

Classify the liquid substance in packing group I if it ignites on contact with the inert carrier, or if ignites or chars the filter paper.

A.4.2.2 Test method for self-heating substances

A.4.2.2.1 Principle

Specimens of the substance in cubical containers of sides 25 mm and 100 mm are maintained at temperatures of 100 °C, 120 °C or 140 °C for 24 h and their temperatures are then measured to determine whether they exceed the oven temperature by 60 °C.

A.4.2.2.2 Apparatus

A.4.2.2.2.1 Oven, of the hot-air circulating type, of inner volume exceeding 9 L and capable of maintaining an internal temperature of 100 °C ± 2 °C, 120 °C ± 2 °C or 140 °C ± 2 °C.

A.4.2.2.2.2 Specimen containers, a 25 mm cubical container and a 100 mm cubical container, both made of stainless steel net of mesh aperture size 0,05 mm, and both having an open top face. Each container is housed in a cube-shaped holder with an open top face that is also made of stainless steel net of mesh aperture size 0,60 mm, and is slightly larger than the specimen container, so that the container just fits into the holder. Another holder, of dimensions 150 mm × 150 mm × 250 mm and made of stainless steel net of mesh aperture size 0,595 mm, is used to suspend the assembly in the oven.

A.4.2.2.2.3 Chromel-alumel thermocouples, of diameter 0,3 mm and capable of continuously measuring the temperatures in the centre of the specimens and between the specimen containers and the oven wall.

A.4.2.2.3 Procedure

A.4.2.2.3.1 Fill the 100 mm specimen container (see A.4.2.2.2.2) to the brim with the powdered or granular substance, in the form to be transported, and tap the container several times. Once the specimen has settled, add more specimen. When the specimen is heaped, level it to the brim. Ensure that the container is housed in the holder and is suspended in the centre of the oven inside the large stainless steel holder, which shall be so located as to avoid the effects of air circulation.

A.4.2.2.3.2 Raise the oven temperature to 140 °C ± 2 °C and maintain this temperature for 24 h. Record the temperature of the specimen and of the oven continuously. Note whether spontaneous ignition occurs or the temperature of the specimen exceeds the oven temperature by 60 °C.

A.4.2.2.3.3 If negative results are obtained, do not undertake any further testing. If positive results are obtained,perform a second test, using the specimen in the 25 mm specimen container to determine the data for the packing group assignment (see A.4.2.2.5).

A.4.2.2.3.4 If positive results are obtained at 140 °C with the substance in a 100 mm container, but not in a 25 mm container, then an additional test with the substance in a 100 mm container shall be performed

a) at 120 °C if the substance is intended for transport in packaging of capacity exceeding 450 L volume but not exceeding 3 m^3, or

b) at 100 °C if the substance is intended for transport in packaging of capacity not exceeding 450 L volume.

A.4.2.2.4 Assessment of results

A substance is not classified as a self-reactive substance of division 4.2 if

a) a negative result is obtained in a test using a 100 mm specimen container at 140 °C,

b) a positive result is obtained with a 100 mm specimen container at 140 °C and a negative result is obtained with a 25 mm specimen container at 140 °C, and with the additional test at 120 °C (see A.4.2.2.3.4(a)),provided that the substance is to be transported in packages of capacity not exceeding 3 m^3, and

c) a positive result is obtained with a 100 mm specimen container at 140 °C and a negative result is obtained with a 25 mm specimen container at 140 °C and with the additional test at 100 °C (see A.4.2.2.3.4(b)), provided that the substance is to be transported in packages of capacity not exceeding 450 L.

A.4.2.2.5 Assignment of packing groups

A.4.2.2.5.1 Packing group II

Packing group II is assigned to a self-heating substance if a positive result is obtained in a test using a 25 mm specimen container at 140 °C.

A.4.2.2.5.2 Packing group III

Packing group III is assigned to a self-heating substance if

a) a positive result is obtained in a test using a 100 mm specimen container at 140 °C and a negative result is obtained using a 25 mm specimen container at 140 °C, and the substance is to be transported in packages of
capacity exceeding 3 m^3,

b) a positive result is obtained in a test using a 100 mm specimen container at 140 °C and a negative result is obtained using a 25 mm specimen container, a positive result is obtained in the additional test using a 100 mm specimen container at 120 °C, and the substance is to be transported in packages of capacity exceeding 450 L, and

c) a positive result is obtained in a test using a 100 mm specimen container at 140 °C and a negative result is obtained using a 25 mm specimen container at 140 °C, and a positive result is obtained using a 100 mm specimen container at 100 °C.

A.4.3 Division 4.3: Test methods for water-reactive substances

A.4.3.1 Principle

The test methods are used to determine whether the reaction of a substance with water leads to the evolution of a dangerous amount of flammable gases. The test methods can be applied to solid and liquid substances. The methods are not applicable to pyrophoric substances. Except in test D (see A.4.3.2.4), the substance is tested in its commercial form by bringing it into contact with water at ambient temperature. If the gas ignites spontaneously at any step, no further testing is necessary.

A.4.3.2 Procedures

A.4.3.2.1 Test A

Place a small quantity (approximately 2 mm in diameter) of the test substance into a trough of distilled water at 20 °C. Note if any gas evolves and if the gas ignites spontaneously.

A.4.3.2.2 Test B

In a 100 mm diameter evaporating dish, float filter paper on distilled water at 20 °C. Place a small quantity (approximately 2 mm in diameter) of the test substance on the centre of the filter paper. Note if any gas evolves and if the gas ignites spontaneously.

NOTE The purpose of the filter paper is to keep the substance from dispersing, under which condition the likelihood of spontaneous ignition of any gas is the greatest.

A.4.3.2.3 Test C

Make the test substance into a pile of height approximately 20 mm and of diameter 30 mm, with an indentation at the top. Put a few drops of water in the hollow and note if any gas evolves and if the gas ignites spontaneously.

A.4.3.2.4 Test D

In the case of solid substances, inspect the substance for any powder particles of diameter less than 500 µm. If the powder particles constitute more than 1 % (by mass) of the total, or if the substance is friable, grind the entire specimen to a powder before testing, to allow for a reduction in particle size during handling and transport. Test liquid substances in their commercial state. Carry out the test in triplicate at ambient temperature and at normal atmospheric pressure.

Weigh a suitable amount of the substance under test (up to a maximum of 25 g) into a conical flask, to produce between 100 mL and 250 mL of gas.

Fill a dropping funnel with water. Open the tap of the dropping funnel to let the water into the conical flask and, at the same time, start a stopwatch. Using any suitable means, measure the volume of the gas that evolves, and note the time it takes for all the gas to be evolved.

Calculate the rate of evolution of gas over 7 h at 1 h intervals. If the rate of evolution is erratic or increases after 7 h, extend the measuring time to a maximum time of 5 d.

Stop the 5 d test if the rate of gas evolution becomes steady or continually decreases and sufficient data have been established to assign a packing group to the substance under test, or to determine that the substance shall not be classified in division 4.3. Test the gas for flammability if its chemical identity is unknown.

A.4.3.3 Assignment of packing groups

A.4.3.3.1 Packing group I

Packing group I is assigned to a substance that

a) reacts violently with water at ambient temperature, with a general tendency for the gas evolved to ignite spontaneously, and

b) reacts readily with water at ambient temperature at such a rate that the evolution of flammable gas is equal to or exceeds 10 L/kg of the substance in any 1 min.

A.4.3.3.2 Packing group II

Packing group II is assigned to a substance that

a) reacts readily with water at ambient temperature at such a rate that the evolution of flammable gas is equal to or exceeds 20 L/kg/h of the substance under test, and

b) does not comply with the criteria for packing group I.

A.4.3.3.3 Packing group III

Packing group III is assigned to a substance that

a) reacts slowly with water at ambient temperature at such a rate that the evolution of flammable gas is equal to or exceeds 1 L/kg/h of the substance under test, and

b) does not comply with the criteria for packing groups I or II.

A.5 Test methods for oxidizing substances and organic peroxides of class 5

A.5.1 Division 5.1: Test methods for oxidizing substances

A.5.1.1 Test method for oxidizing solids

A.5.1.1.1 Principle

The potential for a solid substance to increase the burning rate or burning intensity of a combustible substance when the two components are thoroughly mixed in a ratio of 1:1 (by mass) and 1:4 (by mass), is measured.

A.5.1.1.2 Reagents

A.5.1.1.2.1 Potassium bromate (technically pure), of particle size in the range of 0,15 mm to 0,3 mm, is used as the standard substance.

Do not grind the potassium bromate. Dry it at 65 °C for a minimum of 12 h and keep in a desiccator until cool and required for use.

A.5.1.1.2.2 Cellulose, of fibre length between 50 µm and 250 µm and a mean diameter of 25 µm is used as the combustible material.

Dry the cellulose in a layer of thickness not exceeding 25 mm at 105 °C for 4 h and keep in a desiccator until cool and required for use. The water content shall be less than 0,5 % (by dry mass). If necessary, the drying time shall be prolonged to achieve this.

A.5.1.1.3 Apparatus

A.5.1.1.3.1 Ignition wire, an inert metal wire, for example nickel/chromium, shaped as shown in figure A.1 connected to an electrical power source and with the following characteristics:

a) length 30 cm ± 1 cm;

b) diameter 0,60 mm ± 0,05 mm;

c) electrical resistance 6,0 Ω/m ± 0,5 Ω/m; and

d) electrical power dissipated in the wire 150 W ± 7 W.

A.5.1.1.3.2 **Glass funnel**, a 60° glass funnel with a base diameter of 70 mm and sealed at the narrow end.

A.5.1.1.3.3 **Plate, impervious**, low heat conducting plate of dimensions 150 mm × 150 mm and a thickness of 6 mm.

NOTE A thermal conductivity of 0,23 W/mK at a temperature of 0 °C is suitable. Other plates with a similar conductivity could be used.

A.5.1.1.3.4 **Fume cupboard**, or other kind of ventilated area in which there is some ventilation but with an air stream velocity of 0,5 m/s. The fume system shall be suitable for the capture of toxic fumes.

A.5.1.1.4 Preparation

A.5.1.1.4.1 Inspect the specimen, in the form it is intended for transport, for any powder particles of less than 500 µm. If the powder constitutes more than 10 % (by mass) of the total, or if the substance is friable, the whole specimen shall be ground to a powder before testing. This is to allow for a reduction in particle size during handling and transport.

A.5.1.1.4.2 Prepare 30,0 g ± 0,1 g standard mixtures of potassium bromate and cellulose in the potassium bromate to cellulose ratios of 2:3 (by mass), 3:2 (by mass) and 3:7 (by mass).

A.5.1.1.4.3 Prepare 30,0 g ± 0,1 g mixtures of the specimen, in the form it is intended for transport (see A.5.1.1.4.1), and cellulose in the specimen to cellulose ratios of 1:1 (by mass) and 4:1 (by mass).

A.5.1.1.4.4 Mechanically mix each mixture as thoroughly as possible without excessive stress. Each mixture shall be made individually, used as soon as possible, and not taken from a batch.

A.5.1.1.5 Procedure

A.5.1.1.5.1 Place the plate in a ventilated area (see A.5.1.1.3.4) and perform the test at atmospheric pressure and an ambient temperature of 20 °C ± 5 °C. Place the ignition wire (see figure A.1) on the plate.

A.5.1.1.5.2 Fill the glass funnel with the test mixture and form the mixture into a conical pile of base diameter approximately 70 mm, covering the looped ignition wire resting on the plate.

A.5.1.1.5.3 Supply electric power to the ignition wire and maintain the power for the duration of the test or for 3 min if the mixture does not ignite and burn.

A.5.1.1.5.4 Record the time from when the power is switched on until the main reaction, for example flame, incandescence or glowing combustion, ends. Intermittent reaction, such as sparking or spluttering, after the main reaction shall not be taken into account.

A.5.1.1.5.5 Repeat the test if the ignition wire breaks during the test, unless breaking of the wire clearly does not affect the result.

A.5.1.1.5.6 Perform the test five times on each specimen mixture and five times on each standard mixture.

A.5.1.1.6 Assignment of packing groups

A.5.1.1.6.1 General

The packing groups of solid oxidizing substances are assigned on the basis of

a) the comparison of the mean burning time with those of the standard mixtures, and

b) whether the mixture of oxidizing substance and cellulose ignites and burns.

A.5.1.1.6.2 Packing group I

Packing group I is assigned to a substance tested in the 1:1 (by mass) or 4:1 (by mass) mixture of specimen and cellulose that exhibits a mean burning time less than the mean burning time of a 3:2 (by mass) standard mixture of potassium bromate and cellulose.

A.5.1.1.6.3 Packing group II

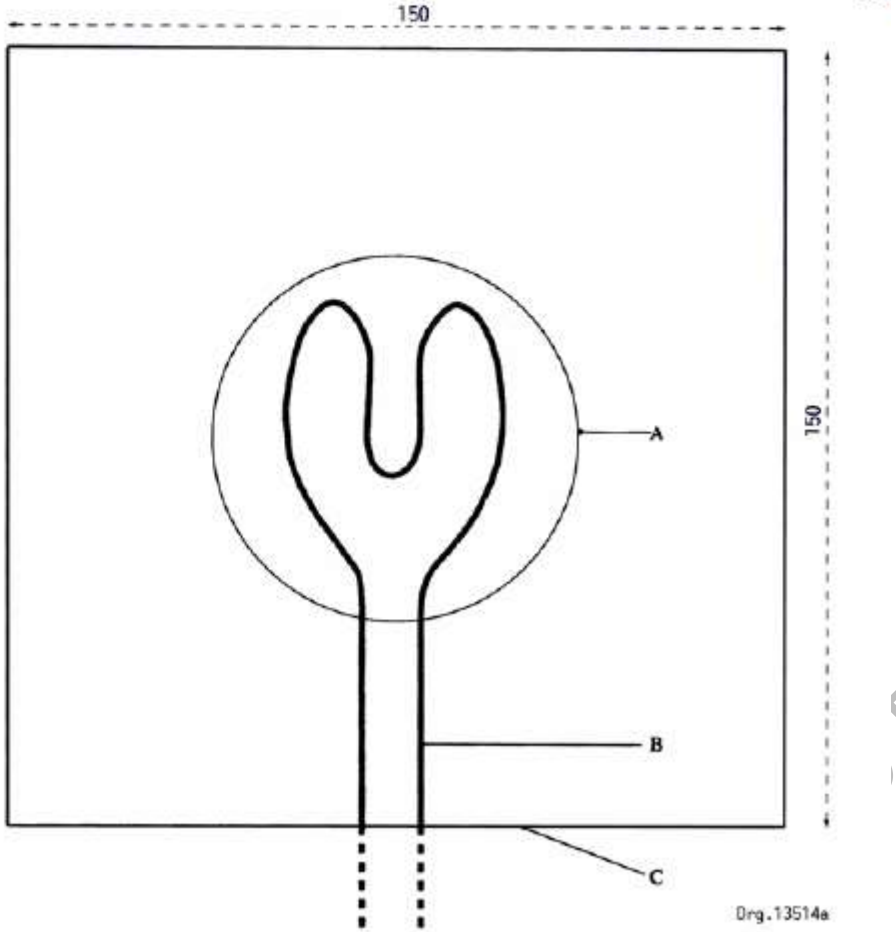
Packing group II is assigned to a substance tested in the 1:1 (by mass) or 4:1 (by mass) mixture of specimen and cellulose that exhibits a mean burning time equal to or less than the mean burning time of a 2:3 (by mass) mixture of potassium bromate and cellulose.

A.5.1.1.6.4 Packing group III

Packing group III is assigned to a substance tested in the 1:1 (by mass) or 4:1 (by mass) mixture of specimen and cellulose that exhibits a mean burning time equal to or less than the mean burning time of a 3:7 (by mass) mixture of potassium bromate and cellulose.

A.5.1.1.6.5 Not division 5.1

Division 5.1 does not apply to a substance in both the 1:1 (by mass) and 4:1 (by mass) mixtures of specimen and cellulose that does not ignite and burn, or that exhibits a mean burning time exceeding that of a 3:7 (by mass) mixture of potassium bromate and cellulose.



Dimensions in millimetres

Legend

A	base of sample cone (70 mm diameter)
B	heating wire
C	low heat conducting plate

Figure A.1 — Ignition wire

A.5.1.2 Test methods for oxidizing liquids

A.5.1.2.1 Principle

The potential for a liquid substance to increase the burning rate or burning intensity of a combustible substance (fibrous cellulose) when the two components are thoroughly mixed in a ratio of 1:1 (by mass), is measured.

A.5.1.2.2 Reagents

A.5.1.2.2.1 Cellulose, of fibre length between 50 µm and 250 µm and a mean diameter of 25 µm is used as the combustible material.

Dry the cellulose in a layer of thickness not exceeding 25 mm at 105 °C for 4 h and keep in a desiccator until cool and required for use. The water content shall be less than 0,5 % (by dry mass). If necessary, the drying time shall be prolonged to achieve this.

A.5.1.2.2.2 Standard substances, 50 % perchloric acid, 40 % aqueous sodium chlorate solution and 65 % nitric acid.

A.5.1.2.3 Apparatus

A.5.1.2.3.1 Pressure vessel (see figure A.2), cylindrical steel pressure vessel (A) of length 89 mm and of external diameter 60 mm.

Two flats are machined on opposite sides (reducing the cross section of the vessel to 50 mm) to facilitate holding whilst fitting up the firing plug (C) and the bursting disc (E).

The pressure vessel, that has a bore of diameter 20 mm, is internally rebated at either end to a depth of 19 mm and threaded to accept a one inch British Standard Pipe (BSP).

A pressure take-off, in the form of a side arm (F), is screwed into the curved face of the pressure vessel 35 mm from one end at 90° to the machined flats. The socket for this is bored to a depth of 12 mm and threaded to accept a half inch BSP thread on one end of the side arm. If necessary, an inert seal is fitted to ensure a gastight seal. The side arm extends 55 mm beyond the pressure vessel body and has a bore of 6 mm. The end of the side arm is rebated and threaded to accept a diaphragm type pressure transducer (G). Any pressure measuring device can be used, provided that it is not affected by the hot gases or the decomposition products and is capable of responding to rates of pressure rise of 690 kPa to 2 070 kPa in not more than 5 min.

The end of the pressure vessel furthest from the side arm is closed with a firing plug (C) that is fitted with two electrodes, one (J) insulated from, and the other (K) earthed to, the plug body. The other end of the pressure vessel is closed by a bursting disc (E) with a bursting pressure of approximately 2 200 kPa and held in place with a retaining plug (B) that has a bore of 20 mm. If necessary, an inert seal is used with the firing plug (C) to ensure a gas-tight fit. A support stand holds the assembly together (see A.5.1.2.3.2).

A.5.1.2.3.2 Support stand (see figure A.3), a mild steel base plate of dimensions 235 mm × 184 mm × 6 mm and a 185 mm length of square hollow section of dimensions 70 mm × 70 mm × 4 mm.

A section is so cut from each of the two opposite sides at one end of the length of the square hollow section that a structure that has two flat sided legs surmounted by 86 mm length of intact box results. One end of these flat sides is cut to an angle of 60° to the horizontal and welded to the base plate. A slot of width 22 mm and of depth 46 mm is machined in one side of the upper end of the base section in such a manner that, when the pressure assembly is lowered into the box section support with the firing-plug end first, the side arm is accommodated in the slot.

A packing piece of steel of width 30 mm and of thickness 6 mm is welded to the lower internal face of the box section to act as a spacer. Two 7 mm thumb screws, tapped into the opposite face, serve to hold the pressure vessel firmly in place. Two strips of steel of width 12 mm and of thickness 6 mm are welded to the side pieces abutting the base of the box section, to support the pressure vessel from beneath.

A.5.1.2.3.3 Ignition system, of nickel/chromium wire with one of the configurations shown in figure A.4 and with the following characteristics:

a) length 25 cm;

b) diameter 0,6 mm; and

c) electrical resistance 3,85 Ω/m.

The distance between the bottom of the pressure vessel (see A.5.1.2.3.1 and figure A.2) and the underside of the ignition coil should be 20 mm. If the electrodes are not adjustable, the ends of the ignition wire between the coil and the bottom of the pressure vessel shall be insulated by a ceramic sheath. The wire is heated by a constant power supply able to deliver at least 10 A.

A.5.1.2.3.4 Armoured fume cupboard, or firing cell.

A.5.1.2.4 Preparation

Assemble the apparatus complete with the pressure transducer and the heating system, but without the bursting disc in position, and support with the firing plug down.

A.5.1.2.5 Procedure

A.5.1.2.5.1 Mix 2,5 g of the specimen with 2,5 g of the dried cellulose in a glass beaker with a glass stirring rod.

WARNING — For safety reasons the mixing shall be performed with a safety shield between the operator and the mixture.

A.5.1.2.5.2 Add the specimen mixture, in small portions, with tapping, to the pressure vessel. Make sure that the mixture is packed around the ignition coil and is in good contact with it. Ensure that the coil has not been distorted during the packing process.

NOTE If the specimen mixture ignites during mixing or filling, no further testing is necessary.

A.5.1.2.5.3 Place the bursting disc in position and screw in the retaining plug tightly.

A.5.1.2.5.4 Transfer the charged vessel, with the bursting disc uppermost, to the support stand in the armoured fume cupboard or firing cell.

A.5.1.2.5.5 Connect the power supply to the external terminals of the firing plug and apply a current of 10 A. The time that elapses from the moment when the mixing is started until such time when the power is switched on should be about 10 min.

A.5.1.2.5.6 Record the signal produced by the pressure transducer on a suitable system, for example, a transient recorder coupled to a chart recorder, which allows for both the evaluation and the generation of a permanent record of the time profile obtained.

A.5.1.2.5.7 Heat the mixture until the bursting disc ruptures, or until at least 60 s has elapsed.

WARNING — If the bursting disc does not rupture, the mixture shall be allowed to cool before carefully dismantling the apparatus and precautions shall be taken to allow for any pressurization.

A.5.1.2.5.8 Perform five trials with the mixture and each of the standard substances (see A.5.1.2.2.2). The concentration of the substance tested shall be specified in the test report. If saturated solutions are tested, they should be prepared at 20 °C.

A.5.1.2.5.9 Note the time taken for the pressure to rise from 690 kPa to 2 070 kPa above atmospheric pressure.

Use the mean time interval for classification of the substance.

A.5.1.2.6 Assessment of results

The test results are assessed on the basis of

a) whether the mixture of specimen and cellulose ignites spontaneously, and

b) the comparison of the mean time taken for the pressure to rise from 690 kPa to 2 070 kPa gauge pressure with those of the standard substances.

A.5.1.2.7 Assignment of packing groups

A.5.1.2.7.1 Packing group I

Packing group I is assigned to any substance that

a) in the 1:1 (by mass) mixture (see A.5.1.2.5.1) of specimen and cellulose tested, ignites spontaneously, or

b) in the 1:1 (by mass) mixture (see A.5.1.2.5.1) of specimen and cellulose tested, exhibits a mean pressure rise time less than the pressure rise time of a 1:1 (by mass) mixture of 50 % perchloric acid and cellulose.

A.5.1.2.7.2 Packing group II

Packing group II is assigned to a substance that

a) in the 1:1 (by mass) mixture (see A.5.1.2.5.1) of specimen and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 (by mass) mixture of 40 % aqueous sodium chlorate solution and cellulose, and

b) does not comply with the criteria for packing group I.

A.5.1.2.7.3 Packing group III

Packing group III is assigned to a substance that

a) in the 1:1 (by mass) mixture (see A.5.1.2.5.1) of specimen and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 (by mass) mixture of 65 % nitric acid and cellulose, and

b) does not comply with the criteria for packing groups I or II.

A.5.1.2.7.4 Exemption from division 5.1

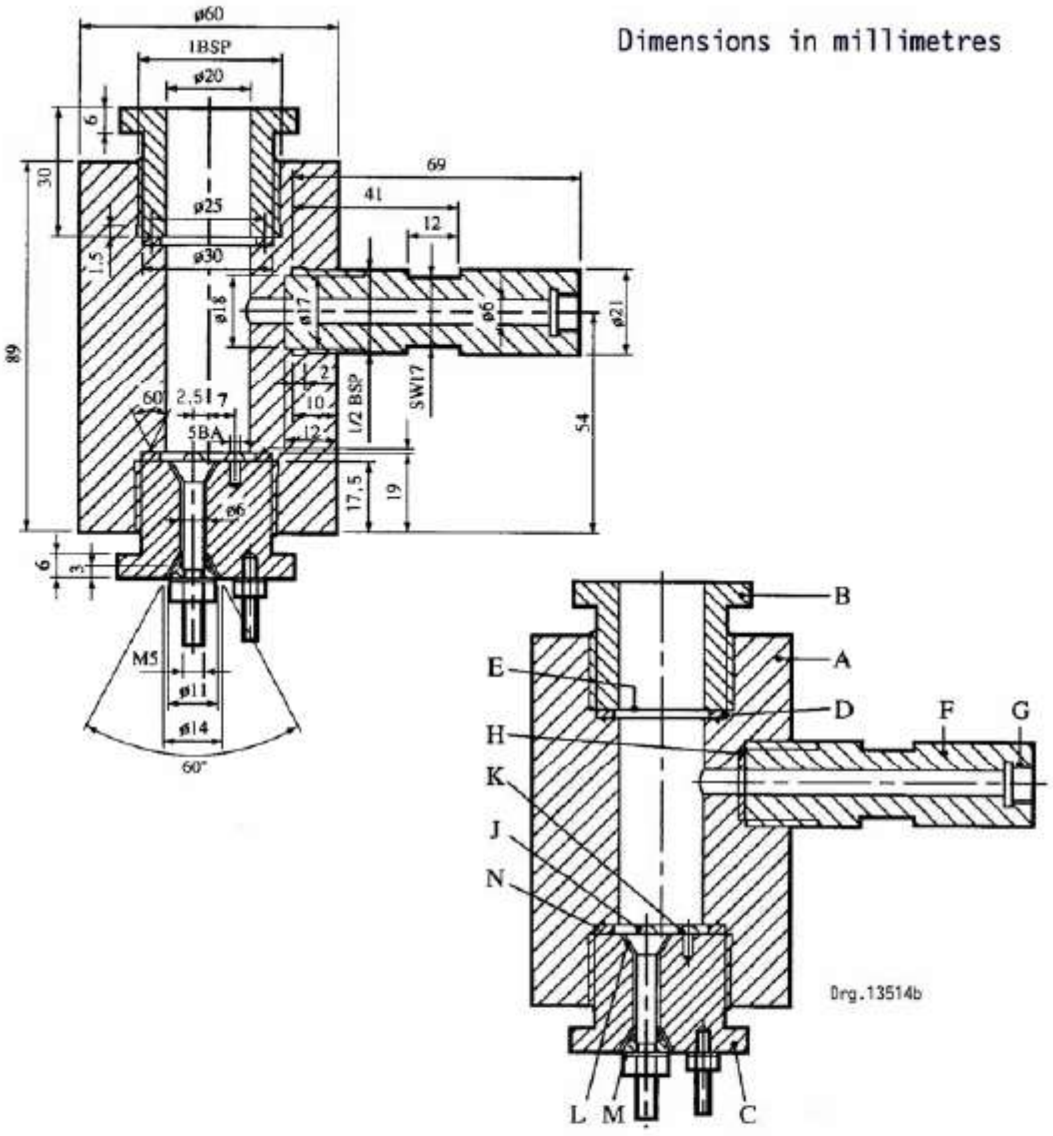
Division 5.1 does not apply to a substance that

a) in the 1:1 (by mass) mixture (see A.5.1.2.5.1) of specimen and cellulose tested, exhibits a pressure rise of less than 2 070 kPa gauge pressure, or

b) exhibits a mean pressure rise time exceeding the mean pressure rise time of a 1:1 (by mass) mixture of 65 % nitric acid and cellulose.

A.5.2 Division 5.2: Test methods for organic peroxides

Dimensions in millimetres



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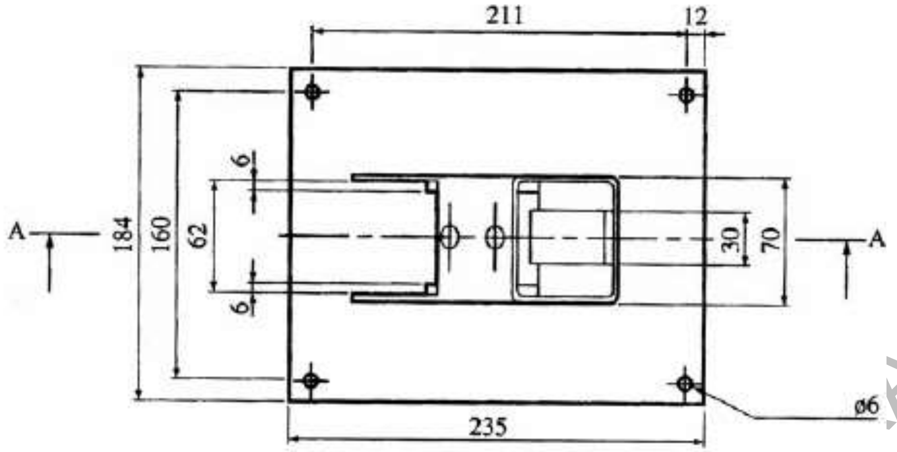
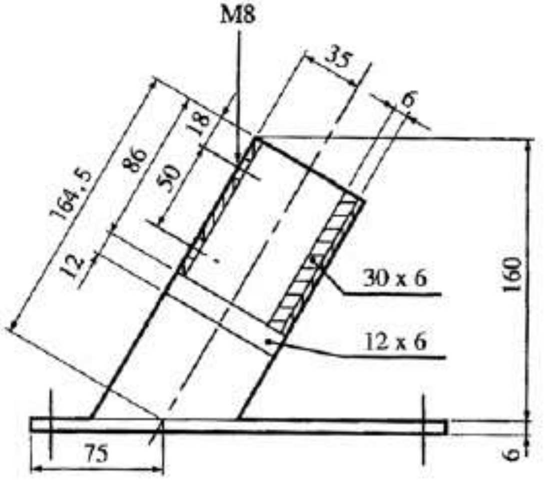
Legend

A	pressure vessel body H washer
B	bursting disc retaining plug J insulated electrode
C	firing plug K earthed electrode
D	soft lead washer L insulation
E	bursting disc M steel cone
F	side arm N washer distorting groove
G	pressure transducer thread

Figure A.2 — Pressure vessel





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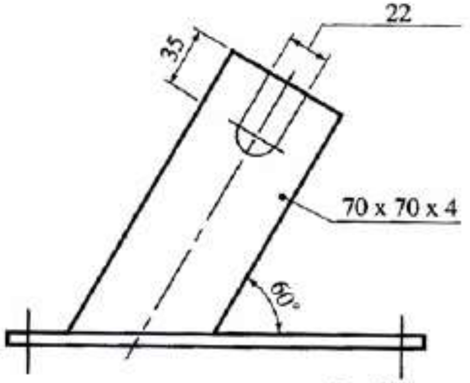

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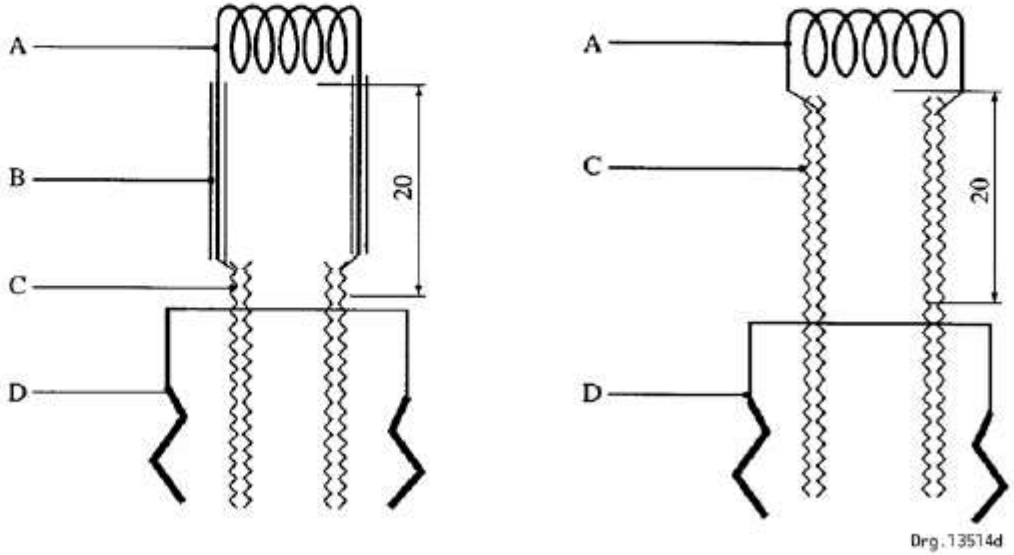
Dimensions in millimetres

Figure A.3 — Support stand

Dimensions in millimetres



NOTE Either of these configurations may be used.

Legend

A ignition coil

B insulation

C electrodes

D firing plug

Figure A.4 — Ignition system

A.6 Test methods for toxic and infectious substances of class 6

A.6.1 Division 6.1: Test methods for inhalation toxicity of liquid mixtures

A.6.1.1 General

If the formulas given in 12.1.4.9 cannot be applied because of the absence of inhalation toxicity data for the constituents of a liquid mixture, the following simplified threshold toxicity tests can be performed in order to assign a packing group to the mixture. When these threshold tests are used, the most restrictive packing group determined shall be used for the transport of the mixture.

A.6.1.2 Test methods for packing group I assignment

A.6.1.2.1 Method A

Vaporize a sample of the liquid mixture and dilute it with air to create a test atmosphere of 1 000 mL/m^3 of vaporized mixture in air.

Expose five female and five male albino rats to the test atmosphere for 1 h and observe the test animals for 14 d.

Note how many of the test animals die within this observation time.

A.6.1.2.2 Method B

Dilute a sample of the vapour in equilibrium with the liquid mixture at 20 °C with nine equal volumes of air to form a test atmosphere.
Expose five female and five male albino rats to the test atmosphere for 1 h and observe the test animals for 14 d.

Note how many of the test animals die within this observation time.

A.6.1.2.3 Criteria

If five or more of the test animals die within the 14 d observation time, the liquid mixture is assumed to have;

a) an LC50 equal to or less than 1 000 mL/m3, and

b) a volatility equal to or exceeding 10 times the volatility of the inhalation toxicity (LC50) of the mixture.

A.6.1.2.4 Packing group assignment

Assign packing group I to the liquid mixture if both the criteria of A.6.1.2.3 are met.

A.6.1.3 Test methods for packing group II assignment

A.6.1.3.1 Method A

Vaporize a sample of the liquid mixture and dilute it with air at 20 °C to create a test atmosphere of 3 000 mL/m^3 vaporized mixture in air.

Expose five female and five male albino rats to the test atmosphere for 1 h and observe the test animals for 14 d.

Note how many of the test animals die within this observation time.

A.6.1.3.2 Method B

Use a sample of the vapour in equilibrium with the liquid mixture at 20 °C as test atmosphere.

Expose five female and five male albino rats to the test atmosphere for 1 h and observe the test animals for 14 d.

Note how many of the test animals die within this observation time.

A.6.1.3.3 Criteria

If five or more of the test animals die within the 14 d observation time, the liquid mixture is assumed to have

a) an LC50 equal to or less than 3 000 mL/m3, and

b) a volatility equal to or exceeding the volatility of the inhalation toxicity (LC50) of the mixture.

A.6.1.3.4 Packing group assignment

Assign packing group II to the mixture if both criteria of A.6.1.3.3 are met and packing group I does not apply.

A.6.1.4 Test methods for packing group III assignment

A.6.1.4.1 Method A

Vaporize a sample of the liquid mixture and dilute it with air to create a test atmosphere of 5 000 mL/m^3 vaporized mixture in air.

Expose five female and five male albino rats to the test atmosphere for 1 h and observe the test animals for 14 d.

Note how many of the test animals die within this observation time.

A.6.1.4.2 Method B

Measure the vapour pressure of the liquid mixture at 20 °C.

A.6.1.4.3 Criteria

A.6.1.4.3.1 If five or more of the test animals subjected to method A described in A.6.1.4.1 die within the 14 d observation time, the mixture is assumed to have an LC50 equal to or less than 5 000 mL/m3.

A.6.1.4.3.2 If the vapour pressure of the liquid mixture at 20 °C is equal to or exceeding 1 000 mL/m3, the mixture is presumed to have a volatility equal to or exceeding one fifth of the volatility of the inhalation toxicity (LC50) of the mixture.

A.6.1.4.4 Packing group assignment

Assign packing group III to the liquid mixture if both criteria given in A.6.1.4.3 are met and packing group I and packing group II do not apply.

A.6.2 Division 6.2: Test methods for infectious substances

See 11.2.6.1.

A.7 Test methods for radioactive material of class 7

Consult with the relevant competent authorities.

A.8 Test methods for corrosive substances of class 8

See 14.3.2.

A.9 Test methods for miscellaneous dangerous substances and goods of class 9

A.9.1 Test methods for ammonium nitrate fertilizers capable of self-sustaining

Decomposition See section 38.2, part III of the United Nations' Manual of tests and criteria.

A.9.2 Test methods for lithium batteries

See section 38.3, part III of the United Nations' Manual of tests and criteria.

Annex B
(normative)

Special provisions relating to articles or substances and numerical list of dangerous goods

B.1 Special provisions applicable to certain articles or substances

B.1.1 When column 6 of the Dangerous Goods List indicates that a special provision is relevant to a substance or article, the meaning and requirements of that special provision are as set forth below.

16 Samples of new or existing explosive substances or articles can be transported as directed by the competent authority for purposes of testing, classification, research and development and quality control, or as a commercial sample. Explosive samples that are not wetted or desensitized shall be limited to 10 kg in small packages or as specified by the competent authority. Explosive samples that are wetted or desensitized shall be limited to 25 kg.

23 Although this substance has a flammability hazard, it only exhibits such hazard under extreme fire conditions in confined areas.

26 This substance shall be prohibited from transport in portable tanks or in intermediate bulk containers of capacity exceeding 450 L, owing to potential initiation of explosion when the substance is transported in large volumes.

28 This substance may be transported under the provisions of division 4.1, provided that it is so packed that the percentage of diluent will not, at any time during transport, fall below that stated.

29 This substance is exempt from labelling, but shall be marked with the appropriate class or division.

32 This substance is considered non-dangerous when in any other form.

37 The coated substance is considered non-dangerous for transport.

38 This substance is considered non-dangerous for transport when it contains not more than 0,1 % of calcium carbide.

39 This substance is considered dangerous for transport when it contains 30 % or more (by mass) of silicon and less than 90 % (by mass) of silicon.

43 When transported as pesticides, these substances shall be transported under the relevant pesticide entry in accordance with 12.1.4.11, 12.1.4.12 and 12.1.5.

45 Antimony sulfides and oxides that contain less than 0,5 % of arsenic, calculated on the total mass, are considered non-dangerous for transport.

47 Ferricyanides and ferrocyanides are considered non-dangerous for transport.

48 If this substance contains more than 20 % (by mass) of hydrocyanic acid, its transport shall be prohibited, unless the competent authority grants special authorization.

59 These substances are considered non-dangerous for transport when they contain 50 % (by mass) or less of magnesium.60 If this substance contains more than 72 % (by mass) of perchloric acid, its transport shall be prohibited,
unless the competent authority grants special authorization.

61 The technical name, supplementing the proper shipping name, shall be the ISO common name (see E.1).

62 This substance is considered non-dangerous for transport when it contains 4 % (by mass) or less of sodium hydroxide.

63 The division of class 2 and the subsidiary risks depend on the nature of the contents of the aerosol dispenser. The following shall apply:

a) division 2.1 when the aerosol dispenser contains equal to or more than 85 % (by mass) of flammable components and the heat of combustion is 30 kJ/g or more;

b) division 2.2 when the aerosol dispenser contains equal to or less than 1 % (by mass) of flammable components and the heat of combustion is less 20 kJ/g;

c) otherwise, the aerosol dispenser shall be tested in accordance with section 31, part III of the United Nations' Manual of tests and criteria. Extremely flammable and flammable aerosol dispensers shall be classified in division 2.1 and non-flammable aerosol dispensers shall be classified in division 2.2;

d) a gas of division 2.3 shall not be used as a propellant in an aerosol dispenser;

e) where the contents, other than the propellant of an aerosol dispenser, are classified as a toxic substance of division 6.1, packing groups II or III, or as a corrosive substance of class 8, packing groups II or III, the aerosol dispenser shall be assigned a subsidiary risk of division 6.1 or class 8;

f) the transport of aerosol dispensers with contents that comply with the criteria of packing group I for toxicity or corrosivity are prohibited; and

g) hazard labels KS 2530 indicating the subsidiary risks might be required for air transport.

Flammable components of aerosol dispensers are flammable gases and gas mixtures (see 8.2.1 and 8.4.2), flammable liquids (see 9.1.2) and flammable solids (see 10.1.1). This designation does not
include pyrophoric, self-heating or water-reactive substances.

NOTE The test methods for heat of combustion and flammability are given in A.2.1.

65 Hydrogen peroxide aqueous solutions with less than 8 % hydrogen peroxide are not subject to the requirements of this standard.

66 Mercurous chloride and cinnabar are considered non-dangerous for transport.

103 The transport of ammonium nitrites and mixtures of an inorganic nitrite and an ammonium salt shall be prohibited.

105 Nitrocellulose of UN 2556 or UN 2557 may be assigned to division 4.1.

106 Considered dangerous for air transport only.

113 The transport of chemically unstable mixtures shall be prohibited.

117 Considered dangerous for sea transport only.

119 Refrigerating machines include air-conditioning units and other appliances that have been designed for the specific purpose of keeping food or other items at a low temperature in an internal compartment.

Refrigerating machines and refrigerating machine components are considered non-dangerous for transport if they contain less than 12 kg of non-flammable, non-toxic gas or less than 12 L of ammonia solution (UN 2672).

122 The subsidiary risks, control and emergency temperatures, if any, and the generic entry number for each of the currently assigned organic peroxide formulations are given in B.2 and in annex C.

127 Other inert material or inert material mixtures may be used at the discretion of the competent authority, provided that this inert material has identical phlegmatizing properties.

131 The phlegmatized substance shall be significantly less sensitive than dry PETN (pentaerythritol tetranitrate).

132 During transport, this substance shall be protected from direct sunlight and stored (or kept) in a cool and well-ventilated place, away from all sources of heat.

133 The "EXPLOSIVE" label can be disposed of in the case of substances of UN 2956, UN 3242 and UN 3251, when packed in

a) a fibre drum that can be fitted with a liner or coating and that is of a maximum net mass of 50 kg,

b) combination packaging that comprises a fibreboard box with a single inner plastics bag and that is of a maximum net mass of 50 kg, and

c) combination packaging that comprises a fibreboard box or a fibre drum with inner plastics packaging, each containing a maximum mass of 5 kg and of a maximum net mass of 25 kg.

NOTE The packaging complies with packing instruction P409 of KS 2530

135 The dihydrated sodium salt of dichloroisocyanuric acid is considered non-dangerous.

138 p-Bromobenzyl cyanide is considered non-dangerous for transport.

141 Products that have undergone sufficient heat treatment to render them non-dangerous for transport can be regarded as such.

142 Solvent-extracted soya bean meal that contains not more than 1,5 % (by mass) of oil and 11 % (by mass) of moisture and that is substantially free from flammable solvent is considered non-dangerous for transport.

144 An aqueous solution that contains not more than 24 % (by volume) of alcohol is considered non-dangerous for transport.

145 Alcoholic beverages of packing group III, transported in receptacles with a capacity not exceeding 250 L, are regarded as dangerous in the case of air transport only.

146 Alcoholic beverages of packing group II, transported in receptacles with a capacity not exceeding 5 L, are regarded as non-dangerous for transport in the case of road and rail transport.

152 The classification of this substance will vary with particle size and packaging, but borderlines have not been experimentally determined. Classify the substances in accordance with the criteria of clause 7.

153 This entry applies only if it has been demonstrated, by tests, that the substances, when in contact with water, are not combustible and do not show a tendency to auto-ignition and that the mixture of gases evolved is not flammable.

163 A substance specifically listed by name in B.2 and annex C shall not be transported under this entry.
Materials transported under this entry may contain 20 % or less nitrocellulose, provided that the
nitrocellulose contains not more than 12,6 % (by dry mass) nitrogen.

168 The following asbestos commodities are considered non-dangerous for transport:

a) asbestos that is so immersed or fixed in a natural or artificial binder (such as cement, plastics, asphalt, resins or mineral ore) that no escape of dangerous quantities of respirable asbestos fibres can occur during transport; and

b) manufactured articles that contain asbestos and do not satisfy the requirement of (a) above, provided that they are so packed that no escape of dangerous quantities of respirable asbestos fibres can occur during transport.

169 Phthalic anhydride

a) in the solid state and tetrahydrophthalic anhydrides that contain not more than 0,05 % (by mass) of maleic anhydride are considered non-dangerous for transport, and

b) molten, at a temperature above its flash point, and that contains not more than 0,05 % (by mass) of maleic anhydride, shall be allocated to UN 3256.

172 Radioactive material with a subsidiary risk shall be

a) labelled with the hazard labels (see DEAS 951:2019) corresponding to each subsidiary risk exhibited by the material. Corresponding placards shall be affixed to transport units in accordance with KS 2382-1, and

b) allocated to packing groups I, II or III corresponding to the nature of the predominant subsidiary risk. The transport document DEAS 951:2019 as applicable) shall include a description of these subsidiary risks, the name of the constituents that most predominantly contribute to the subsidiary risk(s) and, where applicable, the packing group.

177 Barium sulfate is considered non-dangerous for transport.

178 This designation shall be used only when no other appropriate designation exists in the list, and only with the approval of the competent authority.

179 a) This designation shall be used for substances and mixtures that are dangerous to the aquatic environment or that are marine pollutants that do not meet the classification of any other class or another substance within class 9.

b) This designation may be used for

1) waste not otherwise subject to the requirements of this standard but that are covered under the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, and

2) substances designated to be environmentally hazardous by the competent authority of the country of origin, transit or destination but that do not meet the criteria for an environmentally hazardous substance in accordance with the requirements of this standard or for any other class.

181 A package that contains this type of substance shall bear the "EXPLOSIVE" class label as a subsidiary risk. However, the competent authority can permit the label to be dispensed with if it has been proved that the packaging listed eliminates the explosive behaviour.

NOTE When packages that contain different organic peroxides are transported together in a vehicle, consideration should be given to the possibility that an explosion hazard might arise.

182 The group of alkali metals includes lithium, sodium, potassium, rubidium and caesium.

183 The group of alkaline earth metals includes magnesium, calcium, strontium and barium.

186 When the ammonium nitrate content is being determined, all nitrate ions for which a molecular equivalent of ammonium ions is present in the mixture shall be calculated as ammonium nitrate.

187 Packaging tests are required for substances of packing groups II and III in quantities of 5 L or less in metal or plastics packaging in the case of air transport only

a) in palletized loads, for example individual packagings placed or stacked on and secured to a pallet by strapping, shrink-wrapping or other suitable means, or

b) as inner packaging of a combination packaging with a total mass of 40 kg or less.

188 Cells and batteries offered for transport are considered non-dangerous for transport if

a) the lithium content of a lithium metal battery or a lithium alloy battery does not exceed 1 g, and for a lithium-ion cell, the watt-hour rating does not exceed 20 Wh,

b) the aggregate lithium content of a lithium metal battery or a lithium alloy battery does not exceed 2 g, and for a lithium-ion battery, the Watt-hour rating does not exceed 100 Wh. Lithium-ion batteries subject to this provision shall be marked with the Watt-hour rating on the outside case,

c) each cell or battery is of the type proved to comply with the requirements of the tests in section 38.3, part III of the United Nations' Manual of tests and criteria,

d) the cells and batteries (except when installed in equipment), shall be packed in inner packagings that completely enclose the cell or battery. Cells and batteries shall be protected so as to prevent short circuits. This includes protection against contact with conductive material within the same packaging that could lead to short circuit. The inner packagings shall be packed in strong outer packagings DEAS 951:2019

e) cells and batteries when installed in equipment shall be protected from damage and short circuit, and the equipment shall be equipped with an effective means of preventing accidental activation. When lithium batteries are installed in equipment, the equipment shall be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging’s capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained,

f) each package shall be marked with the following:

i) an indication that the package contains “lithium metal” or “lithium-ion” cells or batteries, as appropriate;

ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;

iii) an indication that special procedures shall be followed when the package is damaged, including inspection and repacking if necessary; and

iv) a telephone number for additional information,

NOTE Packages that contain not more than four cells installed in equipment, or packages that contain not more than two batteries installed in equipment, are not subject to these requirements.

g) each consignment of one or more packages marked in accordance with paragraph (f) shall be accompanied with a document giving

(i) an indication that the package contains “lithium metal” or “lithium-ion” cells or batteries, as appropriate,

(ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged,

(iii) an indication that special procedures shall be followed when the package is damaged, to including inspection and repacking if necessary, and

(iv) a telephone number for additional information,

h) except when lithium batteries are installed in equipment, each package shall be capable of withstanding a 1,2 m drop test in any orientation without damage to cells or batteries contained therein and without shifting of the contents. This is to ensure that battery to battery (or cell to cell) contact and release of contents will not occur during normal conditions of transport, and

i) except when lithium batteries are installed in, or packed with equipment, packages shall not exceed 30 kg gross mass.

For the purposes of this standard, "lithium content" means the mass of lithium in the anode of a lithium metal or alloy cell.
Separate entries exist for lithium metal batteries and lithium-ion batteries to facilitate the transport of these batteries for specific modes of transport and to enable the application of different emergency response actions.

190 Aerosol dispensers shall be provided with protection against inadvertent discharge. Aerosol dispensers of capacity not exceeding 50 mL that contain only non-toxic constituents are considered non-dangerous for transport.

191 Small receptacles that contain gas may be regarded as being similar to aerosol dispensers except that they are not fitted with a release device. Gas receptacles of capacity not exceeding 50 mL that contain only nontoxic constituents are considered non-dangerous for transport.

193 This entry may only be used for uniform ammonium nitrate based fertilizer mixtures of the nitrogen, phosphate or potash type that contain

a) not more than 70 % (by mass) ammonium nitrate and not more than 0,4 % (by mass) total combustible(or organic) material, calculated as carbon, or

b) not more than 45 % (by mass) ammonium nitrate and unrestricted combustible material. Fertilizers within these composition limits are regarded as dangerous in the case of air and sea transport only. Fertilizers are regarded as non-dangerous for transport if they are not liable to self-sustaining decomposition when tested in accordance with section 38.3, part III of the United Nations' Manual of tests and criteria.

194 The control and emergency temperatures, if any, and the generic entry number for each of the currently assigned self-reactive substances are given in B.2 and annex C.

195 In the case of certain organic peroxides of type B or type C, a smaller packaging shall be used than that allowed by packing methods OP5A (or OP5B) or OP6A (or OP6B), respectively (see SANS 10229-1).

196 Formulations that, in laboratory testing, neither detonate in the cavitated state nor deflagrate, that show no effect when heated under confinement and that do not exhibit explosive power, may be transported under this entry. Such formulations shall also be thermally stable, i.e. they shall have a SADT of at least 60 °C for a 50 kg package. Formulations that do not comply with these criteria shall be transported under the provisions of division 5.2 (see SANS 10229-1).

198 Nitrocellulose solutions that contain not more than 20 % of nitrocellulose may be transported as paint or printing ink, as applicable. See UN 1210, UN 1263, UN 3066, UN 3469 and UN 3470.

199 Lead compounds which, when mixed in a ratio of 1:1000 with 0,07 mol/L hydrochloric acid and stirred for 1 h at a temperature of 23 °C ± 2 °C, exhibit a solubility of 5 % or less (see ISO 3711) are considered insoluble and non-dangerous for transport unless they meet the criteria for inclusion in another hazard class or division.

201 Lighters and lighter refills shall be provided with protection against inadvertent discharge. The liquid portion of the gas shall not exceed 85 % (by mass) of the capacity of the receptacle at 15 °C. The receptacles, including the closures, shall be capable of withstanding an internal pressure of twice the pressure of the liquefied petroleum gas at 55 °C. The valve mechanisms and ignition devices shall be securely sealed, taped or otherwise fastened or shall be designed to prevent operation or leakage of the contents during transport. The lighters or lighter refills shall be tightly packed to prevent inadvertent operation of the release devices. Lighters shall contain not more than 10 g of liquefied petroleum gas. Lighter refills shall contain not more than 65 g of liquefied petroleum gas.

203 This entry shall not be used for polychlorinated biphenyls, UN 2315.

204 Articles that contain one or more corrosive smoke-producing substance(s) shall also bear a class 8 hazard label DEAS 951:2019

205 This entry shall not be used for pentachlorophenol, UN 3155.

206 The transport of ammonium permanganate is prohibited, unless special authorization has been granted by the competent authority.

207 These beads may be polystyrene, poly(methyl methacrylate) or other polymeric material.

208 The commercial grade of calcium nitrate fertilizer that consists mainly of a double salt (calcium nitrate and ammonium nitrate) and contains not more than 10 % (by mass) of ammonium nitrate and at least 12 % (by mass) of water of crystallization is considered non-dangerous for transport.

209 The gas shall be at ambient atmospheric pressure, and shall not exceed 105 kPa (absolute) at the time that the containment system is to be closed.

210 Toxins from plant, animal or bacterial sources that contain infectious substances, or are contained in them, shall be classified in division 6.2.

215 a) This entry only applies to the technically pure substance or to formulations derived from it and that have an SADT higher than 75 °C.

b) This entry does not apply to a formulation that is a self-reactive substance (see 10.1.2).

c) Unless the criteria of another class or division are met, a homogeneous mixture that contains not more that 35 % (by mass) of azodicarbonamide and at least 65 % (by mass) of an inert substance is considered non-dangerous for transport.

216 Mixtures of solids that are non-dangerous for transport and flammable liquids may be transported under this entry without the classification criteria of division 4.1 first being applied, provided that no free liquid is visible at the time the substance is loaded or at the time the packaging or transport unit is closed. Each packaging or transport unit shall be leakproof at the level of packing group II (DEAS 951:2019)
Sealed packets are regarded as non-dangerous for transport if they contain less than 10 mL of packing group II or packing group III flammable liquids absorbed into a solid material and provided that no free liquid is present in the packet.

217 Mixtures of solids that are non-dangerous for transport and toxic liquids may be transported under this entry without the classification criteria of division 6.1 first being applied, provided that no free liquid is visible at the time the substance is loaded or at the time the packaging or transport unit is closed. Each transport unit shall be leakproof when used as a bulk packaging. The entry shall not be used for solids that contain a packing group I liquid.

218 Mixtures of solids that are non-dangerous for transport and corrosive liquids may be transported under this entry without the classification criteria of class 8 first being applied, provided that no free liquid is visible at the time the substance is loaded or at the time the packaging or transport unit is closed. Each transport unit shall be leakproof when used as a bulk packaging.

219 GMMOs and GMOs that meet the definition of an infectious substance and the criteria for inclusion in division 6.2 in accordance with 12.2.5 shall be transported under UN 2814, UN 2900 or UN 3373, as appropriate.

220 In the case of this solution or mixture, only the technical name of the flammable liquid component shall be shown in parentheses immediately after the proper shipping name.

221 Substances of packing group I are excluded from this entry.

223 A substance is considered non-dangerous for transport if its chemical or physical properties are such that, when the substance is tested, it does not comply with the established criteria for a class or division listed in B.2 and annex C.

224 The substance (freezing temperature at or below −15 °C) shall be transported as a liquid and shall remain liquid during normal transport conditions, unless it can be demonstrated by testing that the substance is not more sensitive in the liquid state.

225 Fire extinguishers of this entry may be fitted with actuating cartridges (cartridges and power devices of division 1.4C or 1.4S) and may remain classified in division 2.2, provided that the total quantity of deflagrating (propellant) explosives does not exceed 3,2 g per extinguishing unit.

226 Formulations of these substances that contain at least 30 % of non-volatile, non-flammable phlegmatizer are regarded as non-dangerous for transport.

227 When the substance is phlegmatized with water and inorganic inert material, the content of urea nitrate may not exceed 75 % (by mass). The mixture shall not detonate when tested in accordance with test series 1, type (a) in part I of the United Nations' Manual of tests and criteria.

228 Mixtures that do not comply with the criteria for flammable gases of division 2.1 shall be transported under UN 3163.

230 This entry applies to cells and batteries that contain lithium in any form, including lithium polymer and lithium-ion cells and batteries, provided that they comply with the following provisions:

a) each cell and battery type comply with the criteria for class 9 dangerous goods when tested in accordance with section 38.3, part III of the United Nations' Manual of tests and criteria;

b) each cell and battery is fitted with a safety venting device or is so designed that a violent rupture under normal conditions of transport cannot occur;

c) each cell and battery is fitted with an effective means of preventing external short-circuits; and

d) each battery that contains cells or series of cells connected in parallel is equipped with diodes, fuses,etc. to prevent reverse current flow.

232 This designation is applicable only when the substance does not comply with the criteria of any other class.
Bulk transport in units other than multimodal tanks shall be in accordance with the regulations laid down by the competent authority of the country of origin.

235 This entry applies to articles that contain explosive substances of class 1 and that can also contain dangerous goods of other classes. These articles are used as life-saving vehicle air-bag inflators, or air-bag modules, or seat-belt pretensions.

236 Polyester resin kits consist of two components, i.e. a base material (class 3, packing group II or packing group III) and an activator (organic peroxide). The organic peroxide shall be of type D, E or F and that does not require temperature control. The limited quantities and the excepted quantity codes shown in columns 7(a) and 7(b) of the dangerous goods list (see B.2) apply to the base material.

237 The membrane filters, including the paper separators, coating or backing material, etc., that are present during transport, shall not be liable to propagate detonation when tested in accordance with test series 1(a) in part I of the United Nations' Manual of tests and criteria. In addition, the competent authority can determine, on the basis of results obtained by the burning rate test (see A.4.1.2), that the nitrocellulose membrane filters, in the form in which they are to be transported, are not subject to the requirements for flammable solids of division 4.1.

238 a) Batteries may be considered non-spill able, provided that they are capable of withstanding the vibration and pressure differential tests given below, without leakage of battery fluid:

1) vibration test: clamp the battery firmly to the platform of a vibration machine. Apply a harmonic motion with an amplitude of 0,8 mm (1,6 mm maximum total excursion) and vary the frequency at a rate of 1 Hz/min between the limits of 10 Hz and 55 Hz. Traverse the entire range of frequencies and return in 95 min ± 5 min for each mounting position (direction of vibration) of the battery. Test the battery in three mutually perpendicular positions (with openings for filling and vents, if any, in an inverted position) for equal periods of time; and

2) pressure differential test: after completion of the vibration test, store the battery for 6 h at 24 °C ± 4 °C while subjecting it to a pressure differential of at least 88 kPa. Test the battery in three mutually perpendicular positions (with openings for filling and vents, if any, in an inverted position) for at least 6 h in each position.

b) Non-spillable batteries are considered non-dangerous for transport if, when the batteries are at a temperature of 55 °C, no electrolyte or free liquid flows from a ruptured or cracked case and, when the batteries are packed for transport, the terminals are so protected to prevent a short-circuit.

NOTE Non-spillable type batteries that are an integral part of, and necessary for, the operation of mechanical or electronic equipment, should be securely fastened in the battery holder provided on the equipment and protected in such a manner as to prevent damage and short-circuits during transport.

239 a) Batteries or cells shall not contain dangerous goods other than sodium, sulfur or polysulfides (or both).

b) Batteries or cells shall not be offered for transport at such a temperature that liquid elemental sodium is present in the battery or cell unless approved by the competent authority and under the conditions established by the competent authority.

c) Cells shall consist of hermetically sealed metal casings that fully enclose the dangerous goods and that are so constructed and closed as to prevent the release of the dangerous goods under normal conditions of transport.

d) Batteries shall consist of cells secured within, and fully enclosed by, a metal casing that is so constructed and so closed as to prevent the release of the dangerous goods under normal conditions of transport.

e) Except for air transport, batteries installed in vehicles (UN 3171) are regarded as non-dangerous for transport.

240 This entry applies only to vehicles and equipment powered by wet batteries, sodium batteries or lithium batteries and transported with these batteries installed. Examples of such vehicles and equipment are electrically powered cars, lawnmowers, wheelchairs and other mobility aids.

Hybrid electric vehicles powered by both an internal combustion engine and wet batteries, sodium batteries or lithium batteries transported with the battery or batteries installed shall be consigned under entries UN 3166 VEHICLE, FLAMMABLE GAS POWERED or UN 3166 VEHICLE, FLAMMABLE LIQUID POWERED, as appropriate.

241 The formulation shall be prepared in such a manner that it remains homogeneous during transport. Formulations that have a low nitrocellulose content that do not detonate, deflagrate or explode when heated under confinement when tested in accordance with test series 1(a), 2(b) and 2(c) in part I of the United Nations' Manual of tests and criteria, and do not comply with the requirements of a flammable solid when tested in accordance with A.4.1, are considered non-dangerous for transport. For the tests, chips may be crushed and sieved to a particle size of less than 1,25 mm.

242 Sulfur is considered non-dangerous for transport when it has been formed into a specific shape (for exampleprills, granules, pellets, pastilles or flakes).

243 Motor spirit, gasoline and petrol for use in engines, for example, automobiles, stationary engines and other engines, shall be assigned to this entry regardless of variations in volatility.

244 This entry includes aluminium dross, aluminium skimmings, spent cathodes, spent potliner, and aluminiumsalt slags.

246 This substance shall be packed in accordance with packing method OP6B (see table 7 and DEAS 951:2019,During transport, it shall be protected from direct sunlight and stored (or kept) in a cool and well-ventilated place, away from all sources of heat.

247 Alcoholic beverages that contain more than 24 % (by volume) of alcohol but not more than 70 % (by volume) of alcohol, when transported as part of the manufacturing process, may be transported in wooden casks (barrels) of capacity not exceeding 500 L, thus deviating from the provisions on packing (see DEAS 951:2019,, provided that

a) the casks are checked and tightened before filling,

b) sufficient ullage (not less than 3 %) is left to allow for the expansion of the liquid,

c) the casks are transported with the bungholes pointing upwards,
d) the casks are transported in containers that comply with the requirements of the International convention for safe containers. Each cask shall be secured in custom-made cradles and shall be wedged by appropriate means to prevent it from being displaced in any way during transport, and

e) when transported by sea, the containers shall be placed in open cargo spaces only.

249 Ferrocerium, stabilized against corrosion and with a minimum iron content of 10 % (by mass), is regarded as non-dangerous for transport.

250 This entry shall only be used for samples of chemicals that have been taken for analysis in connection with the implementation of the Convention on the prohibition of the development, production, stockpiling and use of chemical weapons and on their destruction (A/RES/47/39), adopted by the General Assembly of the United Nations in New York, United States of America, on 30 November 1992. Such substances shall be transported in accordance with the chain of custody and security procedures as specified by the Organization for the prohibition of chemical weapons in The Hague, The Netherlands. Before a chemical sample is transported, approval shall be granted by the competent authority or the Director-General of the Organization for the prohibition of chemical weapons and provided that

a) the sample is packed in accordance with Packing Instruction 623 of the International Civil Aviation Organization’s technical instructions for the safe transport of dangerous goods by air, and

b) a copy of the document of approval for transport, showing the quantity limitations and the packaging provisions, accompanies the chemical sample.
251 a) The entries "CHEMICAL KIT" or "FIRST-AID KIT" apply to boxes, cases, etc., that contain small quantities of various dangerous goods which are used for medical, analytical or testing purposes. Such kits shall not contain dangerous goods for which the quantity “0” has been been indicated in column 7(a) of the dangerous goods list (see B.2).

b) Components shall not react dangerously in the case of a spill. The total quantity of dangerous goods in any one kit shall not exceed either 1 L or 1 kg. The packing group assigned to the kit as a whole, shall be the most stringent packing group assigned to any individual substance in the kit.

c) Kits that are transported on vehicles for first-aid or operating purposes are regarded as non-dangerous for transport.

d) Chemicals kits and first-aid kits that contain dangerous goods in inner packaging that do not exceed the quantity limits applicable to individual substances (see B.2), may be transported as limited quantities (DEAS 951:2019,).

252 Aqueous solutions of ammonium nitrate that contain not more than 80 % (by mass) ammonium nitrate and not more than 0,2 % (by mass) combustible material, are non-dangerous for transport, provided that the ammonium nitrate remains in solution under all conditions of transport.

266 Competent authority approval is required for the transport of this substance if it contains less alcohol, water or phlegmatizer than the quantity specified in B.2.

267 Any explosives, blasting type C, that contain chlorates shall be segregated from explosives that contain ammonium nitrate or other ammonium salts.

270 Aqueous solutions of inorganic nitrate substances are not considered oxidizing substances of division 5.1 if the concentration of the inorganic nitrate in solution, at the minimum temperature encountered during transport, does not exceed 80 % of the saturation limit.

271 a) Lactose or glucose or similar materials can be used as phlegmatizer, provided that the substance contains not less than 90 % (by mass) of phlegmatizer. The competent authority may authorize these mixtures to be classified in division 4.1 based on results from test series 6(c) in part I of the United Nations' Manual of tests and criteria, on at least three packages as prepared for transport.

b) Mixtures that contain at least 98 % (by mass), of phlegmatizer are non-dangerous for transport.
Packages that contain mixtures with not less than 90 % (by mass), of phlegmatizer need not bear a "TOXIC" hazard label to indicate the subsidiary risk.

272 Competent authority approval is required for the transport of this substance under the provisions of division 4.1 (see UN 0143).

273 Maneb and maneb preparations need not be classified in division 4.2 if it can be demonstrated by testing that a cubic volume of 1 m3 of the substance does not self-ignite, and that the temperature at the centre of the sample does not exceed 200 °C, when the sample is maintained at a temperature of at least 75 °C ± 2 °C for a period of 24 h.

274 The proper shipping name shall be supplemented with the technical name for purposes of documentation and package marking (DEAS 951:2019,).

276 This entry includes any substance that is not covered by any of the other classes, but that has narcotic, noxious, or other properties such that, in the event of spillage or leakage on an aircraft, annoyance or discomfort could be caused to crew members so as to prevent the correct performance of their duties.

277 The limited quantity value for aerosol dispensers or receptacles that contain toxic substances is 120 mL. The limited quantity value for all other aerosol dispensers or receptacles is 1 000 mL.

278 These substances shall only be classified and transported when so authorized by the competent authority on the basis of results from series 2 tests and from test series 6(c) in part I of the United Nations' Manual of tests and criteria. The packages used for the tests shall be prepared as for transport. The competent authority shall assign the packing group in accordance with 9.3 of this standard and the package type used for the said series 6(c) test.

279 The substance is assigned to this classification or packing group based on human experience rather than the strict application of the classification criteria set out in this standard.

280 This entry applies to articles that are used as life-saving vehicle air-bag inflators, or air-bag modules, or seat-belt pretensioners and that contain dangerous goods of class 1 or dangerous goods of other classes.

The component parts and the articles, as presented for transport, shall be tested in accordance with test series 6(c) in part I of the United Nations' Manual of tests and criteria, and shall show

a) no explosion of the device,

b) no fragmentation of the device casing or of the pressure vessel, and

c) no projection hazard nor thermal effect that would significantly hinder fire-fighting or other emergency response efforts in the immediate vicinity.

281 Sea transport of hay, straw or bhusa, wet, damp or contaminated with oil, is prohibited. These products may only be transported by air, road or rail if so authorized by the relevant competent authority. If these materials are not wet, damp or contaminated with oil, they are considered dangerous for transport only when transported by sea.

283 Gas-containing articles, intended to be used as shock absorbers, including impact energy-absorbing devices, or pneumatic springs, are non-dangerous for transport provided that

a) each article has a gas space capacity not exceeding 1,6 L and a charge pressure not exceeding 28 000 kPa where the product of the capacity (in litres) and the charge pressure (in kilopascals) does not exceed 8 000. This means

1) a gas space of 0,28 L and a charge pressure of 28 × 103 kPa,

2) a gas space of 0,5 L and a charge pressure of 16 × 103 kPa,

3) a gas space of 1 L and a charge pressure of 8 × 103 kPa, and

4) a gas space of 1,6 L and a charge pressure of 5 × 103 kPa;

b) each article has a minimum burst pressure at 20 °C of

1) four times the charge pressure for products that do not exceed a gas space capacity of 0,5 L, and

2) five times the charge pressure for products that have a gas space capacity exceeding 0,5 L;

c) each article is manufactured from material that will not fragment upon rupture;

d) each article is manufactured in accordance with a quality assurance standard acceptable to the competent authority; and

e) the design type of each article has been subjected to a fire test, demonstrating that the pressure in the article is relieved by means of a fire degradable seal, or other pressure relief device, such that the article will not fragment and that the article does not rocket.

284 An OXYGEN GENERATOR, CHEMICAL, that contains oxidizing substances shall comply with the following conditions:

a) a generator that contains an explosive actuating device shall only be transported under this entry when it is excluded from class 1 (see the note to 7.1.2.2);

b) a generator, without its packaging, shall be capable of withstanding a 1,8 m drop test onto a rigid, non resilient, flat and horizontal surface, in the position most likely to cause damage, without the loss of its contents and without actuation; and

c) a generator that is equipped with an actuating device, shall be fitted with at least two positive means of preventing unintentional actuation.

286 Nitrocellulose membrane filters covered by this entry, with a mass not exceeding 0,5 g each, are non dangerous for transport when they are contained individually in an article or in a sealed packet.

288 These substances shall only be classified and transported if authorized by the competent authority on the basis of results from series 2 tests and from test series 6(c) on packages as prepared for transport in accordance with part I of the United Nations' Manual of tests and criteria.

289 Airbag inflators, air bag modules or seat belt pretentioners installed in vehicles or in completed vehicle components, such as steering columns, door panels and seats are non-dangerous for transport.

290 When this material complies with the definitions and criteria of other classes or divisions, it shall be classified in accordance with the precedence of hazard (see clause 21 and table 17). Such material shall be declared under the proper shipping name and UN number appropriate to the material in that predominant class or division, and in addition, the name applicable to this material, as given in column 2 of B.2.

291 Flammable liquefied gases shall be contained within refrigerating machine components. These components shall be designed and tested to at least three times the working pressure of the machinery. The refrigerating machines shall be designed and constructed to contain the liquefied gas, and preclude the risk of bursting, or cracking, of the pressure retaining components during normal conditions of transport. Refrigerating machines and refrigerating machine components are considered non-dangerous for transport if they contain less than 12 kg of gas.

292 Only mixtures that contain not more than 23,5 % (by volume) oxygen can be transported under this entry provided that no other oxidizing gases are present. A division 5.1 hazard label, indicating the oxidizing subsidiary risk, is not required for any concentrations within this limit.

293 The following definitions apply to matches:

a) fusee matches – matches of which the heads are prepared with a friction-sensitive igniter composition and a pyrotechnic composition that burn with little or no flame, but with intense heat;

b) safety matches – matches that are combined or attached to the box, book or card and that can be ignited by friction only on a prepared surface;

c) strike-anywhere matches – matches that can be ignited by friction on a solid surface; and

d) wax "Vesta" matches – matches that can be ignited by friction, either on a prepared surface or on a solid surface.

294 Safety matches and wax "Vesta" matches in outer packaging not exceeding 25 kg net mass are not subject to any other requirements except marking of the package when packaged in accordance with packing instruction P407 (see SANS 10229-1).

295 Batteries need not be individually marked and labelled if the pallet bears the appropriate mark and label.

296 These entries apply for life-saving appliances such as life rafts, personal flotation devices and self-inflating slides. UN 2990 applies for self-inflating appliances and UN 3072 applies for life-saving appliances that are not self-inflating. Life-saving appliances may contain:

a) signal devices of class 1, which can include smoke and illuminating signal flares. The signal devices shall be packed in packaging that prevents the devices from being inadvertently activated;

b) cartridges and power devices of division 1.4, compatibility group S for purposes of self-inflating mechanism, provided that the quantity of explosive per appliance does not exceed 3,2 g (applicable for UN 2990 only);

c) compressed gases of division 2.2,

d) electric storage batteries of class 8 and lithium batteries of class 9,

e) first-aid kits or repair kits that contain small quantities of dangerous goods of class 3, division 4.1, division 5.2, class 8 or class 9; or

f) “strike-anywhere” matches packed in packaging that prevent them from being inadvertently activated.

297 Arrangements shall be made between the consignor and the operator(s) for each consignment to be transported by air in order to ensure that ventilation safety procedures are followed.

Transport units that contain solid carbon dioxide and are intended for transport by sea, shall be conspicuously marked on two sides: "WARNING CO2 SOLID (DRY ICE)".

Other packaging that contains solid carbon dioxide and is intended for transport by sea, shall be marked
"CARBON DIOXIDE, SOLID – DO NOT STOW BELOW DECK".
Solid carbon dioxide (dry ice) is exempted from the shipping paper requirements (see SANS 10232-1), if the package is marked "Carbon dioxide, solid" or "Dry ice" and with an indication that the refrigerated substance contained in the package is used for diagnostic treatment purposes, for example frozen medical specimens.

299 Consignments of COTTON, DRY, with a relative density of 360 kg/m3 when tested in accordance with ISO 8115, are non-dangerous for transport when transported in closed transport units.

300 Fish meal and fish scrap is not allowed for transportation if the temperature of the product at the time ofloading exceeds 35 °C or the temperature of the product is 5 °C above the ambient temperature, whichever is higher.
301 a) This entry only applies to apparatus or machinery that contains dangerous substances as a residue, or an integral element, of the apparatus or the machinery. This entry shall not be used for apparatus or machinery for which a proper shipping name already exists in B.2 and annex C.

b) Apparatus or machinery transported under this entry shall contain dangerous goods that are authorized for transport in accordance with the requirements for limited quantities (KS 2530,). The quantity of dangerous goods in apparatus and machinery shall not exceed the quantity specified in column 7(a) of B.2 for each item of dangerous goods contained. However, the competent authority can authorize the transport of apparatus or machinery that contains dangerous goods exceeding the limited quantities given in column 7(a) of B.2.

c) If apparatus or machinery contains more than one item of dangerous goods, the individual substances shall not be capable of reacting dangerously with one another.

d) To ensure that liquid dangerous goods remain in their intended orientation, packaging orientation labels, in accordance with ISO 780, shall be affixed to at least two vertical sides with the arrows pointing in the correct direction.

e) Apparatus or machinery that contains dangerous goods and which would otherwise be transported under this entry, can be exempted from regulation by the competent authority.

302 The word "UNIT" in the proper shipping name means a

a) road freight vehicle,

b) railway freight wagon,

c) freight container,

d) road tank vehicle,

e) railway tank wagon, or

f) portable tank.

For sea transport only, the transport documents associated with the transport of fumigated transport units shall show the date of fumigation and the type and amount of the fumigant used. In addition, instructions for disposal of any residual fumigant, including fumigation devices (if used), shall be provided. A warning sign shall be placed on each fumigated transport unit in such a location that it is readily visible to persons attempting to enter the interior of the unit.

303 The classification of UN 2037 shall be based on the gases contained in the gas receptacle and shall be carried out in accordance with the classification criteria as given in clause 8.

304 BATTERIES, DRY, that contain a corrosive electrolyte are non-dangerous for transport if the electrolyte does not flow out of a cracked battery case, and provided that the batteries are securely packed and protected against short-circuits. Examples of such batteries are alkali-manganese, zinc-carbon, nickel-metal hydride and nickel-cadmium batteries.

305 These substances are non-dangerous for transport when in concentrations of not more than 50 mg/kg.

306 This entry shall only be used for substances that do not exhibit explosives properties of class 1 when tested in accordance with test series 1 and 2 in part I of the United Nations' Manual of tests and criteria.

307 This entry shall only be used for uniform mixtures that contain ammonium nitrate as main ingredient within the following composition limits:

a) at least 90 % (by mass) ammonium nitrate, with not more than 0,2 % (by mass) total combustible (organic) material, calculated as carbon, and with added matter, if any, that is inorganic and inert towards ammonium nitrate; or

b) less than 90 % (by mass) but more than 70 % (by mass) ammonium nitrate, that contains other inorganic compatible material; or

c) more than 80 % (by mass) but less than 90 % (by mass) ammonium nitrate, mixed with calcium carbonate or dolomite or mineral calcium sulfate (or any combination of these) and not more than 0,4 % (by mass) total combustible (organic) material, calculated as carbon; or

d) nitrogen type ammonium nitrate based fertilizers that contain mixtures of ammonium nitrate and ammonium sulfate with more than 45 % (by mass) but less than 70 % (by mass) ammonium nitrate, and not more than 0,4 % (by mass) total combustible (organic) material calculated as carbon. The sum of the percentage compositions (by mass) of ammonium nitrate and ammonium sulfate shall exceed 70 % (by mass).

308 Fish scrap or fish-meal shall contain at least 100 mg/kg of antioxidant (ethoxyquin) at the time of consignment.

309 a) The entry applies to non-sensitized emulsions, suspensions and gels that consist primarily of a mixture of ammonium nitrate and fuel, intended to produce a type E blasting explosive only after further processing before use.

b) The mixture for emulsions typically has the following composition:

— ammonium nitrate, % (by mass): 60 — 85 water, % (by mass): 5 — 30 fuel, % (by mass): 2 — 8

— emulsifier, % (by mass): 0,5 — 4

— soluble flame suppressants and trace additives, % (by mass): 0 — 10

c) The mixture for suspensions and gels typically has the following composition:

— ammonium nitrate, % (by mass): 60 — 85sodium or potassium perchlorate, % (by mass): 0 — 5 hexamine nitrate or mono methylamine

— nitrate, % (by mass) 0 — 17

- water, % (by mass): 5 — 15
- emulsifier (thickening agent), % (by mass): 0,5 — 4
- soluble flame suppressants and trace additives, % (by mass): 0 — 10

Other inorganic nitrate salts may replace part of the ammonium nitrate in the emulsions, suspensions and gels.
c) The non-sensitized emulsions, suspensions and gels shall satisfactory pass test series 8 of the United Nations’ Manual of tests and criteria and be approved by the competent authority.

310 The testing requirements of section 38.3, part III of the United Nations' Manual of tests and criteria are not applicable to production runs up to 100 cells and batteries, or to pre-production prototypes of lithium cells and batteries when these prototypes are transported for testing, provided that

a) the cells and batteries are transported in an outer packaging that is a metal, plastics or plywood drum,
or a metal, plastics or wooden box that complies with the requirements for packing group I, and

b) each cell and battery is individually packed in an inner packaging inside an outer packaging and is surrounded by cushioning material that is non-combustible and non-conductive.

311 Substances shall only be transported under this entry when so approved by the competent authority on the basis of the results obtained of appropriate tests in accordance with part I of the United Nations’ Manual of tests and criteria. The packaging shall be such to ensure that, at any time during transport, the percentage of diluent does not fall below that stated in the competent authority approval.

312 Vehicles that contain an internal combustion engine shall be consigned under the entries UN 3166 VEHICLE, FLAMMABLE GAS POWERED or UN 3166 VEHICLE, FLAMMABLE LIQUID POWERED, as appropriate. These entries include hybrid electric vehicles powered by both an internal combustion engine and wet batteries, sodium batteries or lithium batteries, transported with the battery or batteries installed.

313 Substances and mixtures meeting the criteria for class 8 shall be labelled with a “CORROSIVE” subsidiary risk label DEAS 951:2019.

314 These substances are liable to exothermic decomposition at elevated temperatures. Decomposition can be initiated by heat or by impurities, for example, powdered metals of iron, manganese, cobalt, magnesium and their compounds. They shall be shaded from direct sunlight and all sources of heat during transport and shall be placed in adequately ventilated areas.

315 This entry shall not be used for substances of division 6.1 that meet the inhalation toxicity criteria for packing group I (see 12.1.4.6).

316 This entry applies only to CALCIUM HYPOCHLORITE, DRY, when transported in non-friable tablet form.

317 “Fissile-excepted” radioactive material shall be packed in accordance with the requirements given in , DEAS 951:2019.

318 For the purposes of documentation, the proper shipping name shall be supplemented with the technical name. Technical names need not be shown on the package. When the infectious substances to be transported are unknown, but suspected of meeting the criteria for inclusion in category A and assignment to UN 2814 or UN 2900, the words “suspected category A infectious substance” shall be shown, in parentheses, following the proper shipping name on the transport document, but not on the outer packaging.

319 Substances packed and marked in accordance with packing instruction P650 (see SANS 10229-1) are regarded as non-dangerous for transport.

320 It is intended that this entry will be deleted from modal requirements effective on 1 January 2007. In the interim period, this entry or the appropriate generic entry may be used.

321 These storage systems shall always be considered containing hydrogen.

322 When transported in non-friable tablet form, these goods are assigned to packing group III.

323 The hazard label for division 5.2 as given in DEAS 951:2019.

324 This substance needs to be stabilized when in concentrations of not more than 99 % (by mass).

325 In the case of non-fissile or fissile excepted uranium hexafluoride, the material shall be classified under UN No 2978.

326 In the case of fissile uranium hexafluoride, the material shall be classified under UN 2977.

327 Waste aerosols (see clause 18) shall be transported under this entry for the purposes of reprocessing or disposal. They need not be protected against inadvertent discharge, provided that measures to prevent dangerous build up of pressure and dangerous atmospheres are addressed. Waste aerosols, other than those leaking or severely deformed, shall be packed in accordance with packing instruction P003 and special provision PP87 (see DEAS 951:2019. or packing instruction LP02 and special packing provision L2 (DEAS 951:2019.. Leaking or severely deformed aerosols shall be transported in salvage packaging, provided that appropriate measures are taken to ensure there is no dangerous build up of pressure. Waste aerosols shall not be transported in closed freight containers.

328 This entry applies to fuel cell cartridges contained in equipment or packed with equipment. Fuel cell cartridges installed in or integral to a fuel cell system are regarded as contained in equipment. Fuel cell cartridges shall be designed and constructed to prevent fuel leakage under normal conditions of transport.

Fuel cell cartridge design types using liquids as fuels shall pass an internal pressure test at a pressure of 100 kPa (gauge) without leakage.

Except for fuel cell cartridges containing hydrogen in metal hydride in compliance with special provision 339, each fuel cell cartridge design type shall pass an 1,2 m drop test (see KS 2530,) in the orientation most likely to result in failure of the containment system and with no loss of contents. Fuel cell cartridges containing hydrogen in a metal hydride transported under this entry shall have a water capacity less than or equal to 120 mL.

331 Environmentally hazardous substances meeting the requirements of class 9 (see 15.2), shall display an additional mark to the class 9 label DEAS 951:2019. as shown in figure B.1.

Figure B.1 — Environmentally hazardous mark

332 Magnesium nitrate hexahydrate is considered non-dangerous for transport.

333 Ethanol and gasoline, motor spirit or petrol mixtures for use in spark-ignition engines, for example, in automobiles, stationary engines and other engines, shall be assigned to this entry regardless of variations involatility.

334 A fuel cell cartridge may contain an activator, provided that it is fitted with two independent means of preventing unintended mixing with the fuel during transport.

335 Mixtures of solids that are not subject to the requirements of this standard, and environmentally hazardous liquids or solids, shall be classified as UN 3077 and can be transported under this entry, provided that there is no free liquid visible at the time the substance is loaded or at the time the packaging or transport unit is closed. Each transport unit shall be leakproof when used as a bulk packaging. Sealed packets and articles that contain less than 10 mL of an environmentally hazardous liquid absorbed into a solid material and with no free liquid in the packet or article are regarded as non-dangerous for transport. Likewise, sealed packets and articles that contain less than 10 g of an environmentally hazardous solid, are regarded as nondangerous for transport.

336 When transported by air, a single package that contains solid non-combustible LSA-II or LSA-III material,shall not contain an activity greater than 3 000 A2.

337 Type B(U) and Type B(M) packages intended for transport by air shall not contain activities greater than the following:

a) low dispersible radioactive material — as authorized for the package design as specified in the certificate of approval;

b) special form radioactive material — 3 000 A1 or 100 000 A2, whichever is the lower or;

c) all other radioactive material — 3 000 A2.

338 Each fuel cell cartridge transported under this entry and designed to contain a liquefied flammable gas shall

a) be capable of withstanding a pressure of at least two times the equilibrium pressure of the contents at 55 °C, without leakage or bursting,

b) not contain more than 200 mL of liquefied flammable gas with a vapour pressure lower than 1 000 kPa at 55 °C, and

c) be subjected to a hot water bath test. The temperature of the bath and the duration of the test shall be such that the internal pressure reaches the pressure that would have been reached at 55 °C. If the liquid phase of the gas does not exceed 95 % of the capacity of the receptacle or fuel cell cartridge at 50 °, the temperature of the waterbath and the duration of the test shall be such that the internal pressure reaches the pressure that would have been reached at 50 °C.

If the contents are sensitive to heat or if the receptacle or fuel cell cartridge is manufatured from plastics material that softens at the test temperature, the temperature of the bath shall be set at between 20 °C and 30 °C. In addition, one receptacle or fuel cell cartridge in 2 000 shall be tested at 55 °C.

No leakage or permanent deformation of the receptacle or the fuel cell cartridge shall occur. However, aplastics receptacle or fuel cell cartridge may be deformed through softening, provided that it does not leak.

339 Fuel cell cartridges that contain hydrogen in a metal hydride form and that are transported under this entry shall have a water capacity less than, or equal to, 120 mL.

The pressure in the fuel cell cartridge shall not exceed 5 MPa at 55 °C. The design type shall withstand, without leaking or bursting

a) a pressure of two times the design pressure of the cartridge at 55 °C, or

b) 200 kPa more than the design pressure of the cartridge at 55 °C, whichever is greater.

The pressure at which this test is conducted is referred to in the drop test and the hydrogen cycling test(given below), as the “minimum shell burst pressure”.

Fuel cell cartridges shall be filled in accordance with procedures provided by the manufacturer. The manufacturer shall provide the following information with each fuel cell cartridge:

a) inspection procedures to be carried out before initial filling and before refilling of the fuel cell cartridge;

b) safety precautions and potential hazards to be aware of;

c) a method for determining when the rated capacity has been achieved;

d) minimum and maximum pressure range;

e) minimum and maximum temperature range; and

f) any other requirements to be met for initial filling and refilling, including the type of equipment to be used for initial filling and refilling.

The fuel cell cartridges shall be designed and constructed to prevent fuel leakage under normal conditions of transport. Each cartridge design type, including cartridges integral to a fuel cell, shall be subjected to, and shall pass, the following tests:

Drop test

Drop the fuel cell cartridge from a height of 1,8 m onto an unyielding surface in the following orientations:

a) vertically, on the end containing the shut-off valve assembly;

b) vertically, on the end opposite to the shut-off valve assembly;

c) horizontally, onto a steel apex with a diameter of 38 mm and with the steel apex in the upward position; and

d) at an angle of 45° on the end that contains the shut-off valve assembly.

Acceptance criteria

When tested by means of a soap bubble solution or by other equivalent means, there shall be no leakage on all possible leak locations when the cartridge is charged to its rated charging pressure.
The fuel cell cartridge shall then be hydrostatically pressurized to destruction. The recorded burst pressure shall exceed 85 % of the minimum shell burst pressure.

Fire test

Fill a fuel cell cartridge to its rated capacity with hydrogen and subject it to a fire engulfment test.

NOTE The cartridge design can include a vent feature integral to it.

Acceptance criteria

a) The internal pressure vents to zero gauge pressure without rupture of the cartridge; or

b) the cartridge withstands the fire for a minimum of 20 min without rupture.

Hydrogen cycling test

This test ensures that the design stress limits of a fuel cell cartridge are not exceeded during use.

Cycle the hydrogen capacity of the fuel cell cartridge from not more than 5 % rated hydrogen capacity to not less than 95 % rated hydrogen capacity, and then back to not more than 5 % rated hydrogen capacity. Use the rated charging pressure for charging the fuel cell cartridge and keep the temperature within the operating temperature range. Continue the cycling for at least 100 cycles.

Following the cycling test, charge the fuel cell cartridge and measure the water volume displaced by the cartridge.

Acceptance criteria

The water volume displaced by the cycled cartridge shall not exceed the water volume displaced by an uncycled cartridge charged to 95 % rated capacity and pressurized to 75 % of its minimum shell burst pressure.

Production leak test

Test each fuel cell cartridge, pressurized to its rated charging pressure, for leaks at 15 °C ± 5 °C.

Acceptance criteria

There shall be no leakage, determined by using a soap bubble solution or by other equivalent means at all possible leak locations.

Marking of fuel cell cartridges

Each fuel cell cartridge shall be permanently marked with the following information:

a) the rated charging pressure in megapascals (MPa);

b) the manufacturer's serial number of the fuel cell cartridges or unique identification number; and

c) the expiry date based on the maximum service life (year in four digits and month in two digits).

340 Chemical kits, first-aid kits and polyester resin kits are not individually authorized as excepted quantities in B.2. However, chemical kits, first-aid kits and polyester resin kits that contain dangerous substances in inner packagings not exceeding the quantity limits for excepted quantities applicable to the individual substances as specified in column 7b of B.2, can be transported as E2 excepted quantities in accordance with the requirements of DEAS 951:2019

341 Bulk transport of infectious substance in BK1 and BK2 bulk containers is only permitted for infectious substances contained in animal carcasses, animal body parts or animal foodstuffs.

Annex B

B.2 Numerical list of dangerous goods(see attached DEAS 949 SUPPLIMENT)

B.2.1 Structure of the dangerous goods list

The dangerous goods list is divided into 11 columns as follows:

Column 1 "UN No." - this column contains the serial number assigned to the article or substance under the United Nations system.

Column 2 "Name and description" - this column contains the proper shipping names in uppercase characters, which may be followed by additional descriptive text presented in lowercase characters (see 3.1.2). An explanation of some of the terms used appears in Appendix B. Proper shipping names may be shown in the plural where isomers of similar classification exist. Hydrates may be included under the proper shipping name for the anhydrous substance, as appropriate Unless otherwise indicated for an entry in the dangerous goods list, the word "solution" in a proper shipping name means one or more named dangerous goods dissolved in a liquid that is not otherwise subject to these Regulations

Column 3 "Class or division" - this column contains the class or division and in the case of Class 1, the compatibility group assigned to the article or substance according to the classification system described in Chapter 2.1.

Column 4 "Subsidiary hazard" - this column contains the class or division number of any important subsidiary hazards which have been identified by applying the classification system described in Part 2.

Column 5 "UN packing group" - this column contains the UN packing group number (i.e. I, II or III) assigned to the article or substance. If more than one packing group is indicated for the entry, the packing group of the substance or formulation to be transported shall be determined, based on its properties, through application of the hazard grouping criteria as provided in Part 2.

Column 6 "Special provisions" - this column contains a number referring to any special provision(s) that are relevant to the article or substance. Special provisions apply to all the packing groups permitted for a particular substance or article unless the wording makes it otherwise apparent.

Column 7a "Limited Quantities" - this column provides the maximum quantity per inner packaging or article for transporting dangerous goods as limited quantities

Column 7b "Excepted Quantities" - this column provides an alphanumeric code described in sub-section 3.5.1.2 which indicates the maximum quantity per inner and outer packaging for transporting dangerous goods as excepted quantities .

Column 8 "Packing instruction" - This column contains alphanumeric codes which refer to the relevant packing instructions The packing instructions indicate the packaging (including IBCs and large packagings), which may be used for the transport of substances and articles.

A code including the letter "P" refers to packing instructions for the use of packagings

A code including the letters "IBC" refers to packing instructions for the use of IBCs A code including the letters "LP" refers to packing instructions for the use of Large packaging described in chapter 6.6

When a particular code is not provided, it means the substance is not authorized in the type of packaging that shall be used according to the packing instructions bearing that code.
When N/A is included in the column it means that the substance or article need not be packaged.
The packing instructions are listed in numerical order in section 4.1.4 as follows:

Subsection 4.1.4.1:Packing instructions concerning the use of packagings(except IBCs and large packagings) (p);

Subsection 4.1.4.1::Packing instructions concerning the use of IBCs(IBCs);

Subsection 4.1.4.3::Packing instructions concerning the use of large [packagings(LP);

Column 9 "Special packing provisions" – this column contains alphanumeric codes that refer to the relevant special packing provisions specified .The special packing provisions indicate the special provisions for packaging(including IBCs and large package.

A special packing provision including the letters "PP" refers to the special packing provision applicable to the use of packing instructions bearing the code "P".

A special packing provision including the letter "B" refers to the special packing provision applicable to the use of packing instructions bearing the code "IBC"

A special provision including the letter "L" refers to the special packing provision applicable to packing instructions bearing the code "LP".

Column 10 "Portable tanks and bulk containers/Instructions" – this column contains a number preceded by the letter "T" which refers to the relevant instruction specifying the tank type(s) required for the transport of the substance in portable tanks

A code including the letters "BK" refers to types of bulk containers used for the transport of bulk goods.

The gases authorized for transport in MEGCs are indicated in the column MEGC in Tables 1 and 2 of packing instruction P200

Column 11 "Portable tank and bulk containers/Special provisions" – this column contains a number preceded by the letters "TP" referring to any special provisions that apply to the transport of the substance in portable tanks.

B.2.2 Symbol

The symbol "†" in column 2 indicates that an explanation for the entry is given in annex G.

Abbreviation	Column	Meaning

N.O.S	2	Not otherwise specified
□	2	Entry for which there is an explanation in Appendix B

Annex C Alphabetical list of dangerous goods (see attached DEAS 949 SUPPLIMENT)

Annex D Alphabetical list of basic radionuclide values for individual (see attached DEAS 949 SUPPLIMENT) radionuclides and notes to the annex

Annex G
(informative)
Glossary of terms for explosives

AIR-BAG INFLATORS, PYROTECHNIC or AIR-BAG MODULES, PYROTECHNIC or SEAT-BELT PRETENSIONERS, PYROTECHNIC

Articles containing pyrotechnical substances and used as life-saving vehicle air bags or seat belts.
Ammunition

Generic term related mainly to articles of military application that consist of all kinds of bombs, grenades, rockets, mines, projectiles and other similar devices or contrivances.

AMMUNITION, ILLUMINATING with or without burster, expelling charge or propelling charge

Ammunition designed to produce a single source of intense light for lighting up an area. The term includes illuminating cartridges, grenades and projectiles, and illuminating and target-identification bombs.
The term excludes the following articles that are listed separately in this annex:
CARTRIDGES, SIGNAL;
FLARES, AERIAL;
FLARES, SURFACE;
SIGNAL DEVICES, HAND; and
SIGNALS, DISTRESS.
AMMUNITION, INCENDIARY
Ammunition that contains an incendiary substance which can be a solid, a liquid or a gel, including white phosphorus. Except when the composition is an explosive per se, it can also contain one or more of the following: a propelling charge with primer and igniter charge; a fuze with burster or expelling charge.
The term includes:
AMMUNITION, INCENDIARY, liquid or gel, with burster, expelling charge or propelling charge,
AMMUNITION, INCENDIARY with or without burster, expelling charge or propelling charge, and
AMMUNITION, INCENDIARY, WHITE PHOSPHORUS with burster, expelling charge or propelling charge.
AMMUNITION, PRACTICE
Ammunition without a main bursting charge, and that contains a burster or an expelling charge.
Normally this article also contains a fuze and a propelling charge.
The term excludes GRENADES, PRACTICE, which is listed separately in this annex.

AMMUNITION, PROOF
Ammunition that contains pyrotechnical substances, used to test the performance or strength of new ammunition, weapon components or assemblies.
AMMUNITION, SMOKE
Ammunition that contains a smoke producing substance, such as
a) a chlorosulfonic acid mixture, titanium tetrachloride or white phosphorus, or
b) a smoke-producing pyrotechnic composition based on hexachloroethane or red phosphorus.
Except when the substance is an explosive per se, the ammunition can also contain one (or more) of a propelling charge with primer and igniter charge, and a fuze with burster or expelling charge.
The term includes
AMMUNITION, SMOKE, with or without burster, expelling charge or propelling charge, and
AMMUNITION, SMOKE, WHITE PHOSPHORUS with burster, expelling charge or propelling charge.
AMMUNITION, TEAR-PRODUCING with burster, expelling charge or propelling charge
Ammunition containing a tear-producing substance and one or more of the following: a pyrotechnic substance; a propelling charge with primer and igniter charge; a fuze with burster or expelling charge.
AMMUNITION, TOXIC with burster, expelling charge or propelling
Charge Ammunition containing a toxic agent and one or more of the following: a pyrotechnic substance; a propelling charge with primer and igniter charge; a fuze with burster or expelling charge.
ARTICLES, EXPLOSIVE, EXTREMELY INSENSITIVE (ARTICLES, EEI)
Articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation under normal conditions of transport, and that have passed test series 7 in part I of the United Nations' Manual of tests and criteria.
ARTICLES, PYROPHORIC
Articles that contain a pyrophoric substance that is capable of spontaneous ignition when exposed to air, and an explosive substance or component. The term excludes articles containing white phosphorus.
ARTICLES, PYROTECHNIC for technical purposes
Articles that contain pyrotechnic substances and that are used for technical purposes such as heat generation, gas generation and theatrical effects.
The term excludes the following articles that are listed separately in this annex:
CARTRIDGES, SIGNAL;
CUTTERS, CABLE, EXPLOSIVE;
FIREWORKS;
FLARES, AERIAL;
FLARES, SURFACE;
RELEASE DEVICES, EXPLOSIVE;
RIVETS, EXPLOSIVE;
SIGNAL DEVICES, HAND;

SIGNALS, DISTRESS;
SIGNALS, RAILWAY TRACK, EXPLOSIVE; and
SIGNALS, SMOKE.

BLACK POWDER (GUNPOWDER)

Substance that consists of an intimate mixture of charcoal or other carbon, and either potassium nitrate or sodium nitrate, with or without sulfur. It can be in the form of meal or granules, or it can be compressed or pelletized.

Bombs

Explosive articles intended to be dropped from aircraft. They can contain a flammable liquid with bursting charge, a photo-flash composition or a bursting charge.

The term excludes torpedoes (aerial) but includes
BOMBS, PHOTO-FLASH,
BOMBS with bursting charge, and
BOMBS WITH FLAMMABLE LIQUID with bursting charge.

BOOSTERS

Articles that consist of charges of detonating explosive with, or without, a means of initiation. Boosters are used to increase the initiating power of detonators or detonator cord.

BURSTERS, explosive

Articles that consist of a small charge of explosive used to open projectiles, or other ammunition, in order to disperse their contents.

Cartridges, blank

Articles that consist of a cartridge case with a centre or rim fire primer, and confined charge of smokeless or black powder, but no projectile. Blank cartridges are used for training, saluting, or in starter pistols.

CARTRIDGES, FLASH

Articles that consist of a casing, a primer and flash powder, all assembled in one piece ready for firing.

Cartridges for weapons

Cartridges for weapons consist of:

a) fixed (assembled) or semi-fixed (partially-assembled) ammunition designed to be fired from weapons. Each cartridge includes all the components necessary for the weapon to function once. The name and description shall be used for small arms cartridges that cannot be described as CARTRIDGES, SMALL ARMS. Separate loading ammunition is included under this name and description when the propelling charge and the projectile are packed together (see also "Cartridges, blank"); and

b) incendiary, smoke, toxic and tear-producing cartridges are described in this annex under AMMUNITION, INCENDIARY.

CARTRIDGES FOR WEAPONS, INERT PROJECTILE

A projectile without bursting charge, but with a propelling charge. The presence of a tracer can be disregarded for classification purposes, provided that the predominant hazard is that of a propelling charge.

CARTRIDGES, OIL WELL

Articles that consist of a thin casing made of fibre, metal or other material. Such articles contain only propellants which project a hardened projectile. CHARGES, SHAPED, are excluded from this term since they are listed separately in this annex.

CARTRIDGES, POWER DEVICE

Articles designed to accomplish mechanical actions. They consist of a casing with a charge of deflagrating explosive and a means of ignition. The gaseous products of the deflagration produce inflation, or linear or rotary motion, or activate diaphragms, valves or switches or project fastening devices, or extinguishing agents.

CARTRIDGES, SIGNAL

Articles designed to fire coloured flares or other signals from signal pistols etc.

CARTRIDGES, SMALL ARMS

Ammunition that consists of a cartridge case, fitted with a centre or rim fire primer, and that contains both a propelling charge and a solid projectile. The cartridges are designed to be fired in weapons of calibre not larger than 19,1 mm. Shotgun cartridges of any calibre are included in this description. The term excludes CARTRIDGES, SMALL ARMS, BLANK listed separately in B.2 and annex C, and some small arms cartridges that are listed under CARTRIDGES FOR WEAPONS, INERT PROJECTILE.

CASES, CARTRIDGE, EMPTY, WITH PRIMER

Articles that consist of a cartridge case made from metal, plastics or other non-flammable material, in which the only explosive component is the primer.

CASES, COMBUSTIBLE, EMPTY, WITHOUT PRIMER

Articles that consist of a cartridge case made partly or entirely from nitrocellulose.

Charges, bursting

Articles that consist of a charge of detonating explosive such as hexolite, octolite or plastics-bonded explosive, designed to produce effect by blast or fragmentation.

CHARGES, DEMOLITION

Articles that consist of a charge of detonating explosive in a casing made of fibreboard, plastics, metal or other material. Articles listed separately in this annex, for example, bombs and mines, are excluded from this term.

CHARGES, DEPTH

Articles designed to detonate under water and that consist of a charge of detonating explosive contained in a drum or projectile.

Charges, expelling

Charges of deflagrating explosive designed to eject the payload from the parent articles without damage.

CHARGES, EXPLOSIVE, COMMERCIAL without detonator

Articles that consist of a charge of detonating explosive without means of initiation, used for explosive welding, jointing, forming and other metallurgical processes.

CHARGES, PROPELLING

Articles that consist of a propellant charge in any physical form, with or without a casing and used as a component of rocket motors or for reducing the drag of projectiles.

CHARGES, PROPELLING FOR CANNON

Articles that consist of a propellant charge in any physical form, with or without a casing and that are used in a cannon.

CHARGES, SHAPED, without detonator

Articles that consist of a casing that contains a charge of a detonating explosive with a cavity lined with rigid material, without means of initiation. The charges are designed to produce a powerful, penetrating jet effect.

CHARGES, SHAPED, FLEXIBLE, LINEAR

Articles that consist of a V-shaped core of a detonating explosive clad by a flexible metal sheath.

CHARGES, SUPPLEMENTARY, EXPLOSIVE

Articles that consist of a small removable booster used in the cavity of a projectile between the fuze and the bursting charge.

COMPONENTS, EXPLOSIVE TRAIN, N.O.S.

Articles that contain an explosive, so designed to transmit the detonation or deflagration within an explosive train.

CONTRIVANCES, WATER-ACTIVATED with burster, expelling charge or propelling charge

Articles, where the functioning depends on the physico-chemical reaction of their contents with water.

CORD, DETONATING, flexible

An article that consists of a core of detonating explosive enclosed in spun fabric and covered with plastics or other covering, unless the spun fabric is sift-proof.

CORD (FUSE), DETONATING, metal clad

An article that consists of a core of detonating explosive clad by a soft metal tube with or without protective covering. When the core contains a sufficiently small quantity of explosive, the words "MILD EFFECT" are added to the proper shipping name.

CORD, IGNITER

An article that consists of textile yarns covered with black powder, or another fast burning pyrotechnic composition, and of a flexible protective covering. Alternatively it can consist of black powder surrounded by a flexible woven fabric. The cord burns progressively along its length with an external flame and is used to transmit ignition from a device to a charge or a primer.

CUTTERS, CABLE, EXPLOSIVE

Knife-edged devices that are driven by a small charge of deflagrating explosive into an anvil.

DETONATOR ASSEMBLIES, NON-ELECTRIC for blasting

Non-electric detonators assembled with, and activated by, means such as a safety fuse, a shock tube, a flash tube or a detonating cord. The detonator assemblies can be of instantaneous design or they can incorporate delay elements. Detonating relays incorporating a detonating cord are included. Other detonating relays are included in DETONATORS, NON-ELECTRIC.

Detonators

Articles that consist of a small metal or plastics tube and that contains explosives such as lead azide, PETN (pentaerythritol tetranitrate), or combinations of explosives. Detonators are designed to start a detonator train. Detonators can be constructed to detonate instantaneously, or they can contain a delay element for example, detonating relays without detonating cord.

The term includes

DETONATORS FOR AMMUNITION, and

DETONATORS FOR BLASTING, both ELECTRIC and NON-ELECTRIC.

Entire load and total contents

"Entire load" and "total contents" refer to such a substantial proportion that the practical hazard shall be assessed by assuming simultaneous explosion of the whole of the explosive content of the load or of the package.

Explode

Verb used to indicate those explosive effects capable of endangering life, and property, and the environment through blast, heat and projection of missiles. The term encompasses both deflagration and detonation.

Explosion of the total contents

Term used in testing a single article, or package, or a small stack of articles or packages.

Explosive, blasting

Detonating explosive substances used in mining, construction and similar tasks. The term "Blasting explosives" can be assigned to any of five types of explosives (see EXPLOSIVE, BLASTING, TYPE A to EXPLOSIVE, BLASTING, TYPE E). In addition to the ingredients given for the different types of blasting explosives, they can also contain inert components such as kieselguhr, and minor ingredients such as colouring agents and stabilizers.

EXPLOSIVE, BLASTING, TYPE A

Substances that consist of liquid organic nitrates such as nitroglycerine, or a mixture of such ingredients with one or more of the following: nitrocellulose, ammonium nitrate or other inorganic nitrates, aromatic nitro-derivatives, or combustible materials such as wood-meal and aluminium powder. Blasting explosives of type A are in powdery, gelatinous or elastic form.

The term includes dynamite gelatine, blasting and gelatine dynamites.

EXPLOSIVE, BLASTING, TYPE B

Substances that consist of

a) a mixture of ammonium nitrate or other inorganic nitrates with an explosive such as trinitrotoluene (TNT), with or without other substances such as wood-meal and aluminium powder, or

b) a mixture of ammonium nitrate or other inorganic nitrates with other combustible substances which are explosive ingredients. Such explosives shall not contain nitroglycerine, similar liquid organic nitrates, or chlorates.

EXPLOSIVE, BLASTING, TYPE C

Substances that consist of a mixture of either potassium or sodium chlorate, or sodium or ammonium perchlorate, and with organic nitro-derivatives or combustible materials such as wood-meal or aluminium powder, or a hydrocarbon. Blasting explosives of type C shall not contain nitroglycerine or similar liquid organic nitrates.

EXPLOSIVE, BLASTING, TYPE D

Substances that consist of a mixture of organic nitrated compounds and combustible material such as hydrocarbons and aluminium powder. Blasting explosives of type D shall not contain nitroglycerine, similar liquid organic nitrates, chlorates or ammonium nitrate. The term generally includes plastics explosives.

EXPLOSIVE, BLASTING, TYPE E

Substances that consist of water as an essential ingredient and high proportions of ammonium nitrate or other oxidizers, some or all of which are in solution. Other constituents can include nitro-derivatives such as trinitrotoluene (TNT), hydrocarbons or aluminium powder.

The term includes

a) explosive, emulsions,

b) explosive, slurry, and

c) explosive, water gel.

Explosive, deflagrating

A substance, for example a propellant, that reacts by deflagration rather than by detonation when ignited and used in the normal manner.

Explosive, detonating

A substance that would react by detonation rather than by deflagration when initiated and used in the normal manner.

EXPLOSIVE, EXTREMELY INSENSITIVE DETONATING SUBSTANCE (EIDS)

Substance that, although capable of sustaining a detonation, has demonstrated through tests that it is so insensitive that there is very little probability of accidental initiation.

Explosive, primary

Explosive substance that is manufactured with a view to produce a practical effect by explosion, is very sensitive to heat, to impact or to friction and that, even in very small quantities, either detonates or burns very rapidly. It is able to transmit detonation in the case of an initiating explosive, or deflagration to a secondary explosive close to it. The main primary explosives are mercury fulminate, lead azide and lead styphnate.

Explosive, secondary

Explosive substance that is relatively insensitive when compared to primary explosives. A secondary explosive is usually initiated by primary explosives with or without the aid of boosters or supplementary charges, and it can act as a deflagrating or as a detonating explosive.

FIREWORKS

Pyrotechnic articles designed for entertainment.

Flares

Articles that contain pyrotechnic substances and that are designed for use to illuminate, identify, signal or warn.

The term includes

FLARES, AERIAL, and

FLARES, SIGNAL.

FLASH POWDER

Pyrotechnic substance that, when ignited, produces an intense light.

FRACTURING DEVICES, EXPLOSIVE for oil wells, without detonator

Articles that consist of a charge of detonating explosive contained in a casing and without means of initiation.

These devices are used to fracture rock around a drill shaft to assist the flow of crude oil from the rock.

Fuse or fuze

Although these two words have a common origin (French fusée, fusil), and are sometimes considered to be different spellings of the same concept, it is useful to maintain the convention that fuse refers to a cord-like igniting device, whereas fuze refers to a device used in ammunition that incorporates mechanical, electrical, chemical or hydrostatical components and is used to initiate a train by deflagration or detonation.

FUSE, IGNITER, tubular, metal-clad

An article that consists of a metal tube and a core of deflagrating explosive.

FUSE, INSTANTANEOUS, NON-DETONATING (QUICKMATCH)

An article that consists of cotton yarns impregnated with a fine black powder (Quickmatch). It burns with an external flame and is used in ignition trains for fireworks.

FUSE, SAFETY

An article that consists of a core of fine grained black powder surrounded by a flexible woven fabric with one or more protective outer coverings. When ignited, it burns at a predetermined rate without any external explosive effect.

Fuzes

Articles designed to start a detonation or a deflagration in ammunition. Fuzes incorporate mechanical, electrical, chemical or hydrostatical components, and generally also protective features.

The term includes

FUZES, DETONATING,

FUZES, DETONATING with protective features, and

FUZES, IGNITING.

GRENADES, hand or rifle

Articles designed to be thrown by hand, or to be projected by a rifle.

The term includes

GRENADES, hand or rifle, with bursting charge, and

GRENADES, PRACTICE, hand or rifle.

The term excludes grenades and smoke that are listed under AMMUNITION, SMOKE in B.2.

IGNITERS

Articles that contain one or more explosive substance(s) used to start deflagration in an explosive train.

Igniters can be actuated chemically, electrically or mechanically.

The term excludes the following articles that are listed separately in this annex:

a) CORD, IGNITER;
b) FUSE, IGNITER;
c) FUSE, NON-DETONATING;
d) FUZES, IGNITING;
e) LIGHTERS, FUSE;
f) PRIMERS, CAP TYPE; and
g) PRIMERS, TUBULAR.

Ignition, means of

General term used in connection with the method employed to ignite a deflagrating train of explosive or pyrotechnic substances, for example, a primer for a propelling charge, an igniter for a rocket motor, and an igniting fuze.

Initiation, means of

a) Device intended to cause the detonation of an explosive, for example, a detonator, a detonator for ammunition and a detonating fuze.

b) The term "with its own means of initiation", means that the contrivance has its normal initiating device assembled to it and this device is considered to present a significant risk during transport, but not one great enough to be unacceptable.

The term does not apply, however, to a contrivance packed together with its means of initiation, provided that the device is packaged so as to eliminate the risk of causing detonation of the contrivance in the event of accidental functioning of the initiating device.

The means of initiating can even be assembled to the contrivance, provided that protective features are in place to ensure the unlikelihood of detonation of the contrivance under normal conditions of transport.

c) For classification purposes, the following should be taken into account:

1) any means of initiation without two effective protective features is regarded as a Compatibility Group B explosive;

2) an article with its own means of initiation, and without two effective protective features, is regarded as a Compatibility Group F explosive;

3) a means of initiation which in itself possesses two effective features, is regarded as a Compatibility Group D explosive; and

4) an article with a means of initiation that possesses two protective features can be regarded as a Compatibility Group D or a Compatibility Group E explosive.

The competent authority shall approve means of initiation that is adjudged as having two effective protective features. A common and effective way of achieving the necessary degree of protection is to use a means of initiation that incorporates two or more independent safety features.

JET-PERFORATING GUNS, CHARGED, oil well, without detonator

Shaped charges inserted into a steel tube or a metallic strip. The charges are connected by a detonating cord and without a means of initiation.

LIGHTERS, FUSE

Articles of various design that are actuated by friction, by percussion or by an electric current, and are used to ignite safety fuses.

Mass explosion

An explosion that affects almost the entire load virtually instantaneously.

MINES

Articles, normally consisting of metal receptacles or composition receptacles, and a bursting charge.

The design is such that they can be operated by the passage of ships, by vehicles or by personnel. The term includes "Bangalore torpedoes".

OXYGEN GENERATORS, CHEMICAL

Devices containing chemicals, that on activation, release oxygen as a product of chemical reaction.

Chemical oxygen generators are used for the generation of oxygen for respiratory support, for example, in aircraft, submarines, spacecraft, bomb shelters and breathing apparatus.

Oxidizing salts such as chlorates and perchlorates of lithium, sodium and potassium, used in chemical oxygen generators, evolve oxygen when heated. These salts are mixed (compounded) with a "fuel", usually iron powder, to form a chlorate candle that produces oxygen by continuous reaction.

Once the reaction has started, oxygen is released from the hot salt by thermal decomposition (a thermal shield is placed around the generator). A portion of the oxygen reacts with the "fuel" to produce more heat, which produces more oxygen, and so on.
A percussion device, a friction device or an electric wire can initiate oxygen generators.
POWDER CAKE (POWDER PASTE), WETTED
Substance that consists of nitrocellulose impregnated with more than 60 % (by mass) of nitroglycerine or other liquid organic nitrates, or a mixture of these.
POWDER, SMOKELESS
Substance based on nitrocellulose, and used as propellants. The term includes propellants with a single base (nitrocellulose (NC) alone), those with a double base (such as NC and nitroglycerine (NG)) and those with a triple base (such as NC, NG and nitroguanidine).
Cast, pressed or bag-charges of smokeless powder are given separately in this annex under
CHARGES, PROPELLING or CHARGES, PROPELLING FOR CANNON (see also B.2 and annex C).
PRIMERS, CAP TYPE
Articles that consist of a metal or a plastics cap, that contain a small amount of primary explosive mixture, and that are readily ignited by impact.
Cap type primers serve as igniting elements in small arms cartridges, and in percussion primers for propelling charges.
PRIMERS, TUBULAR
Articles that consist of a primer for ignition and an auxiliary charge of deflagrating explosive such as black powder, to ignite the propelling charge in a cartridge case, for example a cannon.
PROJECTILES
Articles such as a shell or a bullet and that are projected from a cannon or other artillery gun, rifle, or other small arm. Projectiles can be inert, with or without tracer, or can contain a burster or an expelling charge, or a bursting charge.
The term includes
a) PROJECTILES, inert, with tracer,
b) PROJECTILES with burster or expelling charge, and
c) PROJECTILES with bursting charge.
PROPELLANTS
Deflagrating explosives that are used for propulsion, or for reducing the drag of projectiles.
PROPELLANTS, LIQUID
Deflagrating explosive substances in liquid form that are used for propulsion.
PROPELLANTS, SOLID
Deflagrating explosive substances in solid form that are used for propulsion.
RELEASE DEVICES, EXPLOSIVE
Articles, with a means of initiation and consisting of a small charge of explosive. These devices sever rods or links to release equipment quickly.
ROCKET MOTORS
Articles that consist of a solid, liquid or hypergolic fuel contained in a cylinder, fitted with one or more nozzles, and that is designed to propel a rocket or a guided missile.
The term includes
ROCKET MOTORS,

ROCKET MOTORS WITH HYPERGOLIC LIQUIDS, with or without expelling charge, and
ROCKET MOTORS, LIQUID-FUELLED.
ROCKETS
Articles that consist of a rocket motor and a payload that can be an explosive warhead or another device.
The term includes guided missiles and
ROCKETS, LINE-THROWING,
ROCKETS, LIQUID-FUELLED with bursting charge,
ROCKETS with bursting charge,
ROCKETS with expelling charge, and
ROCKETS with inert head.
SIGNALS
Articles that contain pyrotechnic substances and are designed to produce signals by means of sound, flame or smoke, or any combination thereof.
The term includes
SIGNAL DEVICES, HAND,
SIGNALS, DISTRESS, ship,
SIGNALS, RAILWAY TRACK, EXPLOSIVE, and
SIGNALS, SMOKE.
SOUNDING DEVICES, EXPLOSIVE
Articles, consisting of a charge of detonating explosive, and designed to be dropped from ships and function when they reach a predetermined depth, or the seabed.
STABILIZED
"Stabilized" means that the substance is in a condition that precludes uncontrolled reaction. This can be achieved by methods such as the addition of an inhibiting chemical, degassing the substance to remove dissolved oxygen to render the air space in the package inert, or by maintaining the substance under temperature control.
SUBSTANCES, EXPLOSIVE, VERY INSENSITIVE (SUBSTANCES, EVI),
N.O.S.
Substances that present 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.
The substances shall be able to pass test series 5 in part I of the United Nations' Manual of tests and criteria.
TORPEDOES
Articles that contain an explosive, or non-explosive, propulsion system and are designed to be propelled through water. Torpedoes can contain an inert head or a warhead.
The term includes
TORPEDOES, LIQUID-FUELLED, with inert head,
TORPEDOES, LIQUID-FUELLED, with or without bursting charge, and
TORPEDOES with bursting charge.

TRACERS FOR AMMUNITION

Sealed articles that contain pyrotechnic substances and are designed to reveal the trajectory of a projectile.

Warheads

Warheads are articles that consist of detonating explosives and they are designed to be fitted to a rocket, to a guided missile, or to a torpedo. They can contain a burster, or an expelling charge, or a bursting charge.

The term includes

WARHEADS, ROCKET, with burster or expelling charge,
WARHEADS, ROCKET, with bursting charge, and
WARHEADS, TORPEDO, with bursting charge.