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# *Treaty Series*

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*Treaties and international agreements  
registered  
or filed and recorded  
with the Secretariat of the United Nations*

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VOLUME 731

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# *Recueil des Traités*

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*Traités et accords internationaux  
enregistrés  
ou classés et inscrits au répertoire  
au Secrétariat de l'Organisation des Nations Unies*

United Nations • Nations Unies  
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*Treaties and international agreements registered  
or filed and recorded with the Secretariat  
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VOLUME 731

1968

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**Traités et accords internationaux enregistrés  
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**VOLUME 731**

**1968**

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<sup>1</sup> Voir le texte authentique français des annexes telles que modifiées dans le volume 641 du *Recueil des Traités* des Nations Unies.

## NOTE BY THE SECRETARIAT

Under Article 102 of the Charter of the United Nations every treaty and every international agreement entered into by any Member of the United Nations after the coming into force of the Charter shall, as soon as possible, be registered with the Secretariat and published by it. Furthermore, no party to a treaty or international agreement subject to registration which has not been registered may invoke that treaty or agreement before any organ of the United Nations. The General Assembly by resolution 97 (I) established regulations to give effect to Article 102 of the Charter (see text of the regulations, Vol. 76, p. XVIII).

The terms "treaty" and "international agreement" have not been defined either in the Charter or in the regulations, and the Secretariat follows the principle that it acts in accordance with the position of the Member State submitting an instrument for registration that so far as that party is concerned the instrument is a treaty or an international agreement within the meaning of Article 102. Registration of an instrument submitted by a Member State, therefore, does not imply a judgement by the Secretariat on the nature of the instrument, the status of a party or any similar question. It is the understanding of the Secretariat that its action does not confer on the instrument the status of a treaty or an international agreement if it does not already have that status and does not confer on a party a status which it would not otherwise have.

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Unless otherwise indicated, the translations of the original texts of treaties, etc., published in this *Series* have been made by the Secretariat of the United Nations.

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## NOTE DU SECRÉTARIAT

Aux termes de l'Article 102 de la Charte des Nations Unies, tout traité ou accord international conclu par un Membre des Nations Unies après l'entrée en vigueur de la Charte sera, le plus tôt possible, enregistré au Secrétariat et publié par lui. De plus, aucune partie à un traité ou accord international qui aurait dû être enregistré mais ne l'a pas été ne pourra invoquer ledit traité ou accord devant un organe des Nations Unies. Par sa résolution 97 (I), l'Assemblée générale a adopté un règlement destiné à mettre en application l'Article 102 de la Charte (voir texte du règlement, vol. 76, p. XIX).

Le terme « traité » et l'expression « accord international » n'ont été définis ni dans la Charte ni dans le règlement, et le Secrétariat a pris comme principe de s'en tenir à la position adoptée à cet égard par l'État Membre qui a présenté l'instrument à l'enregistrement, à savoir que pour autant qu'il s'agit de cet État comme partie contractante l'instrument constitue un traité ou un accord international au sens de l'Article 102. Il s'ensuit que l'enregistrement d'un instrument présenté par un État Membre n'implique, de la part du Secrétariat, aucun jugement sur la nature de l'instrument, le statut d'une partie ou toute autre question similaire. Le Secrétariat considère donc que les actes qu'il pourrait être amené à accomplir ne confèrent pas à un instrument la qualité de « traité » ou d'« accord international » si cet instrument n'a pas déjà cette qualité, et qu'ils ne confèrent pas à une partie un statut que, par ailleurs, elle ne posséderait pas.

\* \* \*

Sauf indication contraire, les traductions des textes originaux des traités, etc., publiés dans ce *Recueil* ont été établies par le Secrétariat de l'Organisation des Nations Unies.

ANNEX A

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No. 8940. EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR). DONE AT GENEVA ON 30 SEPTEMBER 1957<sup>1</sup>

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ENTRY INTO FORCE OF ANNEXES A AND B TO THE ABOVE-MENTIONED AGREEMENT, AS MODIFIED UPON PROPOSAL FORMULATED BY THE GOVERNMENT OF FRANCE ON 29 JANUARY 1968<sup>2</sup>

*Authentic text of the annexes: French.*

*Registered ex officio on 29 July 1968.*

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<sup>1</sup> United Nations, *Treaty Series*, vol. 619, p. 77, and annex A in volumes 639, 641 and 701.

<sup>2</sup> In accordance with article 14 (3) of the Agreement, the amendments to annexes A and B came into force on 29 July 1968, the date coinciding with the entry into force of the original annexes as provided for by article 7 (1) of the Agreement (i.e., six months after the entry into force, on 29 January 1968, of the Agreement itself). Consequently, annexes A and B, as amended, became applicable on 29 July 1968. The text reproduced herein is the authoritative English translation established in accordance with the final paragraph of the Agreement of 30 September 1957. The authentic French text has been published in volume 641.



## ANNEX A

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## Part I

## DEFINITIONS AND GENERAL PROVISIONS

## DEFINITIONS

1 - 1999

(1) For the purposes of this Annex:

2000

- the term "competent authority" means the authority designated as such in each country and in each specific case by the Government;
- the term "fragile package" means a package containing a fragile receptacle (i.e. a receptacle made of glass, porcelain, stoneware or similar materials) which is not enclosed in a packaging with complete sides protecting it effectively against shock [see also marginal 2001 (5)];
- the term "gas" means a gas or vapour;
- the term "dangerous substances", when used alone, means the substances and articles designated as being substances and articles of ADR:
- the term "carriage in bulk" means the carriage of a solid substance without packaging;
- the term "RID" means the International Regulations concerning the Carriage of Dangerous Goods by Rail [Annex 1 to the International Convention concerning the Carriage of Goods by Rail (CIM)].

(2) For the purposes of this Annex, tanks (see definitions in Annex B) are not placed on the same footing as receptacles, the term "receptacle" being used in a restrictive sense. Provisions concerning receptacles are applicable to fixed tanks, large movable tanks and small tank-containers only if this is expressly stipulated.

(3) The term "complete load" means any load originating from one sender for which the use of a vehicle or of a large container is exclusively reserved and all operations for the loading and unloading of which are carried out in conformity with the instructions of the sender or of the consignee.

Definitions and general provisions

2001

(1) Unless expressly stated otherwise, the sign "%" in this Annex represents:

(a) in the case of mixtures of solids or of liquids, and also in the case of solutions and of solids wetted by a liquid: a percentage by weight based on the total weight of the mixture, the solution or the wetted solid;

(b) in the case of gaseous mixtures: a percentage by volume based on the total volume of the gaseous mixture.

(2) All weights mentioned for packages in this Annex are, unless otherwise specified, gross weights. The weight of containers or tanks used for the carriage of goods is not included in the gross weight.

(3) Pressures of all kinds relating to receptacles (such as test pressure, internal pressure, safety-valve opening pressure) are always indicated in  $\text{kg/cm}^2$  gauge pressure (pressure in excess of atmospheric pressure); however, the vapour pressure of substances is always expressed in  $\text{kg/cm}^2$  absolute pressure.

(4) Where this Annex specifies a degree of filling for receptacles or tanks, that degree of filling is always referred to a temperature of the substances of  $15^{\circ}\text{C}$  unless some other temperature is indicated.

(5) Fragile receptacles secured, either singly or in groups, by cushioning materials in a strong receptacle are not regarded as fragile receptacles on condition that the strong receptacle is leak-proof and so designed that in the event of breakage or leakage of the fragile receptacles their contents cannot escape from the strong receptacle and that the mechanical strength of the latter is not impaired by corrosion during carriage.

2002

## GENERAL PROVISIONS

(1) This Annex specifies the dangerous goods to be excluded from international carriage by road and the dangerous goods to be accepted for such carriage under certain conditions. It groups the dangerous goods in restrictive and non-restrictive Classes. Of the dangerous goods covered by the headings of the restrictive Classes (Classes Ia, Ib, Ic, Id, Ie, II,

Definitions and general provisions

IVb, VI and VII), those which are listed in the clauses concerning these Classes (marginals 2021, 2061, 2101, 2131, 2181, 2201, 2451, 2601 and 2701) are to be accepted for carriage only under the conditions specified in these clauses, and others are to be excluded from carriage. Some of the dangerous goods covered by the headings of the non-restrictive Classes (Classes IIIa, IIIb, IIIc, IVa and V) are, by notes inserted in the clauses concerning the various Classes, excluded from carriage; of the other goods covered by the headings of the non-restrictive Classes, those which are mentioned or defined in the clauses concerning these Classes (marginals 2301, 2331, 2371, 2401 and 2501) are to be accepted for carriage only under the conditions specified in these clauses, and those which are not mentioned or defined therein are not deemed to be dangerous goods for the purposes of this Agreement and are to be accepted for carriage without any special conditions.

2002  
(contd)

(2) The Classes of this Annex are as follows:

Class Ia	Explosive substances and articles	Restrictive
Class Ib	Articles filled with explosive substances	Restrictive
Class Ic	Igniters, fireworks and similar goods	Restrictive
Class Id	Gases: compressed, liquefied, or dissolved under pressure	Restrictive
Class Ie	Substances which give off inflammable gases on contact with water	Restrictive
Class II	Substances liable to spontaneous combustion	Restrictive
Class IIIa	Inflammable liquids	Non-restrictive
Class IIIb	Inflammable solids	Non-restrictive
Class IIIc	Oxidizing substances	Non-restrictive
Class IVa	Toxic substances	Non-restrictive
Class IVb	Radioactive substances	Restrictive
Class V	Corrosive substances	Non-restrictive

Definitions and general provisions2002  
(contd)

Class VI	Repugnant substances and substances liable to cause infection	Restrictive
Class VII	Organic peroxides	Restrictive

(3) Any carriage of goods governed by this Annex shall be the subject of a transport document. The document may be that already required by other regulations in force. Any goods the carriage of which is so governed shall be described in the transport document in conformity with the indications in section B of the special provisions for each Class. The particulars to be entered in the transport document shall be drafted in an official language of the forwarding country, and also, if that language is not English, or French, or German, in English, French or German, unless international road transport tariffs, if any, or agreements concluded between the countries concerned in the transport operation, provide otherwise. The transport document shall be accompanied, if appropriate, by instructions to be implemented in the event of an accident (see Annex B, marginal 10 185). The transport document shall accompany the dangerous substances carried.

(4) If by reason of the size of the load a consignment cannot be loaded in its entirety on a single transport unit, at least as many separate documents, or copies of the single document, shall be made out as transport units loaded. Furthermore, in all cases, separate transport documents shall be made out for consignments or parts of consignments which may not be loaded together on the same vehicle or the same transport unit by reason of the prohibitions set forth in Annex B.

(5) Outer packagings additional to those specified in this Annex may be used providing that they do not contravene the spirit of the provisions of this Annex relating to outer packagings. If such additional packagings are used, the prescribed marking and labels shall be applied to them.

(6) If the mixed packing of several dangerous substances with one another or with other goods is allowed by the provisions of section A.3 of the provisions applicable to the various Classes, the inner packagings

Definitions and general provisions

containing different dangerous substances shall be carefully and effectively separated from one another in the collective packagings if dangerous reactions, such as the production of dangerous heat, combustion, the formation of mixtures sensitive to friction or shock, and the release of inflammable or toxic gases, are liable to occur as a result of damage to or destruction of the inner packagings. In particular, if fragile receptacles are used, and especially if the said receptacles contain liquids, the danger of the formation of dangerous mixtures must be avoided and to this end all appropriate measures shall be taken, such as the use of suitable cushioning materials in sufficient quantity, securing of the receptacles in a second, strong packaging, and subdivision of the collective packaging into several compartments.

2002  
(contd)

(7) If mixed packing is used, the provisions of this Annex concerning the particulars in the transport document shall apply in respect of each of the different kinds of dangerous substance contained in the collective package, and the collective package shall bear all the inscriptions and all the danger labels prescribed in this Annex for the dangerous substances the collective package contains.

(8) If solutions of substances listed in this Annex are not expressly mentioned in the list of the Class to which the dissolved substances belong, they shall nevertheless be considered as substances of ADR if their concentration is such that they retain the danger inherent in the substances themselves; their packaging shall in such event conform to the requirements of section A of the special provisions applicable to the Class to which the said substances belong, it being understood that packagings which would be unsuitable for the carriage of liquids may not be used.

(9) Mixtures of substances of ADR with other substances shall be considered as substances of ADR if they retain the danger inherent in the substance which is a substance of ADR.

Definitions and general provisions2002  
(contd)

(10) A substance whose specific radioactivity does not exceed 0.002 microcurie per gramme and which is covered by a collective heading of any Class shall be excluded from carriage if, in addition, it is covered by the heading of a restrictive Class in which it is not listed.

(11) A substance whose specific radioactivity does not exceed 0.002 microcurie per gramme and which is not listed by name in a Class, but is covered by two or more collective headings of different Classes, shall be subject to the conditions of carriage laid down:

- (a) in the restrictive Class, if one of the Classes concerned is a restrictive Class;
- (b) in the Class corresponding to the predominant danger exhibited by the substance during carriage, if none of the Classes concerned is a restrictive Class.

2003

(1) This Annex contains for each Class:

- (a) a list of the dangerous substances constituting the Class, and, where applicable, in the form of a marginal having a number ending with the letter "a", the exemptions allowed from the provisions of ADR for some of these substances if they comply with certain conditions;
- (b) provisions sub-divided as follows:
  - A. Packages:
    - 1. General conditions of packing;
    - 2. Packing of a single substance or of articles of the same kind;
    - 3. Mixed packing;
    - 4. Marking and danger labels on packages.
  - B. Particulars in the transport document.
  - C. Empty packagings.
  - D. (where appropriate) Other provisions.
- (2) Provisions concerning:
  - - consignment in bulk, in containers and in tanks;
  - method of despatch and restrictions on forwarding;

Definitions and general provisions

- prohibitions on mixed loading; and
- transport equipment

2003  
(contd)

are to be found in Annex B and its appendices, which also contain all other pertinent provisions applying specifically to carriage by road.

(3) The appendices to this Annex contain:

Appendix A.1: Stability and safety conditions relating to explosive substances, inflammable solids and organic peroxides, together with rules for tests;

Appendix A.2: Recommendations relating to the nature of aluminium-alloy receptacles for certain gases of Class Id, and provisions relating to tests on aerosol dispensers and non-refillable containers for gases under pressure of Class Id, 16° and 17°;

Appendix A.3: Tests relating to inflammable liquids of Classes IIIa and IVa;

Appendix A.5: Provisions relating to tests on steel drums for the carriage of inflammable liquids of Class IIIa;

Appendix A.6: Tables; method of applying the criteria of Nuclear Safety Class I; and methods of testing packagings intended for substances of Class IVb;

Appendix A.9: Provisions relating to danger labels, and explanation of the symbols.

Appendices A.5, A.7 and A.8 are reserved.

Where the provisions relating to carriage as a "complete load" are applied, the competent authorities may require the vehicle or large container used for the transport operation concerned to be loaded at only one point and unloaded at only one point.

2004  
2005

(1) If the vehicle carrying out a transport operation subject to the provisions of ADR is conveyed over a section of the journey otherwise than by road haulage, then any national or international regulations which, on the said section, govern the carriage of dangerous goods by the mode of transport used for conveying the road vehicle shall alone be applicable to the said section of the journey.

2006

Definitions and general provisions2006  
(contd)

(2) In cases where a transport operation subject to the provisions of ADR is likewise subject over the whole or a part of its road journey to the provisions of an international convention which regulates the carriage of dangerous goods by a mode of transport other than road carriage by virtue of clauses extending the applicability of the said convention to certain motor-vehicle services, then the provisions of that international convention shall apply, over the journey in question, concurrently with those of ADR which are not incompatible therewith; the other clauses of ADR shall not apply over the journey in question.

2007-  
2009

2010

For the purpose of carrying out the trials necessary with a view to amending the provisions of this Annex in order to adapt them to technological and industrial developments, the competent authorities of the Contracting Parties may agree directly among themselves to authorize certain transport operations in their territories by temporary derogation from the provisions of this Annex. The authority which has taken the initiative with respect to the temporary derogation so granted shall notify the competent service of the United Nations Secretariat of the derogation, which service shall bring it to the attention of the Contracting Parties.

2011-  
2019

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Part IILIST OF SUBSTANCES AND  
SPECIAL PROVISIONS FOR THE VARIOUS CLASSES

## CLASS Ia. EXPLOSIVE SUBSTANCES AND ARTICLES

Note: Substances and articles which cannot explode on contact with a flame and which are not more sensitive to shock or friction than dinitrobenzene are not subject to the provisions of Class Ia.

1. List of substances and articles

(1) Among the substance and articles covered by the heading of Class 2020 Ia, only those listed in marginal 2021 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR.

(2) In the explosives which are to be accepted for carriage, nitroglycerine may be replaced wholly or in part by:

- (a) nitroglycol, or
- (b) dinitrodiethyleneglycol, or
- (c) nitrated sugar (nitrated saccharose), or
- (d) a mixture of the above substances.

1<sup>o</sup> Highly nitrated nitrocellulose (such as guncotton), i.e. with a nitrogen content of more than 12.6%, well stabilized and containing in addition: 2021

when the nitrocellulose is not compressed, not less than 25% water or alcohol (methyl, ethyl, normal propyl or isopropyl, butyl, or amyl alcohol or mixtures thereof), including denatured alcohol; or mixtures of water and alcohol;

when the nitrocellulose is compressed, not less than 15% water, or not less than 12% paraffin wax or other similar substances.

See also Appendix A.1, marginal 3101.

Note: 1. Nitrocellulose with a nitrogen content not exceeding 12.6% is a substance of Class IIIb if it complies with the specifications set out in marginal 2331, 7<sup>o</sup> (a), (b) or (c).

2. Nitrocellulose in the form of nitrocellulose-film waste, free from gelatine, in reels, sheets or strips, is a substance of Class II (see marginal 2201, 4<sup>o</sup>).

## Class Ia

- 2021 (contd)
- 2° Cordite paste, non-gelatinized ("powder cake"), for use in the making of smokeless powders and containing not more than 70% anhydrous substance and not less than 30% water; the anhydrous substance must not contain more than 50% nitroglycerine or similar liquid explosives.
- 3° Gelatinized nitrocellulose powders and gelatinized nitrocellulose powders containing nitroglycerine (nitroglycerine powders):
- (a) non-porous and non-dusty;
- (b) porous or dusty.
- See also Appendix A.1, marginal 3102.
- 4° Plasticized nitrocellulose containing not less than 12% but less than 18% plasticizing substances (such as butyl phthalate or a plasticizer at least equal in effect to butyl phthalate), and whose nitrocellulose has a nitrogen content not exceeding 12.6%, also in the form of chips.
- Note: Plasticized nitrocellulose containing not less than 18% butyl phthalate or a plasticizer at least equal in effect is a substance of Class IIIb [see marginal 2331, 7° (b) and (c)].
- See also Appendix A.1, marginal 3102, 1.
- 5° Non-gelatinized nitrocellulose powders. See also Appendix A.1, marginal 3102.
- 6° Trinitrotoluene (tolite), also when compressed or cast, trinitrotoluene mixed with aluminium, mixtures termed liquid trinitrotoluene, and trinitroanisole. See also Appendix A.1, marginal 3103.
- 7° (a) Hexyl (hexanitrodiphenylamine) and picric acid;
- (b) pentolites (mixtures of pentaerythritol tetranitrate and trinitrotoluene) and hexolites (mixtures of trimethylene-trinitramine and trinitrotoluene) if their trinitrotoluene content is such that their sensitiveness to shock does not exceed that of tetryl;
- (c) phlegmatized penthrite (pentaerythritol tetranitrate) and phlegmatized hexogen (trimethylene-trinitramine), both phlegmatized by incorporation of wax, paraffin wax or other similarly effective substances in such quantity that the sensitiveness of these substances to shock does not exceed that of tetryl.

## Class Ia

For (a), (b) and (c), see also Appendix A.1, marginal 3103.

2021  
(contd)

Note: Substances of 7° (b) and phlegmatized hexogen of 7° (c) may also contain aluminium.

8° Explosive organic nitro-compounds :

- (a) soluble in water, e.g. trinitroresorcinol;
- (b) insoluble in water, e.g. tetryl (trinitrophenylmethylnitramine);
- (c) tetryl gains without metal covering.

For (a) and (b), see also Appendix A.1, marginal 3103.

Note: Except for liquid trinitrotoluene (6°), explosive organic nitro-compounds in the liquid state are not to be accepted for carriage.

- 9° (a) Moist penthrite (pentaerythritol tetranitrate) and moist hexogen (trimethylene-trinitramine) wetted throughout with not less than 20% water in the case of the former and not less than 15% in the case of the latter;
- (b) moist pentolites (mixtures of penthrite and trinitrotoluene) and moist hexolites (mixtures of hexogen and trinitrotoluene) whose sensitiveness to shock in the dry state exceeds that of tetryl and which are wetted throughout with not less than 15% water;
- (c) moist mixtures of penthrite or of hexogen with wax, paraffin wax or substances similar to wax or paraffin wax, whose sensitiveness to shock in the dry state exceeds that of tetryl and which are uniformly wetted throughout with not less than 15% water;
- (d) compressed penthrite gains without metal covering.

For (a), (b) and (c), see also Appendix A.1, marginal 3103.

10° (a) Benzoylperoxide :

1. in the dry state or with less than 10% water;
2. with less than 30% phlegmatizer.

Note: 1. Benzoyl peroxide with not less than 10% water or with not less than 30% phlegmatizer is a substance of Class VII [see marginal 2701, 8° (a) and (b)].

## Class Ia

2021  
(contd)

2. Benzoyl peroxide with not less than 70% dry and inert solids is not subject to the provisions of ADR.

(b) Cyclohexanone peroxides [1-hydroxy-1-hydroperoxy-dicyclohexyl peroxide and bis-(1-hydroxycyclohexyl) peroxide and mixtures of these two compounds]:

1. in the dry state or with less than 5% water;
2. with less than 30% phlegmatizer.

Note: 1. Cyclohexanone peroxides and their mixtures with not less than 5% water or with not less than 30% phlegmatizer are substances of Class VII [see marginal 2701, 9<sup>o</sup> (a) and (b)].

2. Cyclohexanone peroxides and their mixtures with not less than 70% dry and inert solids are not subject to the provisions of ADR.

(c) Parachlorobenzoyl peroxide:

1. in the dry state or with less than 10% water;
2. with less than 30% phlegmatizer.

Note: 1. Parachlorobenzoyl peroxide with not less than 10% water or with not less than 30% phlegmatizer is a substance of Class VII [see marginal 2701, 17<sup>o</sup> (a) and (b)].

2. Parachlorobenzoyl peroxide with not less than 70% dry and inert solids is not subject to the provisions of ADR.

- 11<sup>o</sup> (a) Black powder (with a basis of potassium nitrate) in corned or meal form;
- (b) slow mining powders similar to black powder (composed of sodium nitrate, sulphur and wood charcoal, coal or lignite, or composed of potassium nitrate with or without sodium nitrate, sulphur, coal or lignite);
- (c) cartridges of compressed black powder or powder similar to compressed black powder.

Note: The density of the compressed mass must not be less than 1.5 g per cm<sup>3</sup>.

For (a) and (b), see also Appendix A.1, marginal 3104.

- 12<sup>o</sup> (a) Nitrate explosives, in powder form, not covered by 11<sup>o</sup> or 14<sup>o</sup> (a) or (c), and consisting essentially of ammonium nitrate or of a mixture of alkali or alkaline-earth nitrates with ammonium

## Class Ia

chloride, or of a mixture of ammonium nitrate with alkali or alkaline-earth nitrates and ammonium chloride. They may contain, in addition, combustible substances (such as wood flour or another vegetable flour or hydrocarbons), aromatic nitro-compounds, nitroglycerine or nitroglycol or a mixture of the two, and inert stabilizing or colouring substances. See also Appendix A.1, marginal 3105.

2021  
(contd)

- (b) explosives not containing inorganic nitrates, in powder form, consisting essentially of a mixture of inert substances (such as alkali chlorides) with nitroglycerine or nitroglycol or a mixture of the two. They may contain, in addition, aromatic nitro-compounds, and substances with a phlegmatizing, stabilizing or gelatinizing, or colouring effect. See also Appendix A.1, marginal 3105.

13° Chlorate and perchlorate explosives, i.e. mixtures of chlorates or perchlorates of alkali or alkaline-earth metals with compounds rich in carbon.

See also Appendix A.1, marginal 3106.

- 14° (a) Dynamites with an inert absorbent, and explosives similar to dynamite with an inert absorbent;
- (b) blasting gelatine consisting of gun-cotton and not more than 93% nitroglycerine, and gelatinized dynamites with a nitroglycerine content not exceeding 85%;
- (c) gelatinous nitrate explosives, consisting essentially of ammonium nitrate or of a mixture of ammonium nitrate with nitrates of alkali or alkaline-earth metals containing not more than 40% gelatinized nitroglycerine or gelatinized nitroglycol or a mixture of the two. They may contain, in addition, nitro-compounds or combustible substances (such as wood flour or another vegetable flour or hydrocarbons) and, in addition, other inert or colouring substances.

For (a), (b) and (c), see also Appendix A.1, marginal 3107.

15° Empty packagings, uncleaned, which have contained dangerous substances of Class Ia.

## Class Ia

2. ProvisionsA. Packages1. General conditions of packing

2022

(1) Packagings shall be so closed and leak-proof as to prevent any loss of the contents. The use of metal bands or wires to ensure closure is forbidden unless this procedure is specifically authorized in the special provisions relating to the packing of the substances or articles in question.

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents nor form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. Solid substances shall be firmly secured in their packagings, and inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance or of articles of the same kind", inner packagings may be enclosed in outer packagings, either singly or in groups.

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The thickness of the walls must not be less than 2 mm.

(5) Cushioning materials shall be suited to the nature of the contents; in particular, they must be absorbent if the contents are liquid or might exude liquid.

2. Packing of a single substance or of articles of the same kind

2023

(1) Substances of 1<sup>o</sup> and 2<sup>o</sup> shall be packed:

- (a) in wooden receptacles or in drums made of impermeable fibreboard; these receptacles and drums shall in addition be fitted with a lining impermeable to the liquids they contain; their closure must be leak-proof; or
- (b) in impermeable bags (e.g. made of rubber or of a suitable plastics material not readily inflammable) placed in a wooden case; or
- (c) in iron drums coated inside with zinc or lead; or
- (d) in receptacles made of tin-plate, zinc sheet or aluminium sheet, which shall be secured by cushioning materials in wooden cases.

## Class Ia

(2) Metal receptacles shall be fitted with closures or safety devices yielding when the internal pressure reaches a value not greater than  $3 \text{ kg/cm}^2$ ; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure.

2023  
(contd)

(3) Nitrocellulose of 1<sup>o</sup>, if wetted exclusively with water, may be packed in fibreboard drums; the fibreboard must have undergone a special treatment to render it completely impermeable; the closures of the drums must be water-vapour proof.

(4) A package containing substances of 1<sup>o</sup> must not weigh more than 120 kg or, if it can be rolled, more than 300 kg; however, where fibreboard drums are used, a package must not weigh more than 75 kg.

A package containing substances of 2<sup>o</sup> must not weigh more than 75 kg.

(1) Substances of 3<sup>o</sup> (a) and 4<sup>o</sup> shall be packed:

2024

(a) if they are to be carried as a complete load:

1. in drums made of impermeable fibreboard; or
2. in packagings made of wood or of metal other than black sheet-iron;

(b) if they are not to be carried as a complete load:

1. in boxes made of fibreboard, tin-plate, zinc sheet or aluminium sheet, or of a suitable plastics material not readily inflammable, or in bags made of closely-woven textile or of stout paper of at least two plies or of stout paper lined with aluminium foil or with a suitable plastics material. These packagings shall be placed in wooden cases; or
2. without preliminary packing in boxes or bags:
  - a. in drums made of impermeable fibreboard or in wooden casks; or
  - b. in wooden packagings lined with zinc sheet or aluminium sheet; or
  - c. in receptacles made of metal other than black sheet-iron.

(2) If the powder is in tubes, sticks, threads, bands or sheets it may also be enclosed, without preliminary packing in boxes or bags, in wooden cases.

(3) Metal receptacles shall be fitted with closures or safety devices yielding when the internal pressure reaches a value not greater than  $3 \text{ kg/cm}^2$ ; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure.

## Class Ia

2024  
(contd)

(4) The closure of wooden cases may be ensured by means of bands or wires made of a suitable metal fastened tightly round them. If the bands or wires are made of iron they shall be covered with a material not liable to produce sparks when subjected to impact or friction.

(5) A package must not weigh more than 120 kg; however, where fibreboard drums are used, a package must not weigh more than 75 kg.

2025

(1) Substances of 3<sup>o</sup> (b) and 5<sup>o</sup> shall be packed:

(a) if they are to be carried as a complete load:

1. in drums made of impermeable fibreboard; or
2. in packagings made of wood or of metal other than black sheet-iron;

(b) if they are not to be carried as a complete load:

1. in boxes made of fibreboard, tin-plate or aluminium sheet. A box must not contain more than 1 kg of powder and must be wrapped in paper. These packagings shall be placed in wooden packagings; or
2. in bags made of closely-woven textile or of stout paper of at least two plies or of stout paper lined with aluminium foil or with a suitable plastics material. These bags shall be placed in fibreboard drums or in wooden casks or in other wooden packagings lined with zinc sheet or aluminium sheet, or in receptacles made of zinc sheet or aluminium sheet. Receptacles made of zinc sheet or aluminium sheet shall be completely lined with wood or fibreboard.

(2) Metal receptacles shall be fitted with closures or safety devices yielding when the internal pressure reaches a value not greater than 3 kg/cm<sup>2</sup>; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure.

(3) The closure of wooden cases may be ensured by means of bands or wires made of a suitable metal fastened tightly round them. If the bands or wires are made of iron they shall be covered with a material not liable to produce sparks when subjected to impact or friction.

(4) A package under (1) (a) must not weigh more than 100 kg; however, where fibreboard drums are used, a package must not weigh more than 75 kg. A package under (1) (b) must not weigh more than 75 kg. It must not contain more than 30 kg of nitrocellulose powder.



## Class Ia

(1) Substances of 6° shall be packed in wooden receptacles. Drums 2026 made of impermeable fibreboard are likewise to be accepted for solid trinitrotoluene and for trinitroanisole, and iron receptacles for mixtures termed liquid trinitrotoluene.

(2) Metal receptacles shall be fitted with closures or safety devices yielding when the internal pressure reaches a value not greater than  $3 \text{ kg/cm}^2$ ; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure.

(3) A package must not weigh more than 120 kg or, if it can be rolled, more than 300 kg; however, where fibreboard drums are used, a package must not weigh more than 75 kg.

(1) Substances of 7° shall be packed:

2027

(a) substances of 7° (a): in wooden receptacles or in drums made of impermeable fibreboard. Lead and materials containing lead (alloys or compounds) must not be used in the packaging of hexyl (hexanitrodiphenylamine) and picric acid.

Picric acid may also be packed, not more than 500 g per receptacle, in receptacles made of glass, porcelain, stoneware or similar materials or of a suitable plastics material, secured in a wooden case by cushioning material (e.g. corrugated fibreboard). The receptacles shall be closed by means of a stopper, made of cork or rubber or a suitable plastics material, which shall be held in position by an additional device (such as a cap, crown, seal or binding) capable of preventing any loosening of the closure system during carriage;

(b) substances of 7° (b) and (c): not more than 30 kg per bag, in cloth bags which do not allow the contents to filter through, or in bags made of stout paper or a suitable plastics material, which shall be placed in leak-proof wooden receptacles or in drums made of hardened fibreboard capable of being so closed as to be leak-proof and whose bottoms and lids shall be made of plywood. The lids of cases shall be secured by means of screws and those of drums by means of a collar.

## Class Ia

2027  
(contd)

(2) A package containing substances of 7° (a) must not weigh more than 120 kg if it is a wooden receptacle; where fibreboard drums are used, a package must not weigh more than 75 kg. Packages containing picric acid packed in fragile receptacles or in receptacles made of a plastics material must not weigh more than 15 kg. A package containing substances of 7° (b) or (c) must not weigh more than 75 kg; cases which, with their contents, weigh more than 30 kg shall be fitted with means of handling.

2028

(1) Substances and articles of 8° shall be packed:

- (a) substances of 8° (a): in receptacles made of steel not liable to rust, or of any other suitable material (which in particular excludes lead and its alloys). Nitro-compounds shall be uniformly wetted with sufficient water to ensure that they contain not less than 25% water throughout the journey, at every point in the substance. Metal receptacles shall be fitted with closures or safety devices yielding when the internal pressure reaches a value not greater than 3 kg/cm<sup>2</sup>; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure. Receptacles, except those made of steel not liable to rust, shall be secured by cushioning materials in wooden packagings;
- (b) substances of 8° (b): not more than 15 kg per bag, in bags made of cloth or of a suitable plastics material, placed in wooden packagings;
- (c) substances of 8° (a) and (b) may also be packed, not more than 500 g per receptacle, in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, secured by cushioning materials (e.g. corrugated fibreboard) in a wooden case. A package must not contain more than 5 kg of nitro-compounds. The receptacles shall be closed by means of a stopper, made of cork or rubber or a suitable plastics material, which shall be held in position by an additional device (such as a cap, crown, seal or binding) capable of preventing any loosening of the closure system during carriage;
- (d) articles of 8° (c): separately in stout paper and placed, not more than 100 per box, in sheet-metal boxes. Not more than 100 of these boxes shall be packed in a wooden packing case;

## Class Ia

(2) A package under paragraph (1) (a) or (b) must not weigh more than 75 kg; it must not contain more than 25 kg of substances of 8° (a) or more than 50 kg of substances of 8° (b). A package under paragraph (1) (c) must not weigh more than 15 kg, or a package under paragraph (1) (d) more than 40 kg. 2028 (contd)

(1) Substances and articles of 9° shall be packed: 2029

(a) substances of 9° (a) to (c):

1. not more than 10 kg per bag, in bags made of cloth or of a suitable plastics material, placed in an impermeable fibreboard box or in a box made of tin-plate or aluminium sheet or zinc sheet; or
2. not more than 10 kg per receptacle, in receptacles made of fibreboard of adequate strength, impregnated with paraffin wax or rendered impermeable by some other means.

Boxes made of tin-plate or aluminium sheet or zinc sheet and boxes or receptacles of other kinds shall be placed in a wooden case lined with corrugated fibreboard; metal boxes so placed shall be separated from one another by means of a corrugated-fibreboard wrapping. A case may not contain more than four boxes or receptacles of other kinds. The lids of cases shall be secured by means of screws;

(b) penthrite [9° (a)] may also be packed either:

1. not more than 5 kg per receptacle, in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, closed by means of a stopper made of cork or rubber or a suitable plastics material; each receptacle shall be placed in a metal receptacle hermetically closed by welding or soldering and cushioned with resilient materials so as to wedge the inner receptacle securely without leaving any empty space. Not more than 4 metal receptacles shall be packed in a wooden case lined with corrugated fibreboard and shall be separated from one another by several thicknesses of corrugated fibreboard or of another material capable of performing the same function; or

## Class Ia

2029  
(contd)

2. not more than 500 g dry weight per receptacle, in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, closed by means of a stopper made of cork or rubber or a suitable plastics material. These receptacles shall be placed in a wooden case. They shall be separated from one another by means of a corrugated fibreboard wrapping and from the sides of the case by a space of not less than 3 cm filled with cushioning materials;

- (c) hexogen  $\sqrt{9^{\circ}}$  (a) may also be packed as provided under (b) 1. above for penthrite;
- (d) articles of  $9^{\circ}$  (d): first separately in stout paper and placed, not more than 3 kg per case, in fibreboard cases in which they shall be fixed in position by cushioning materials; these cases, not more than 10 per wooden case, shall be so secured by cushioning materials in a wooden case closed by means of screws that there is a space of not less than 3 cm filled with cushioning materials at all points between the fibreboard cases and the packing case.

(2) A package under (1) (a) or (1) (b) 1. must not weigh more than 75 kg; a package under 1 (c) must not weigh more than 10 kg; a package under (1) (b) 2. or (1) (d) must not weigh more than 35 kg. Packages which, with their contents, weigh more than 30 kg shall be fitted with means of handling.

2030

(1) Substances of  $10^{\circ}$  shall be packed, not more than 500 g per bag, in firmly-tied bags made of a suitable pliant material; each bag shall be placed in a box made of metal, fibreboard or paperboard; these boxes, not more than 30 per packing case, shall be secured by cushioning materials in a wooden packing case with complete sides not less than 12 mm thick.

(2) A package must not weigh more than 25 kg.

2031.

- (1) Substances and articles of  $11^{\circ}$  shall be packed:
- (a) substances of  $11^{\circ}$  (a) and (b):
1. not more than 2.5 kg per bag, in bags placed in boxes made of fibreboard, tin-plate or aluminium. The boxes shall be secured by cushioning materials in wooden packaging ; or

## Class Ia

2. in bags made of closely-woven fabric, placed in wooden casks or cases; 2031  
(contd.)
- (b) articles of 11<sup>o</sup> (c): rolled in stout paper; each roll must not weigh more than 300 g. The rolls shall be placed in a wooden case lined with stout paper.
- (2) The lids of the wooden cases shall be secured by means of screws; if the screws are made of iron they shall be coated with a material not liable to produce sparks when subjected to shock or friction.
- (3) A package must not weigh more than 75 kg if it is carried as part of a complete load, and not more than 35 kg if it is not carried as part of a complete load.
- (1) Substances of 12<sup>o</sup> shall be cartridgeed in wrappings made of a suitable plastics material or of paper. The cartridges may be dipped in paraffin wax, ceresine or resin, or be wrapped in a suitable plastics material, so as to be protected from damp. Explosives containing more than 6% liquid nitric esters shall be cartridgeed in paper coated with paraffin wax or ceresine or in an impermeable plastics material such as polyethylene. The cartridges shall be placed in wooden packagings. 2032
- (2) Cartridges not coated with paraffin wax or ceresine, or cartridges in permeable wrappings, shall be made up into packets weighing not more than 2.5 kg each. Packets so made up, whose wrapping must consist at least of stout paper, shall be dipped in paraffin wax, ceresine or resin or wrapped in a suitable plastics material so as to be protected from damp. The packets shall be placed in wooden packagings.
- (3) The closure of wooden packagings may be ensured by means of metal bands or wires fastened tightly round them.
- (4) A package must not weigh more than 75 kg. It must not contain more than 50 kg of explosives.
- (5) Instead of the wooden packagings prescribed in paragraph (1) and paragraph (2), it is also permissible to use suitable cases, made of solid fibreboard or corrugated fibreboard, which are of sufficient mechanical strength and whose lid flaps and bottom flaps must be closed by means of

## Class Ia

- 2032 (contd) adhesive strips of sufficient strength. The design of cases made of solid fibreboard or corrugated fibreboard must be approved by the competent authority of the country of departure. Such a package must not weigh more than 30 kg; it must not contain more than 25 kg of explosives.
- 2033 (1) Substances of 13<sup>o</sup> shall be cartridge'd in paper wrappings. Cartridges not coated with paraffin wax or ceresine shall first be rolled in paper that has been rendered impermeable. They shall be made up by means of a paper wrapping into packets weighing not more than 2.5 kg each, which shall be secured by cushioning materials in wooden packagings whose closure may be ensured by means of metal bands or wires fastened tightly round them.
- (2) A package must not weigh more than 35 kg.
- 2034 (1) Substances of 14<sup>o</sup> shall be packed:
- (a) substances of 14<sup>o</sup> (a): cartridge'd in wrappings made of paper that has been rendered impermeable. The cartridges shall be made up into packets by means of a paper wrapping or, if without a paper wrapping, secured by cushioning materials in fibreboard cases. The packets or fibreboard cases shall be secured by inert cushioning materials in wooden packagings whose closure may be ensured by means of metal bands or wires fastened tightly round them;
- (b) substances of 14<sup>o</sup> (b): cartridge'd in wrappings made of paper that has been rendered impermeable. The cartridges shall be placed in a fibreboard box. The fibreboard boxes, wrapped in paper that has been rendered impermeable, shall be secured, leaving no empty spaces, in wooden packagings whose closure may be ensured by means of metal bands or wires fastened tightly round them;
- (c) substances of 14<sup>o</sup> (c):
1. cartridge'd in wrappings made of a suitable plastics material or of paper. The cartridges may be dipped in paraffin wax, ceresine or resin or be wrapped in a suitable plastics material, so as to be protected from damp. Explosives containing more than 6% liquid nitric esters shall be cartridge'd in paper coated with paraffin wax or ceresine or in an impermeable plastics material such as polyethylene. The cartridges shall be placed in wooden packagings;

## Class Ia

2. cartridges not coated with paraffin wax or ceresine, or cartridges in permeable wrappings, shall be made up into packets weighing not more than 2.5 kg each. Packets so made up, whose wrapping must consist at least of stout paper, shall be dipped in paraffin wax, ceresine or resin or be wrapped in a suitable plastics material, so as to be protected from damp. The packets shall be placed in wooden packagings;
3. the closure of wooden packagings may be ensured by means of metal bands or wires fastened tightly round them;
4. instead of the wooden packagings prescribed under 1. and 2. above, it is also permissible to use suitable cases, made of solid fibreboard or corrugated fibreboard, which are of sufficient mechanical strength and whose lid flaps and bottom flaps must be closed by means of adhesive strips of sufficient strength. The design of cases made of solid fibreboard or corrugated fibreboard must be approved by the competent authority of the country of departure.

2034  
(contd)

(2) A package containing substances of 14<sup>o</sup> (a) or (b) must not weigh more than 35 kg. A package containing substances of 14<sup>o</sup> (c) must not weigh more than 75 kg; it must not contain more than 50 kg of explosives; in the case of a packaging conforming to paragraph (1) (c) 4., the package must not weigh more than 30 kg nor contain more than 25 kg of explosives.

3. Mixed packing

Substances listed under an item number of marginal 2021 may not be included in the same package either with substances grouped under the same or another item number of that marginal, or with substances or articles of other Classes, or with other goods.

2035

Note: Packages as referred to in marginal 2028 (1) (c) may contain organic nitro-compounds having different compositions and names.

4. Marking and danger labels on packages (see Appendix A.9)

Packages containing picric acid [7<sup>o</sup> (a)] shall be marked with the name of the substance in clearly legible and indelible red characters. This marking shall be in an official language of the country of departure and also, if that language is not English, or French, or German, in English, French or

2036

## Class Ia

- 2036 German, unless international road transport tariffs, if any, or agreements  
(contd) concluded between the countries concerned in the transport operation, provide otherwise.
- 2037 (1) Packages containing dangerous substances of Class Ia shall bear a label conforming to model No. 1.  
(2) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.
- 2038 B. Particulars in the transport document
- 2039 (1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2021. Where the name of the substance is not indicated in the case of 8<sup>o</sup> (a) and (b), the trade name must be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. Ia, 3<sup>o</sup> (a), ADR].  
(2) The following must be certified in the transport document: "The nature of the goods, and the packaging, are in conformity with the provisions of ADR".  
(3) For consignments which, under marginal 11 400 of Annex B, are to be accepted for carriage as a complete load only, the transport document shall also show the weight of each package and the number and nature of the packagings.
- 2040-  
2045 C. Empty packagings
- 2046 (1) Packagings of 15<sup>o</sup> must be securely closed and be leak-proof in the same degree as though they were full.  
(2) The description in the transport document must be : "Empty packaging, Ia, 15<sup>o</sup>, ADR (or RID)". This description must be underlined in red.
- 2047-  
2059



## CLASS Ib. ARTICLES FILLED WITH EXPLOSIVE SUBSTANCES

1. List of articles

(1) Among the articles covered by the heading of Class Ib, only those listed in marginal 2061 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These articles to be accepted for carriage under certain conditions are to be considered as articles of ADR. 2060

(2) If the articles listed under 7<sup>o</sup>, 10<sup>o</sup> or 11<sup>o</sup> of marginal 2061 are composed of, or filled with, explosive substances listed in marginal 2021, those substances must satisfy the stability and safety conditions laid down concerning them in Appendix A.1.

1<sup>o</sup> Fuses, not primed:

2061

- (a) rapid combustion fuses (fuses consisting of a thick tube with a core of black powder, or with a core of threads impregnated with black powder, or with a core of nitrated cotton threads);
- (b) detonating fuses in the form of small-section metal tubes with thin walls and a core filled with an explosive substance; see also Appendix A.1, marginal 3108;
- (c) flexible detonating fuses wrapped in textile or a plastics material, of small section and with a core filled with an explosive substance; see also Appendix A.1, marginal 3109;
- (d) instantaneous detonating fuses (small-section woven fuses with a core filled with an explosive substance more dangerous than penthrite).

For other fuses, see Class Ic, 3<sup>o</sup> (marginal 2101).

2<sup>o</sup> Non-detonating primers (primers which do not produce a disruptive effect either with the aid of detonators or by other means):

- (a) percussion caps;
- (b) 1. primed cases of central-percussion cartridges, not filled with propellant powder, for firearms of all calibres;
- 2. primed cases of rim-fire cartridges, not filled with propellant powder, for Flobert weapons and firearms of similar calibres;

## Class Ib

2061  
(contd)

- (c) quick-matches, screw-primers and other similar primers containing a small charge (black powder or other explosives), set in action by friction, percussion or electricity;
- (d) fuses without any device, e.g. detonator, producing a disruptive effect and without a transmission charge.

3° Railway fog signals4° Small-arms cartridges [with the exception of those containing a bursting charge (see under 11°)]:

- (a) sporting cartridges;
- (b) Flobert cartridges;
- (c) tracer cartridges;
- (d) incendiary cartridges;
- (e) other central-percussion cartridges.

Note: Apart from sporting cartridges with lead pellets, only cartridges whose calibre does not exceed 13.2 mm are to be considered as articles of 4°.

5° Detonating fuses:

- (a) detonators with or without a delayed-action device; delayed-action connecting pieces for detonating fuses;
- (b) electric detonators fitted with fuses with or without a delayed-action device;
- (c) detonators connected firmly to a black-powder fuse;
- (d) detonators with gaines (detonators combined with a transmission charge composed of a compressed explosive); see also Appendix A.1, marginal 3110;
- (e) fuses with detonators (fused detonators) with or without a transmission charge;
- (f) detonators with percussion cap ("bouchons allumeurs") with or without a delayed-action device, with or without a mechanical device for firing, and without a transmission charge.

6° Sounding caps (detonators, with or without primers, contained in sheet-metal tubes).

## Class Ib

- 7° Articles with a propellant charge, other than those listed under 8°; articles with a bursting charge; articles with a propellant and a bursting charge, provided that they contain only explosive substances of Class Ia, all without a device producing a disruptive effect (e.g. detonator). The charge in these articles may comprise a tracer substance (see also under 8° and 11°).
- Note:* Non-detonating primers (2°) are allowed in these articles.
- 8° Articles filled with tracer substances or substances intended for signalling, with or without a propellant charge, with or without an ejection charge, and without a bursting charge, in which the propellant or tracer substance is compressed in such a way that the articles cannot explode when ignited.
- 9° Smoke-producing devices containing chlorates or carrying an explosive charge or an explosive ignition charge.
- For smoke-producing substances for agricultural and forestry purposes, see Class Ic, marginal 2101, 27°.
- 10° Boring devices containing a charge of dynamite or of an explosive similar to dynamite, without fuses and without any device producing a disruptive effect (e.g. detonator), hollow-charge devices for industrial purposes, containing not more than 1 kg of explosive secured within the casing, and without a detonator.
- 11° Articles with a bursting charge, articles with a propellant and a bursting charge, all fitted with a device producing a disruptive effect (e.g. detonator), the whole well secured. The weight of each article must not exceed 25 kg.

2061  
(contd)2. ProvisionsA. Packages1. General conditions of packing

2062

(1) Packages shall be so closed and leak-proof as to prevent any loss of the contents. The use of metal bands or wires fastened round the packages to ensure their closure is allowed; their use is compulsory with

## Class Ib

2062  
(contd)

cases having hinged lids if the lids are not fitted with an effective device to obviate any loosening of the closure.

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents or form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. Articles shall be firmly secured in their packagings, and inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of articles of the same kind", inner packagings may be enclosed in outer packagings, either singly or in groups.

(4) Cushioning materials shall be suited to the nature of the contents.

2. Packing of articles of the same kind

2063

Articles of 1<sup>o</sup> shall be packed as follows:

- (a) articles of 1<sup>o</sup>(a) and (b): in wooden packagings or in drums made of impermeable fibreboard. A package must not weigh more than 120 kg; however, a fibreboard drum must not weigh more than 75 kg;
- (b) articles of 1<sup>o</sup>(c): rolled in lengths of up to 250 m on reels made of wood or fibreboard. The reels shall be placed in wooden cases in such a manner that they cannot come into contact either with one another or with the sides of the cases. A case must not contain more than 1,000 m of fuse;
- (c) articles of 1<sup>o</sup>(d): rolled in lengths of up to 125 m on reels made of wood or fibreboard which shall be packed in a wooden case, closed by means of screws and with sides not less than 18 mm thick, in such a manner that the reels cannot come into contact either with one another or with the sides of the case. A case must not contain more than 1,000 m of instantaneous detonating fuse.

## Class Ib

- (1) Articles of 2<sup>o</sup> shall be packed as follows: 2064
- (a) articles of 2<sup>o</sup>(a): caps with an uncovered explosive charge, not more than 500 per box or small case, and caps with a covered explosive charge, not more than 5,000 per box or small case, in sheet-metal boxes, fibreboard boxes or small wooden cases. These packagings shall be placed in a packing case made of wood or sheet-metal;
  - (b) articles of 2<sup>o</sup>(b)1: primed cases of central-percussion cartridges, not filled with propellant powder, for firearms of all calibres, in cases made of wood or fibreboard or in textile bags;
  - (c) articles of 2<sup>o</sup>(b)2: primed cases of rim-fire cartridges, not filled with propellant powder, for Flobert weapons and firearms of similar calibres, not more than 5,000 per box, in boxes made of sheet-metal or fibreboard which shall be placed in a packing case made of wood or sheet-metal; however, these primed cases for rim-fire cartridges may also be packed, not more than 25,000 per bag, in a bag which must be secured by means of corrugated fibreboard in a packing case made of wood or iron;
  - (d) articles of 2<sup>o</sup>(c) and (d): in boxes made of fibreboard, wood or sheet-metal which shall be placed in packagings made of wood or metal.
- (2) A package containing articles of 2<sup>o</sup>(a), (c) or (d) must not weigh more than 100 kg.
- (1) Articles of 3<sup>o</sup> shall be packed in cases made of boards not less than 18 mm thick, tongued and grooved and assembled by means of wood screws. Fog signals shall be secured in cases by cushioning materials in such a manner that they cannot come into contact either with one another or with the sides of the case. 2065
- (2) A package must not weigh more than 50 kg.
- (1) Articles of 4<sup>o</sup>(a), (b), and (e) shall be placed tightly in firmly-closing boxes made of sheet-metal, wood or fibreboard; these boxes shall be housed, leaving no empty spaces, in packing cases made of metal, wood, hardboard, solid fibreboard or corrugated fibreboard; the fibreboard must have been rendered impermeable by impregnation and be of sufficient mechanical strength. 2066

## Class Ib

2066  
(contd)

Fibreboard cases shall be closed by means of adhesive strips of sufficient strength. The production model of cases made of solid fibreboard or corrugated fibreboard must be approved by the competent authority of the country of departure.

(2) Articles of 4<sup>o</sup>(c) and (d) shall be placed, not more than 400 per box, in boxes made of sheet-metal, wood or fibreboard; these boxes shall be packed securely in packing cases made of metal or wood,

(3) A package must not weigh more than 100 kg; however, where hardboard or fibreboard cases are used, a package containing articles of 4(a), (b) or (e) must not weigh more than 40 kg.

2067

(1) Articles of 5<sup>o</sup> shall be packed as follows:

- (a) articles of 5<sup>o</sup>(a): not more than 100 per receptacle in the case of detonators and not more than 50 per receptacle in the case of connecting pieces, in receptacles, made of sheet-metal or impermeable fibreboard, in which they shall be well protected against ignition and secured by cushioning materials. Sheet-metal receptacles shall be lined with a resilient material. The lids shall be secured all round by adhesive strips. Receptacles shall, not more than 5 per packet or box in the case of detonators and not more than 10 per packet or box in the case of connecting pieces, be enclosed in a packet or placed in a fibreboard box. The packets or boxes shall be packed in a wooden case closed by means of screws and with sides not less than 18 mm thick, or in a sheet-metal packaging, the case or packaging being secured by cushioning materials in a packing case with sides not less than 18 mm thick in such a manner that there is a space of not less than 3 cm filled with cushioning materials at all points between the wooden case or sheet-metal packaging and the packing case;
- (b) articles of 5<sup>o</sup>(b); not more than 100 per packet, in packets with alternate detonators lying towards opposite ends of the packet. Not more than 10 of these packets shall be tied together to form a collective packet. Not more than 5 of these collective packets shall

## Class Ib

be secured by cushioning materials in a wooden packing case with sides not less than 18 mm thick, or in a sheet-metal packaging, in such a manner that there is a space of not less than 3 cm filled with cushioning materials at all points between the collective packets and the packing case or sheet-metal packaging;

2067  
(contd)

- (c) articles of 5<sup>o</sup>(c): fuses fitted with detonators, rolled into coils; not more than 10 coils shall be made into a roll which shall be wrapped in paper. Not more than 10 rolls shall be secured by cushioning materials in a small wooden case closed by means of screws and with sides not less than 12 mm thick. Not more than 10 small cases shall be secured by cushioning materials in a packing case with sides not less than 18 mm thick in such a manner that there is a space of not less than 3 cm filled with cushioning materials at all points between the small cases and the packing case;
- (d) articles of 5<sup>o</sup>(d):
1. not more than 100 detonators per case, in wooden cases with sides not less than 18 mm thick, in such a manner that the detonators are spaced not less than 1 cm from one another and from the sides of the case. The said sides shall be mortised and the bottom and lid shall be secured by screws. If the case is lined with zinc sheet or aluminium sheet, a side thickness of 16 mm is sufficient. The case shall be secured by cushioning materials in a packing case with sides not less than 18 mm thick in such a manner that there is a space of not less than 3 cm filled with cushioning materials at all points between it and the packing case; or
  2. not more than 5 detonators per box, in sheet-metal boxes, the detonators being placed therein in slatted wooden frames or in holed pieces of wood. The lid shall be secured all round by adhesive strips. Not more than 20 sheet-metal boxes shall be placed in a packing case with sides not less than 18 mm thick;

## Class Ib

- 2067  
(contd)
- (e) articles of 5<sup>o</sup>(e): not more than 50 per case, in wooden cases with sides not less than 18 mm thick. The articles shall be secured within the cases by a wooden structure in such a manner that they are spaced not less than 1 cm from one another and from the sides of the case. The sides of the case shall be mortised and the bottom and lid shall be secured by screws. Not more than 6 cases shall be secured by cushioning materials in a packing case with sides not less than 18 mm thick in such a manner that there is a space of not less than 3 cm filled with cushioning materials at all points between the cases and the packing case. The space may be reduced to not less than 1 cm if it is filled with porous wood-fibre slabs. If the articles are individually packed and firmly secured in hermetically-closing boxes made of sheet-metal or a plastics material, they may be placed in a wooden packing case with sides not less than 18 mm thick. The articles must be separated from one another and firmly secured by fibreboard or by wood-fibre slabs;
- (f) articles of 5<sup>o</sup>(f):
1. not more than 50 per case, in wooden or metal cases; in these cases each detonating part of the "bouchon allumeur" shall be so accommodated in a slotted wooden support that the distance between adjacent detonators and between the detonators of the outermost "bouchons allumeurs" and the side of the case is not less than 2 cm; closing the lid of the case shall ensure complete immobility of the whole; not more than 3 cases shall be placed, leaving no empty spaces, in a wooden packing case with sides not less than 18 mm thick; or
  2. in boxes made of wood or metal; in these boxes each "bouchon allumeur" shall be so supported by a frame that the distance between two "bouchons allumeurs" and between a "bouchon allumeur" and the side of the box is not less than 2 cm and that the immobility of the whole is ensured; these boxes shall be placed in a packing case with sides not less than 18 mm thick in such a



## Class Ib

manner that there is a space of not less than 3 cm filled with cushioning materials at all points between the boxes and between the boxes and the packing case; a package must not contain more than 150 "bouchons allumeurs".

2067  
(contd)

(2) The lid of the packing case shall be closed by means of screws or of hinges and folding bars.

(3) Each package containing articles of 5° shall be provided with a closure protected either by lead or other seals (stamp or mark) applied to two screw-heads at the ends of the major axis of the lid or of the folding bars, or by a strip, bearing the trade mark, gummed on to the lid and on two opposite sides of the case.

(4) A package must not weigh more than 75 kg; packages weighing more than 30 kg shall be fitted with means of handling.

(1) Articles of 6° shall be rolled separately in paper and placed in corrugated fibreboard wrappings. They shall be packed, not more than 25 per box, in boxes made of fibreboard or sheet-metal. The lids shall be secured all round by adhesive strips. Not more than 20 boxes shall be placed in a wooden packing case.

2068

(2) A package must not weigh more than 50 kg. Packages weighing more than 30 kg shall be fitted with means of handling.

(1) Articles of 7° shall be packed in wooden cases closed by means of screws or of hinges and folding bars and with sides not less than 16 mm thick, or in receptacles made of metal or a suitable plastics material of adequate strength. The lids and bottoms of the wooden cases may also be made of highly-compressed paperboard equalling the sides in strength. Articles weighing more than 20 kg may also be despatched in crates or without packing.

2069

(2) A package must not weigh more than 100 kg if it contains articles each of which weighs not more than 1 kg. Cases which, with their contents, weigh more than 30 kg shall be fitted with means of handling.

## Class Ib

2070

(1) Articles of 8<sup>o</sup> shall be packed in wooden cases, in drums made of fibreboard which has been rendered impermeable, or in receptacles made of metal or of a suitable plastics material of adequate strength. The ignition head shall be protected in such a manner as to prevent any scattering of the charge from the article.

(2) A package must not weigh more than 100 kg; however, where fibreboard drums are used a package shall not weigh more than 75 kg. Cases which, with their contents, weigh more than 30 kg shall be fitted with means of handling.

2071

Articles of 9<sup>o</sup> shall be enclosed in wooden packagings. A package must not weigh more than 75 kg; packages weighing more than 30 kg shall be fitted with means of handling.

2072

Articles of 10<sup>o</sup> shall be packed in wooden cases. Packages weighing more than 30 kg shall be fitted with means of handling.

2073

Articles of 11<sup>o</sup> shall be packed as follows:

(a) articles less than 13.2 mm in diameter: not more than 25 per box, packed tightly in firmly-closing fibreboard boxes or in receptacles made of a suitable plastics material of adequate strength; these boxes or receptacles shall be placed, leaving no empty spaces, in a wooden case, with sides not less than 18 mm thick, which may be lined with tin-plate, zinc or aluminium sheet, or a suitable plastics or similar material of adequate strength.

A package must not weigh more than 60 kg. Packages weighing more than 30 kg shall be fitted with means of handling.

(b) articles from 13.2 mm to 57 mm in diameter:

1. separately

in a tube made of fibreboard or of a suitable plastics material, strong, close-fitting and closing firmly at both ends; or

in a tube made of fibreboard or of a suitable plastics material, strong, close-fitting, closed at one end and open at the other; or

## Class Ib

in a tube made of fibreboard or of a suitable plastics material, open at both ends but with an inner projection or other suitable internal device to prevent the article from moving.

2073  
(contd)

Packed in this manner, not more than:

300 articles not less than 13.2 mm and not more than 21 mm in diameter; or

60 articles more than 21 mm but not more than 37 mm in diameter; or

25 articles more than 37 mm but not more than 57 mm in diameter shall be placed in layers in a wooden case with sides not less than 18 mm thick, the wooden case being lined with tin-plate, zinc sheet, or aluminium sheet.

In the case of articles packed in tubes open at both ends or at one end, the packing case shall be lined on the side or sides adjacent to the open ends of the tubes either with a felt pad not less than 7 mm thick or with a sheet of the same thickness of double-faced corrugated fibreboard or similar material.

A package must not weigh more than 100 kg. Packages weighing more than 30 kg shall be fitted with means of handling.

2. articles 20 mm in diameter may also be packed, not more than 10 per box, in strong, closely-fitting fibreboard boxes coated with paraffin wax and equipped with a honey-combed bottom insert and with partitions made of fibreboard coated with paraffin wax. The boxes shall be closed by a gummed flap. Not more than 30 boxes shall be tightly packed in a wooden case with sides not less than 18 mm thick, the wooden case being lined with zinc sheet, tin-plate or aluminium sheet.

A package must not weigh more than 100 kg. Packages weighing more than 30 kg shall be fitted with means of handling.

3. articles not more than 30 mm in diameter may, in a number not exceeding that indicated under 1., also be put on to strips and packed in a strong steel receptacle. This receptacle may be cylindrical.

## Class Ib

2073  
(contd)

These articles put on to strips shall be surrounded by a suitable device so as to constitute a compact unit and as to prevent individual articles from becoming detached. One or more units shall be so fixed in the receptacle that they cannot be displaced.

The ends of articles put on to strips shall rest on shock-absorbing non-metallic supports.

The lid of the receptacle must be so closed as to be leak-proof and be so secured by a locking device capable of being sealed that the articles cannot fall out.

A package must not weigh more than 100 kg. Packages weighing more than 30 kg shall be fitted with means of handling. Receptacles capable of being rolled shall have their lids fitted with a strong handle enabling them to be carried;

4. . articles not less than 30 mm and not more than 57 mm in diameter may also be packed separately in a strong, closely-fitting, hermetically-closed cylindrical box made of fibreboard, fibre or a suitable plastics material. Not more than 40 of these boxes shall be placed in layers in a wooden case with sides not less than 18 mm thick.

A package must not weigh more than 100 kg. Packages weighing more than 30 kg shall be fitted with means of handling.

- (c) Other articles of 11<sup>o</sup>: in conformity with the provisions of marginal 2069(1). A package must not weigh more than 100 kg. Packages weighing more than 30 kg shall be fitted with means of handling.

Note: In the case of articles containing both propellant and bursting charges, the diameter referred to is that of the cylindrical portion containing the bursting charge.

3. Mixed packing

2074

(1) Articles listed under an item number of marginal 2061 may not be included in the same package either with articles of a different kind but of the same item number, or with articles of another item number of that marginal, or with substances or articles belonging to other Classes, or with other goods.

## Class Ib

- (2) The following may, however, be included in the same package: 2074  
(contd)
- (a) articles of 1<sup>o</sup> with one another.  
When articles of 1<sup>o</sup>(a) and (b) are included in the same package, they shall be packed in conformity with marginal 2063 (a).  
When articles of 1<sup>o</sup>(c) are included in the same package with articles of 1<sup>o</sup>(a) or (b) or both, those of 1<sup>o</sup>(c) shall be made up into packages in conformity with the provisions applicable to them and the outer packaging shall be that prescribed for articles of 1<sup>o</sup>(a) or (b). A package must not weigh more than 120 kg;
- (b) articles of 2<sup>o</sup>(a) with those of 2<sup>o</sup>(b), provided that both are contained in inner packagings consisting of boxes placed in wooden cases. A package must not weigh more than 100 kg;
- (c) articles of 4<sup>o</sup> with one another, taking into account the provisions for inner packaging, in a wooden outer packaging. A package must not weigh more than 100 kg;
- (d) articles of 7<sup>o</sup> with those of 5<sup>o</sup>(a), (d), (e) and (f), on condition that the packaging of these latter prevents the transmission of a possible detonation to the articles of 7<sup>o</sup>. In one package, the number of articles of 5<sup>o</sup>(a), (d), (e) and (f) must be the same as that of the articles of 7<sup>o</sup>. A package must not weigh more than 100 kg.
4. Marking and danger labels on packages (see Appendix A.9) 2075  
Packages containing articles of Class Ib shall bear a label conforming to model No.1. 2076
- B. Particulars in the transport document
- (1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2061; it must be 2077

## Class Ib

2077  
(contd) underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. Ib, 2<sup>o</sup>(a), ADR]

(2) The following must be certified in the transport document:  
"The nature of the goods, and the packaging, are in conformity with the provisions of ADR".

2078-  
2082

C. Empty packagings

2083

No provisions.

2084-  
2099

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## CLASS Ic. IGNITERS, FIREWORKS AND SIMILAR GOODS

1. List of goods

(1) Among the substances and articles covered by the heading of Class Ic, only those listed in marginal 2101 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR. 2100

(2) Articles to be accepted must fulfil the following conditions:

- (a) the explosive charge shall be constituted, arranged and distributed in such a manner that neither friction, shaking, shock nor ignition of the packed articles can lead to an explosion of the whole contents of the package;
- (b) white or yellow phosphorus may not be used except in articles of 2<sup>o</sup> and 20<sup>o</sup>;
- (c) the detonating compound of fireworks (21<sup>o</sup> - 24<sup>o</sup>), flash-powders (26<sup>o</sup>), and the smoke-producing compounds of pesticides (27<sup>o</sup>), must not contain chlorates;
- (d) the explosive charge must satisfy the stability conditions of Appendix A.1, marginal 3111.

A. Igniters:

2101

- 1<sup>o</sup> (a) Safety matches (with a potassium chlorate and sulphur base);
- (b) Matches with a base of potassium chlorate and of phosphorus sesquisulphide, also friction igniters.
- 2<sup>o</sup> Strips of amorces for safety lamps and strips of paraffin-waxed amorces for safety lamps. 1,000 amorces must not contain more than 7.5 g explosive.  
For strips of caps, see under 15<sup>o</sup>.
- 3<sup>o</sup> Slow-combustion fuses (fuses consisting of a thin impermeable tube with a narrow-section core of black powder).  
For other fuses, see Class Ib, 1<sup>o</sup> (marginal 2061).

## Class Ic

- 2101 (contd)
- 4° Pyroxylin thread (nitrated cotton thread). See also Appendix A.1, marginal 3101.
- 5° Tubular igniters ("lances d'allumage") (tubes, made of paper or fibreboard, containing a small quantity of a fuse composition of oxygenated substances and organic substances and, possibly, of nitrated aromatic compounds) and thermite caps with pellet igniters.
- 6° Safety igniters for fuses (paper cartridges containing a primer pierced by a thread intended to cause friction or tearing, or similar devices).
- 7° (a) Electric primers without detonator;  
(b) pellets for electric primers.
- 8° Electric igniters (e.g. igniters intended for igniting photographic magnesium powders). The charge of each must not exceed 30 mg nor contain more than 10% fulminate of mercury.  
Note: Appliances of the electric-bulb type producing a sudden light and containing an ignition charge similar to that of electric igniters are not subject to the provisions of ADR.
- B. Pyrotechnic articles and toys: caps and strips (strings) of caps; detonating articles :
- 9° Indoor pyrotechnic articles (e.g. Bosco cylinders, confetti bombs, cotillion fruits). Articles with a nitrated-cotton (collodion-cotton) base must not contain more than 1 g per article.
- 10° Fulminating bonbons, flower crackers, strips of nitrated paper (collodion paper).
- 11° (a) Fulminating peas, fulminating grenades and other similar pyrotechnic toys containing fulminate of silver;  
(b) fulminating matches;  
(c) accessories with fulminate of silver.  
Ad. (a), (b) and (c): 1,000 articles must not contain more than 2.5 g fulminate of silver.
- 12° Detonating pebbles, each carrying on the outside a charge of not more than 3 g of an explosive other than fulminate.



## Class Ic

- 13° Pyrotechnic matches (e.g. Bengal matches, golden-rain matches or cascade-of-flowers matches). 2101 (contd)
- 14° Miracle candles without ignition heads.
- 15° Caps for children's toys, strips (strings) of caps and rings of caps. 1,000  
caps must not contain more than 7.5 g of an explosive free from fulminate.  
For strips of caps for safety lamps, see under 2°.
- 16° Explosive corks with an explosive charge having a phosphorus and chlorate base or with a charge of fulminate or a similar compound compressed into cardboard cartridges. 1,000 corks must not contain more than 60 g chlorate explosive nor more than 10 g of fulminate or of a compound with a fulminate base.
- 17° Round petards with an explosive charge having a phosphorus and chlorate base. 1,000 petards must not contain more than 45 g explosive.
- 18° Cardboard caps (toy ammunition) with an explosive charge having a phosphorus and chlorate base or with a charge of fulminate or a similar compound. 1,000 caps must not contain more than 25 g explosive.
- 19° Cardboard caps exploding under foot, with a protected charge having a phosphorus and chlorate base. 1,000 caps must not contain more than 30 g explosive.
- 20° (a) Detonating sheets;  
(b) Martinikas (so-called Spanish fireworks).  
Both comprise a mixture of white (yellow) and red phosphorus with potassium chlorate and not less than 50% inert substances not taking part in the decomposition of the mixture of phosphorus and chlorate. A sheet must not weigh more than 2.5 g and a martinika not more than 0.1 g.
- C. Fireworks
- 21° Anti-hail rockets not fitted with a detonator, bombs and firepots. The charge, including the propellant charge, must not weigh more than 14 kg per article, the bomb or firepot not more than 18 kg in all.
- 22° Incendiary bombs, rockets, Roman candles, fountains, wheels and similar fireworks, with a charge not weighing more than 1,200 g per article.

## Class Ic

2101  
(contd)

- 23° Cannon shots each containing not more than 600 g granulated black powder or 220 g of an explosive not more dangerous than aluminium powder with potassium perchlorate, rifle shots (crackers) each containing not more than 20 g granulated black powder, all provided with fuses with covered ends; and similar articles for producing a loud detonation.

For railway fog-signals, see Class Ib, 3° (marginal 2061).

- 24° Small fireworks (e.g. jumping-crackers, serpents, golden rain, silver rain, if they contain not more than 1,000 g granulated black powder per 144 articles; volcanoes and hand comets, if they contain not more than 30 g each of granulated black powder).
- 25° Bengal fires without ignition heads (e.g. Bengal torches, lights, flames).
- 26° Magnesium flash-powders, not more than 5 g per bag or tube, in paper bags or in small glass tubes.
- D. Posticides (substances and articles):
- 27° Smoke-producing substances for agricultural and forestry purposes, and smoke-producing cartridges for use as pesticides.

For smoke-producing devices containing chlorates or carrying an explosive charge or an explosive ignition charge, see Class Ib, 9° (marginal 2061).

2. ProvisionsA. Packages1. General conditions of packing

2102

(1) Packagings shall be so closed and leak-proof as to prevent any loss of the contents.

(2) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. Articles shall be firmly secured in their packagings, and inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance or of articles of the same kind", inner packagings may be enclosed in outer packagings, either singly or in groups.

(3) Cushioning materials shall be suited to the nature of the contents.

## Class Ic

2. Packing of a single substance or of articles of the same kind

(1) Articles of 1<sup>o</sup> (a) shall be packed in boxes or in books.

2103

These boxes or books shall be wrapped in stout paper to form a collective packet all the folds of which shall be glued. The books may also be placed in boxes made of thin fibreboard or of a material not readily inflammable (e.g. cellulose acetate). The fibreboard boxes or the collective packets shall be placed in a strong case made of wood, metal, compressed-wood hardboard, strong solid fibreboard or double-faced corrugated fibreboard.

All joints of metal cases shall be closed by soft soldering or by double-seaming.

Fibreboard cases shall be closed by means of joined flaps. The edges of the outer flaps, and all joints, must be either glued or firmly closed by some other suitable means.

If the fibreboard boxes or collective packets are packed in fibreboard cases, the weight of a package may not exceed 20 kg.

(2) Articles of 1<sup>o</sup> (b) shall be so packed in boxes as to prevent any movement. Not more than 12 of these boxes shall be enclosed in a packet all the folds of which shall be glued.

Not more than 12 of these packets shall be wrapped in stout paper to form a collective packet all the folds of which shall be glued. The collective packets shall be placed in a strong case made of wood, metal, compressed-wood hardboard, strong solid fibreboard or double-faced corrugated fibreboard.

All joints of metal cases shall be secured by soft soldering or double-seaming.

Fibreboard cases shall be closed by means of joined flaps. The edges of the outer flaps, and all joints, must be either glued or firmly closed by some other suitable means.

If the collective packets are packed in fibreboard cases, the weight of a package must not exceed 20 kg.

## Class Ic

- 2104 (1) Articles of 2<sup>o</sup> shall be packed in boxes made of sheet-metal or fibreboard. Not more than 30 sheet-metal or 144 fibreboard boxes shall be enclosed in a packet which must not contain more than 90 g explosive. These packets shall be placed in a packing case, with well-jointed sides not less than 18 mm thick, lined with stout paper or with thin zinc or aluminium sheet or with a sheet of a plastics material not readily inflammable. A side thickness of 11 mm is sufficient for a package weighing not more than 35 kg if the case is encircled with an iron band.
- (2) A package must not weigh more than 100 kg.
- 2105 (1) Articles of 3<sup>o</sup> shall be packed in wooden cases lined with stout paper or thin zinc or aluminium sheet, or in drums made of impermeable fibreboard.
- Small consignments weighing not more than 20 kg, wrapped in corrugated fibreboard, may also be made up into packets in stout two-ply packing paper securely tied with string.
- (2) Where fibreboard drums are used, a package must not weigh more than 75 kg.
- 2106 (1) Pyroxylin thread (4<sup>o</sup>) shall be rolled, in lengths not exceeding 30 m per strip, on fibreboard strips. Each roll shall be wrapped in paper. Not more than 10 of these rolls shall be wrapped in packing paper to form packets which shall be secured by cushioning materials in small wooden cases. The cases shall be placed in a wooden packing case.
- (2) A package must not contain more than 6,000 m of pyroxylin thread.
- 2107 (1) Articles of 5<sup>o</sup> shall be packed, not more than 25 per box, in boxes made of tin-plate or fibreboard; however, thermite caps may be packed, not more than 100 per box, in fibreboard boxes. Not more than 40 of these boxes shall be secured by cushioning materials in a wooden case in such a manner that they cannot come into contact either with one another or with the sides of the case.
- (2) A package must not weigh more than 100 kg.

## Class Ic

(1) Articles of 6° - 8° shall be packed:

2108

- (a) articles of 6°: in wooden cases;
- (b) articles of 7°(a): in wooden cases or in wooden casks or in drums made of impermeable fibreboard;
- (c) articles of 7°(b): not more than 1,000 per box, secured by sawdust cushioning in fibreboard boxes divided into not less than three compartments each containing approximately the same number of articles and separated by interposed fibreboard sheets. The lids of the boxes shall be secured by gummed strips applied all round. Not more than 100 of these fibreboard boxes shall be placed in a perforated sheet-iron receptacle. This receptacle shall be secured by cushioning materials in a wooden packing case closed by means of screws and with sides not less than 18 mm thick, in such a manner that there is a space of not less than 3 cm filled with cushioning materials at all points between the sheet-iron receptacle and the packing case;
- (d) articles of 8°: in fibreboard boxes. The boxes shall be made up into a packet containing not more than 1,000 electric igniters. The packets shall be placed in a wooden packing case.

(2) In the case of fibreboard drums, a package containing articles of 7°(a) must not weigh more than 75 kg. A package containing articles of 7°(b) must not weigh more than 50 kg; if it weighs more than 30 kg it shall be fitted with means of handling.

(1) Articles of 9° - 26° shall be enclosed (inner packaging):

2109

- (a) articles of 9° and 10°: in paper packagings or in boxes;
- (b) articles of 11°(a): not more than 500 per fibreboard box or per small wooden case, secured by sawdust cushioning:
  - 1. in fibreboard boxes which shall be wrapped in paper; or
  - 2. in small wooden cases;
- (c) articles of 11°(b): not more than 10 per book, in books; not more than 100 books together shall be packed in a fibreboard box or wrapped in stout paper;

## Class Ic

2109  
(contd)

- (d) articles of 11<sup>o</sup>(c): not more than 10 per bag, in bags made of paper or of a suitable plastics material; not more than 100 bags together shall be packed in a fibreboard box;
- (e) articles of 12<sup>o</sup>: not more than 25 per box, in fibreboard boxes;
- (f) articles of 13<sup>o</sup>: in boxes wrapped in paper to form packets each containing not more than 12 boxes;
- (g) articles of 14<sup>o</sup>: in boxes or in bags made of paper or of a suitable plastics material. These packagings shall be wrapped in paper to form packets each containing not more than 144 of these articles;
- (h) articles of 15<sup>o</sup>: in fibreboard boxes each containing:  
not more than 100 caps each charged with not more than 5 mg explosive;  
or  
not more than 50 caps each charged with not more than 7.5 mg explosive.

Not more than 12 of these boxes shall be made up in paper into a roll and not more than 12 of these rolls shall be wrapped in packing paper to form a packet.

Strips (strings) of 50 caps, each cap being charged with not more than 5 mg explosive, may be packed in the following manner: 5 strips(strings)per box, in fibreboard boxes wrapped 6 together in paper equivalent in strength to Kraft paper of a minimum weight of 40 g/m<sup>2</sup>; 12 small packets so made up shall be wrapped together in paper of the same quality to form a large packet;

- (i) articles of 16<sup>o</sup>: secured by cushioning materials, not more than 50 per box, in fibreboard boxes. The corks shall be glued to the bottom of the boxes or fixed in position there by some equivalent method. Each box shall be wrapped in paper and not more than 10 of these boxes shall be wrapped in packing paper to form a packet;

## Class Ic

- (k) articles of 17<sup>o</sup>: not more than 5 per box, in fibreboard boxes. Not more than 200 boxes, arranged in rolls, shall be placed together in a collective fibreboard box; 2109 (contd)
- (l) articles of 18<sup>o</sup>: secured by cushioning materials, not more than 10 per box, in fibreboard boxes. Not more than 100 boxes, arranged in rolls, shall be wrapped in paper to form a packet;
- (m) articles of 19<sup>o</sup>: secured by cushioning materials, not more than 15 per box, in fibreboard boxes. Not more than 144 boxes, arranged in rolls, shall be packed in a second fibreboard box;
- (n) articles of 20<sup>o</sup>(a): secured by cushioning materials, not more than 144 per case, in fibreboard cases;
- (o) articles of 20<sup>o</sup>(b): not more than 75 per box, in fibreboard boxes; not more than 72 boxes shall be wrapped in fibreboard to form a packet;
- (p) articles of 21<sup>o</sup>: in fibreboard boxes or in stout paper. If the ignition point of the articles is not covered by a protective cap, each article must first be wrapped separately in paper. The propellant charge of bombs weighing more than 5 kg shall be protected by a paper case covering the lower part of the bomb;
- (q) articles of 22<sup>o</sup>: in fibreboard boxes or in stout paper. However, large fireworks need not have an inner packaging if their ignition point is covered by a protective cap;
- (r) articles of 23<sup>o</sup>: secured by cushioning materials in boxes made of wood or fibreboard. The ignition heads shall be protected by a protective cap;
- (s) articles of 24<sup>o</sup>: in fibreboard boxes or in stout paper;
- (t) articles of 25<sup>o</sup>: in fibreboard boxes or in stout paper. However, large fireworks need not have an inner packaging if their ignition point is covered by a protective cap;
- (u) articles of 26<sup>o</sup>: in fibreboard boxes. A box must not contain more than 3 glass tubes.

## Class Ic

2109  
(contd)

- (2) The inner packagings mentioned under (1) shall be placed:
- (a) packagings containing articles of 10<sup>o</sup>, 13<sup>o</sup> and 14<sup>o</sup>, in wooden packing cases; substances or
  - (b) packagings containing/articles of 9<sup>o</sup>, 11<sup>o</sup>, 12<sup>o</sup> and 15<sup>o</sup> - 26<sup>o</sup>, in wooden packing cases with well-jointed sides not less than 18 mm thick, lined with stout paper or thin zinc or aluminium sheet. A side thickness of 11 mm is sufficient for a package weighing not more than 35 kg if the case is encircled with an iron band.
- The contents of a packing case are to be limited as follows :
- in the case of articles of 17<sup>o</sup>, to 50 outer fibreboard boxes;
  - in the case of articles of 18<sup>o</sup>, to 25 packets;
  - in the case of articles of 20<sup>o</sup> (a), to 50 fibreboard cases;
  - in the case of articles of 20<sup>o</sup> (b), to 50 packets, each of 72 fibreboard boxes; and
  - in the case of articles of 21<sup>o</sup>, to a number of articles such that the weight of their total charge does not exceed 56 kg;
- (c) packagings containing magnesium flash-powders (26<sup>o</sup>), either in conformity with (b) above, or in wooden packing cases each weighing not more than 5 kg, or, in the case of packagings in the form of paper bags, in strong fibreboard cases each weighing not more than 5 kg.

(3) Wooden cases containing articles with an explosive charge with a phosphorus and chlorate base must be closed by means of screws.

(4) A package containing articles of 9<sup>o</sup>, 11<sup>o</sup>, 12<sup>o</sup>, 15<sup>o</sup> - 22<sup>o</sup> or 24<sup>o</sup> - 26<sup>o</sup> must not weigh more than 100 kg; it must not weigh more than 50 kg if it contains articles of 23<sup>o</sup> or more than 35 kg if the sides of the case are only 11 mm thick and the case is encircled with an iron band.



## Class Ic

(1) Substances or articles of 27<sup>o</sup> shall be packed in wooden cases lined with packing paper, oiled paper or corrugated fibreboard. No lining is necessary if these substances and articles are wrapped in paper or fibreboard. 2110

(2) A package must not weigh more than 100 kg.

(3) Smoke-producing cartridges for use as pesticides may, if wrapped in paper or fibreboard, likewise be packed:

- (a) in corrugated-fibreboard boxes or in strong fibreboard cases; such a package must not weigh more than 20 kg; or
- (b) in ordinary-fibreboard cases; such a package must not weigh more than 5 kg.

3. Mixed packing

(1) Substances and articles grouped under the same item number may be included in the same package. The inner packagings shall conform to what is laid down for each dangerous substance, and the outer packaging shall be that laid down for the dangerous substances of the item number in question. In this connexion a fibreboard case containing articles of 20<sup>o</sup> (a) shall be deemed equivalent to a packet containing articles of 20<sup>o</sup> (b). 2111

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance or of articles of the same kind", dangerous substances of this Class, in quantities not exceeding 6 kg for all of the dangerous substances listed under the same item number or the same letter, may be enclosed in the same package either with dangerous substances of another item number or of another letter of the same Class, or with dangerous substances belonging to other Classes (if mixed packing is likewise permitted in the case of such substances), or with other goods, subject to the following special conditions.

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions contained in marginals 2001(5) and 2002(6) and (7) must be observed.

A package must not weigh more than 100 kg, or more than 50 kg if it contains articles of 23<sup>o</sup>.

## Class Ic

2111 Special conditions:  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1°	Matches	5 kg	5 kg	Must not be packed together with substances of Classes II, IIIa and IIIb.
2° and 3°	Strips of amorces and slow-combustion fuses	Mixed packing not allowed		
4°	Pyroxylin thread		1,500 m of pyroxylin thread	
5° - 8°	All articles	Mixed packing not allowed		
9° - 20°	All articles			Mixed packing allowed only with small wares or non-pyrotechnic toys, from which they must be kept separate. The collective case must meet the requirements laid down for those articles contained therein in respect of which marginal 2109 (2) and (3) imposes the most stringent conditions.
21° - 25°	All articles			Mixed packing allowed only with one another. The collective case must meet the requirements laid down for those articles contained therein in respect of which marginal 2109 (2) and (3) imposes the most stringent conditions.
26° and 27°	All articles and substances	Mixed packing not allowed		

## Class Ic

4. Marking and danger labels on packages (see Appendix A.9)

Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. 2112

2113

B. Particulars in the transport document

(1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2101; it must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. Ic, 1<sup>o</sup>(a), ADR]. The wording "Fireworks of ADR, Ic, item number.....", with particulars of the item numbers under which the substances or articles to be carried are listed, is also allowed in the transport document. 2114

(2) In the case of substances or articles of 2<sup>o</sup>, 4<sup>o</sup>, 5<sup>o</sup>, 8<sup>o</sup>, 9<sup>o</sup>, 11<sup>o</sup>, 12<sup>o</sup> and 15<sup>o</sup> - 27<sup>o</sup>, the following must be certified in the transport document: "The nature of the goods, and the packaging, are in conformity with the provisions of ADR".

2115-  
2119C. Empty packagings

No provisions.

2120

2121-  
2129



CLASS Id. GASES: COMPRESSED, LIQUEFIED OR DISSOLVED  
UNDER PRESSURE

1. List of substances

(1) Among the substances and articles covered by the heading of Class Id, only those listed in marginal 2131 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR.

(2) The substances of Class Id have a critical temperature lower than 50°C or, at this temperature, a vapour pressure greater than 3 kg/cm<sup>2</sup>.

Note: Hydrogen fluoride is included in Class Id although its vapour pressure at 50°C is only 2.7 to 2.8 kg/cm<sup>2</sup>.

(3) Substances of Class Id which polymerize easily, such as methyl vinyl ether, vinyl chloride, vinyl bromide and ethylene oxide, are to be accepted for carriage only if the necessary precautions have been taken to prevent their polymerization during carriage.

To this end, care must in particular be taken to ensure that receptacles and tanks do not contain any substances liable to promote polymerization.

A. Compressed gases [see also marginal 2131a under (a)]: 2131

Gases whose critical temperature is below -10°C are considered to be compressed gases for the purposes of ADR.

1° (a) Carbon monoxide, hydrogen containing not more than 2% oxygen, methane (fire damp and natural gas);

(b) Water gas, synthetic gases (e.g. from the Fischer-Tropsch process), town gas (lighting gas, coal gas) and other mixtures of gases of 1° (a), such, for example, as a mixture of carbon monoxide with hydrogen.

2° Compressed oil gas (rich gas)

3° Oxygen containing not more than 3% hydrogen, mixtures of oxygen with carbon dioxide containing not more than 20% carbon dioxide, nitrogen, compressed air, a mixture of 20% nitrogen with 80% oxygen,<sup>\*</sup> boron trifluoride, fluorine, helium, neon, argon, krypton, mixtures of rare gases, mixtures of rare gases with oxygen and mixtures of rare gases with nitrogen.

<sup>\*</sup>/ Note by the reviser: the word nitrox, used in the French text to describe this gaseous mixture, has a different meaning in English.

## Class Id

2131  
(contd)

For xenon, see under 9°; for oxygen, see also marginal 2131a, under (a).  
For gases of 3° in aerosol dispensers or in non-refillable containers  
for gases under pressure, see under 16° and 17°.

- B. Liquefied gases [see also marginal 2131a, under (b)]. For gases of  
6° to 10° in aerosol dispensers or in non-refillable containers for  
gases under pressure, see under 16° and 17°:

Gases whose critical temperature is equal to or above -10°C are  
considered to be liquefied gases for the purposes of ADR.

- (a) Liquefied gases with a critical temperature equal to or above 70°C:

- 4° Liquefied oil gas whose vapour pressure at 70°C does not exceed  
41 kg/cm<sup>2</sup> (termed Z gas).
- 5° Hydrogen bromide (anhydrous hydrobromic acid), hydrogen fluoride  
(anhydrous hydrofluoric acid), hydrogen sulphide (sulphuretted  
hydrogen), anhydrous ammonia, chlorine, sulphur dioxide (anhydrous  
sulphurous acid), nitrogen dioxide (nitrogen peroxide, nitrogen  
tetroxide), T gas (mixture of ethylene oxide with not more than  
10% by weight of carbon dioxide, whose vapour pressure at 70°C does  
not exceed 29 kg/cm<sup>2</sup>).
- 6° Propane, cyclopropane, propene (propylene), butane, isobutane,  
butadiene, butene (butylene), isobutene (isobutylene).  
Note: For technical and impure liquefied gases, see under 7°.
- 7° Mixtures of hydrocarbons extracted from natural gas or by the  
distillation of derivatives of mineral oils, coal, etc., and  
mixtures of gases of 6°, which as
- mixture A have a vapour pressure at 70°C not exceeding 11 kg/cm<sup>2</sup>  
and a density at 50°C not lower than 0.525 (g per cm<sup>3</sup>);
  - mixture A Q have a vapour pressure at 70°C not exceeding 16 kg/cm<sup>2</sup>  
and a density at 50°C not lower than 0.495 (g per cm<sup>3</sup>);
  - mixture A 1 have a vapour pressure at 70°C not exceeding 21 kg/cm<sup>2</sup>  
and a density at 50°C not lower than 0.485 (g per cm<sup>3</sup>);
  - mixture B have a vapour pressure at 70°C not exceeding 26 kg/cm<sup>2</sup>  
and a density at 50°C not lower than 0.450 (g per cm<sup>3</sup>);
  - mixture C have a vapour pressure at 70°C not exceeding 31 kg/cm<sup>2</sup>  
and a density at 50°C not lower than 0.440 (g per cm<sup>3</sup>).

## Class Id

Note: In the case of the foregoing mixtures the use of the following names customary in the trade is permitted for describing these substances: 2131 (contd)

<u>Name given under 7°</u>	<u>Name customary in the trade</u>
Mixture A, mixture A O	<u>butane</u>
Mixture C	<u>propane</u>
For butane, see also marginal 2131a, under (d).	
8° (a)	<u>Dimethyl ether (methoxymethane), methyl vinyl ether, chloro-</u> <u>methane (methyl chloride), bromomethane (methyl bromide),</u> <u>chloroethane (ethyl chloride), whether perfumed for spraying or</u> <u>not, phosgene (carbonyl chloride), cyanogen chloride, vinyl</u> <u>chloride, vinyl bromide, methylamine (monomethylamine),</u> <u>dimethylamine, trimethylamine, ethylamine (monoethylamine),</u> <u>ethylene oxide, methanethiol (methyl mercaptan).</u>

Note: 1. A mixture of bromomethane with 1,2-dibromoethane containing not more than 50% (by weight) of bromomethane is not a liquefied gas within the meaning of ADR and thus is not subject to the provisions of ADR.

2. Mixtures of chloromethane or bromomethane with chloropicrin are substances of Class Id if the vapour pressure of the mixture at 50°C is greater than 3 kg/cm<sup>2</sup>.

- (b) Dichlorodifluoromethane, dichlorofluoromethane (dichloromono-  
fluoromethane), chlorodifluoromethane (monochlorodifluoromethane),  
dichlorotetrafluoroethane (CF<sub>2</sub>Cl-CF<sub>2</sub>Cl), chlorotrifluoroethane  
(monochlorotrifluoroethane) (CH<sub>2</sub>Cl-CF<sub>3</sub>), chlorodifluoroethane  
(monochlorodifluoroethane), (CH<sub>3</sub>-CF<sub>2</sub>Cl) chlorotrifluoroethylene  
(monochlorotrifluoroethylene), bromochlorodifluoromethane  
(monochlorodifluoromonobromomethane), 1,1-difluoroethane (CH<sub>3</sub>-CHF<sub>2</sub>),  
octafluorocyclobutane.

Note: For describing the foregoing gases the use of the following names customary in the trade: Algofrene, Arcton, Edifren, Flugene, Forane, Freon, Frigen and Isceon, is permitted, followed by the identification number indicated in the table below:

## Class Id

2131  
(contd)

<u>Name given under 8° (b)</u>	<u>Identification number</u>
Dichlorodifluoromethane	12
Dichlorofluoromethane	21
Chlorodifluoromethane	22
Dichlorotetrafluoroethane (CF <sub>2</sub> Cl-CF <sub>2</sub> Cl)	114
Chlorotrifluoroethane (CH <sub>2</sub> Cl-CF <sub>3</sub> )	133a
Monochlorodifluoroethane (CH <sub>3</sub> -CF <sub>2</sub> Cl)	142b
Chlorotrifluoroethylene	1113
Bromochlorodifluoromethane	12B1
Difluoroethane (CH <sub>3</sub> -CHF <sub>2</sub> )	152a
Octafluorocyclobutane	C318

- (c) Mixtures of substances listed under 8°(b), which as mixture F 1 have a vapour pressure at 70°C not exceeding 13 kg/cm<sup>2</sup> and a density at 50°C not lower than that of dichlorofluoromethane (1.30  $\sqrt{g}$  per cm<sup>3</sup>); mixture F 2 have a vapour pressure at 70°C not exceeding 19 kg/cm<sup>2</sup> and a density at 50°C not lower than that of dichlorodifluoromethane (1.21  $\sqrt{g}$  per cm<sup>3</sup>); mixture F 3 have a vapour pressure at 70°C not exceeding 30 kg/cm<sup>2</sup> and a density at 50°C not lower than that of chlorodifluoromethane (1.09  $\sqrt{g}$  per cm<sup>3</sup>).

Note: Trichloromonofluoromethane (identification number 11), trichlorotrifluoroethane (CFCl<sub>2</sub>-CF<sub>2</sub>Cl) (identification number 113), and chlorotrifluoroethane (CHFCl-CHF<sub>2</sub>) (identification number 133) are not liquefied gases within the meaning of ADR and thus are not subject to the provisions of ADR. They may, however, enter into the composition of mixtures F 1 to F 3.

- (b) Liquefied gases with a critical temperature equal to or above -10°C, but below 70°C:
- 9° Xenon, carbon dioxide, including mixtures of carbon dioxide with not more than 17% by weight of ethylene oxide; coal-firing tubes containing carbon dioxide (such as charged Cardox tubes), nitrous oxide (laughing gas), ethane, ethylene.
- For carbon dioxide, see also marginal 2131a, under (c).



## Class Id

Notes: 1. Carbon dioxide and nitrous oxide are to be accepted for carriage only if they have a degree of purity of not less than 99%.

2131  
(contd)

2. By "coal-firing tube " is meant a steel device, with a very thick wall, fitted with a small bursting disc and containing both carbon dioxide and a cartridge (generally called the heating element) which can be ignited only by means of an electric current; the composition in the heating element must be such that it cannot deflagrate when the device is not filled with carbon dioxide under pressure. Carbox or similar tubes handed over for carriage must be of a type approved by a government department for use in mines.

10° Liquefied hydrogen chloride (anhydrous hydrochloric acid), sulphur hexafluoride, chlorotrifluoromethane, bromotrifluoromethane (trifluoromonobromomethane), trifluoromethane, vinyl fluoride, 1, 1-difluoroethylene (CH<sub>2</sub>-CF<sub>2</sub>).

Notes: 1. Sulphur hexafluoride is to be accepted for carriage only if it has a degree of purity of not less than 99%.

2. For describing the foregoing chloro-fluorohydrocarbons the use of the following names customary in the trade: Algofrene, Arcton, Edifren, Flugene, Forane, Freon, Frigen and Isceon, is permitted, followed by the identification number indicated in the table below:

<u>Name given under 10°</u>	<u>Identification number</u>
Chlorotrifluoromethane	13
Bromotrifluoromethane	13B1
Trifluoromethane	23
Vinyl fluoride	1141
Difluoroethylene	1132a

C. Deeply-refrigerated liquefied gases:

11° Liquid air, liquid oxygen, and liquid nitrogen, also when mixed with rare gases; liquid mixtures of oxygen with nitrogen, also when they contain rare gases; and liquid rare gases.

12° Liquid methane, liquid ethane, liquid mixtures of methane with ethane, also when they contain propane or butane; liquid ethylene.

13° Liquid carbon dioxide.

## Class Id

2131  
(contd)D. Gases dissolved under pressure:14° Ammonia dissolved in water

- (a) with more than 35% but not more than 40% ammonia;
- (b) with more than 40% but not more than 50% ammonia.

Note: Ammonia solution with an ammonia content not exceeding 35% is not subject to the provisions of ADR.

15° Acetylene dissolved in a solvent (e.g. acetone) absorbed by porous substances.E. Aerosol dispensers and non-refillable containers of gas under pressure [see also marginal 2131a, under (d)]:16° Aerosol dispensers

- (a) containing not more than 45% inflammable substances by weight and not more than 250 g of such substances;
- (b) containing more than 45% inflammable substances by weight or more than 250 g of such substances, the percentage being the proportion of the total content (active substance plus propulsive agent).

Note: Aerosol dispensers are receptacles which can be used only once, are equipped with a release valve or a dispersal device, and contain, under pressure, a gas or a mixture of gases listed in marginal 2138(2), or contain an active substance (insecticide, cosmetic, etc.) together with such a gas or mixture of gases as a propellant.

17° Non-refillable containers of gas under pressure

- (a) inflammable gases;
- (b) non-inflammable gases.

Note: Non-refillable containers for gas under pressure are receptacles which can be used only once, which contain a gas or a mixture of gases listed in marginal 2138(2) (e.g. butane for camp kitchens, refrigerant gases, etc.), but which are not equipped with a release valve.

Note: re 16° and 17°: The term "inflammable substances" means:

- gases (propellant in aerosol dispensers; contents of non-refillable containers for gas under pressure) whose mixtures with air can be ignited and have a lower and an upper explosion limit;
- liquid substances (active substances in aerosol dispensers) of Class IIIa.

## Class Id

- F. Empty receptacles and empty tanks: 2131  
 18° Empty receptacles, uncleaned, and empty tanks, uncleaned, which have (contd)  
 contained gases of 1° or 2°, boron trifluoride or fluorine of 3°, or  
 gases of 4° - 10° or 12° - 15°.
- Notes: 1. Receptacles or tanks which, after having been emptied of  
 gases of 1° or 2°, boron trifluoride or fluorine of 3°, or gases of  
 4° - 10° or 12° - 15°, still contain small residual amounts, are  
 regarded as empty.
2. Empty receptacles or tanks, uncleaned, which have contained  
 gases of 3° other than boron trifluoride and fluorine, or gases of 11°,  
 are not subject to the provisions of ADR.
- Gases handed over for carriage in conformity with the following 2131a  
 provisions are subject neither to the provisions for this Class contained  
 in this Annex nor to those contained in Annex B:
- (a) compressed gases which are neither inflammable, nor toxic, nor  
 corrosive, and whose pressure in the receptacle, referred to a  
 temperature of 15°C, does not exceed 2 kg/cm<sup>2</sup>;
- (b) liquefied gases contained, in quantities not exceeding 20 litres, in  
 freezing appliances (refrigerators, ice machines, etc.) and necessary  
 for their operation;
- (c) liquefied carbon dioxide (9°):
1. in seamless receptacles, made of carbon steel or of aluminium  
 alloys, having a capacity of not more than 220 cm<sup>3</sup> and containing  
 not more than 0.75 g carbon dioxide per cm<sup>3</sup> of capacity;
  2. in metal capsules (sodors, sparklets), if the carbon dioxide in  
 the gaseous state contains not more than 0.5% air and the capsules  
 contain not more than 25 g carbon dioxide and not more than  
 0.75 g per cm<sup>3</sup> of capacity;
- (d) articles of 16° and 17° with a capacity not exceeding 50 cm<sup>3</sup>. A  
 package of these articles must not weigh more than 10 kg.

## Class Id

2. ProvisionsA. Packages1. General conditions of packing

2132

(1) The materials of which the receptacles and their closures are made must not be liable to attack by the contents or form harmful or dangerous compounds therewith.\*

(2) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. When outer packagings are prescribed, the receptacles must be firmly secured therein. Unless otherwise specified in the section entitled "Packing of a single substance or of articles of the same kind", inner packagings may be enclosed in outer packagings, either singly or in groups.

(3) Metal receptacles intended for the carriage of gases of 1° - 10°, 14° and 15° must contain only the gas for which they have been tested and whose name is inscribed on the receptacle [see marginal 2148 (1) (a)].

Derogations are allowed:

1. for metal receptacles tested for propane (6°). These receptacles may also be filled with butane (6°), but in such case the maximum filling allowed for butane must not be exceeded. The names of both gases, the prescribed test pressure for propane and the maximum filling weights allowed for propane and butane must be stamped on the receptacle;
2. for metal receptacles tested for mixtures of 7°:
  - (a) receptacles tested for mixture A 0 may also be filled with mixture A. The names of the two gases, the prescribed test pressure for mixture A 0 and the maximum filling weights allowed for mixtures A and A 0 must be stamped on the receptacle;

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\*/ Care must be taken not to allow any moisture to enter receptacles when they are being filled and to dry receptacles completely after hydraulic pressure tests (see marginal 2146) carried out with water or with aqueous solutions.

## Class Id

- 2132  
(contd)
- (b) receptacles tested for mixture A 1 may also be filled with mixtures A or A 0. The names of the three gases, the prescribed test pressure for mixture A 1 and the maximum filling weights allowed for mixtures A, A 0 and A 1 must be stamped on the receptacle;
- (c) receptacles tested for mixture B may also be filled with mixtures A, A 0 or A 1. The names of the four gases, the prescribed test pressure for mixture B and the maximum filling weights allowed for mixtures A, A 0, A 1 and B must be stamped on the receptacle;
- (d) receptacles tested for mixture C may also be filled with mixtures A, A 0, A 1 or B. The names of the five gases, the prescribed test pressure for mixture C and the maximum filling weights allowed for mixtures A, A 0, A 1, B and C must be stamped on the receptacle.
3. for metal receptacles tested for dichlorofluoromethane  $\sqrt{8^{\circ}(b)}$ . These receptacles may also be filled with mixture F 1  $\sqrt{8^{\circ}(c)}$ . The name of the gas must be stamped on the receptacle as follows: "dichlorofluoromethane" (or, alternatively, a recognized name customary in the trade) and "mixture F 1";
4. for metal receptacles tested for dichlorodifluoromethane  $\sqrt{8^{\circ}(b)}$ . These receptacles may also be filled with mixtures F 1 or F 2  $\sqrt{8^{\circ}(c)}$ . The name of the gas must be stamped on the receptacle as follows: "dichlorodifluoromethane" (or, alternatively, a recognized name customary in the trade) and "mixtures F 1 or F 2", and also the maximum filling weight allowed for mixture F 2;
5. for metal receptacles tested for chlorodifluoromethane  $\sqrt{8^{\circ}(b)}$ . These receptacles may also be filled with mixtures F 1, F 2 or F 3  $\sqrt{8^{\circ}(c)}$ . The name of the gas must be stamped on the receptacle as follows: "chlorodifluoromethane" (or, alternatively, a recognized name customary in the trade) and "mixtures F 1, F 2 or F 3", and also the maximum filling weight allowed for mixture F 3;

## Class Id

2132  
(contd)

6. for metal receptacles tested for the mixtures of 8°(c):
- (a) receptacles tested for mixture F 2 may also be filled with mixture F 1. The maximum filling weight allowed must be equal to that prescribed for mixture F 2;
  - (b) receptacles tested for mixture F 3 may also be filled with mixtures F 1 or F 2. The maximum filling weight allowed must be equal to that prescribed for mixture F 3.

For 1. - 6. above, see also marginals 2145, 2148(1)(a) and 2150.

(4) A change in the use to which a receptacle is assigned is allowed in principle if it does not conflict with the national regulations; it requires, however, the approval of the competent authority and replacement of the former markings by markings relating to the new use.

2. Packing of a single substance or of articles of the same kind

Note: Gases of 12° and 13° may not be carried otherwise than in specially-equipped tanks.

a. Nature of receptacles

2133

(1) Receptacles intended for the carriage of gases of 1° - 10°, 14° and 15° shall be so closed and leak-proof as to prevent any escape of the gases.

(2) These receptacles shall be made of carbon steel or of steel alloy (special steel).

The following may, however, be used:

(a) copper receptacles for:

1. compressed gases (1° - 3°), with the exception of boron trifluoride and fluorine (3°), whose filling pressure at a temperature referred to 15°C does not exceed 20 kg/cm<sup>2</sup>;
2. the following liquefied gases: sulphur dioxide and T gas (5°), gases of 8° with the exception of: carbonyl chloride, cyanogen chloride, methylamine, dimethylamine, trimethylamine, ethylamine and methanethiol;

## Class Id

- (b) aluminium-alloy receptacles (see Appendix A.2) for: 2133  
(contd)
1. compressed gases (1° - 3°), with the exception of boron trifluoride and fluorine (3°);
  2. the following liquefied gases: liquefied oil gas (4°), hydrogen sulphide, sulphur dioxide and T gas (5°), gases of 6° and 7° free from alkaline impurities, dimethyl ether, ethylene oxide and methanethiol  $\sqrt{8^{\circ}(a)}$ , gases of 8°(b) and (c) and 9°, sulphur hexafluoride and chlorotrifluoromethane (10°). Sulphur dioxide, gases of 8°(b) and (c) and chlorotrifluoromethane must be dry;
  3. dissolved acetylene (15°).

(1) Receptacles for dissolved acetylene (15°) shall be entirely 2134  
filled with a porous material, uniformly distributed, of a type approved by  
the competent authority, which

- (a) does not attack the receptacles and does not form harmful or dangerous compounds either with acetylene or with the solvent;
- (b) does not shake down, even after prolonged use or under shock, at temperatures up to 60°C;
- (c) is capable of preventing the spread of a decomposition of the acetylene in the mass.

(2) The solvent must not attack the receptacles.

(1) The following liquefied gases may, in addition, be carried in 2135  
glass tubes with thick walls, on condition that the quantity of substance in  
each tube and the degree of filling of the tubes do not exceed the figures  
indicated below:

<u>Names of gases</u>	<u>Quantity of substance</u>	<u>Degree of filling of tube</u>
Carbon dioxide, nitrous oxide, ethane, ethylene (9°)	3 g	one-half of the capacity
Ammonia, chlorine, nitrogen dioxide (5°), cyclopropane (6°), bromomethane, chloroethane $\sqrt{8^{\circ}(a)}$	20 g	two-thirds of the capacity
Sulphur dioxide (5°), phosgene $\sqrt{8^{\circ}(a)}$	100 g	three-quarters of the capacity

## Class Id

2135  
(contd)

(2) The glass tubes shall be flame-sealed and secured separately by infusorial earth cushioning in closed sheet-metal capsules which shall be placed in a wooden case (see also marginal 2152).

(3) For sulphur dioxide (5°) the following are also allowed:

- (a) small seamless aluminium-alloy bottles, which shall not be filled beyond three-quarters of their capacity and shall not contain more than 100 g sulphur dioxide each. The bottles shall be so closed as to be leak-proof and shall, kept apart from one another, be placed in wooden cases;
- (b) stout glass siphons, containing not more than 1.5 kg of substance, which shall not be filled beyond 88% of their capacity. The siphons must be secured by infusorial earth, sawdust or powdered carbonate of lime, or by a mixture of the two latter, in strong wooden cases. A package must not weigh more than 100 kg. If it weighs more than 30 kg it shall be fitted with means of handling.

2136

(1) T gas (5°) and gases of 6° - 8° other than phosgene and cyanogen chloride of 8°(a) [as regards phosgene, see marginal 2135 (1)] may also, on condition that the weight of liquid per litre of capacity does not exceed either the maximum indicated in marginal 2150 or 150 g per tube, be contained in thick-walled glass tubes or in thick-walled metal tubes made of a metal allowed by marginal 2133 (2). The tubes must be free from faults liable to impair their strength; in particular, internal stresses in glass tubes must have been suitably relieved and the thickness of the tube walls may not be less than 2 mm. The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage. The tubes shall be secured by cushioning materials in small boxes made of wood or fibreboard, the number of tubes per box being such that the weight of the liquid contained in a box does not exceed 600 g. These small boxes shall be placed in wooden cases, each of which shall be lined with soft-soldered sheet-metal if its liquid contents weigh more than 5 kg.



## Class Id

- (2) A package must not weigh more than 75 kg. 2136  
(1) Gases of 11<sup>o</sup> shall be enclosed: (contd)  
2137
- (a) in double-walled vacuum-jacketed glass receptacles surrounded by absorbent insulating materials which, in the case of liquid-air and liquid-oxygen receptacles, shall also be incombustible. The glass receptacles shall be protected by iron-wire baskets and placed in cases, made of metal or wood, which shall be fitted with means of handling;
- (b) in receptacles made of another material, on condition that they are protected against heat transmission in such a way that they cannot become coated with dew or hoar-frost. These receptacles need not be placed in a packaging. The receptacles shall be fitted with means of handling.
- (2) Receptacles shall be closed by stoppers allowing gases to escape, preventing any splashing out of the liquid, and so fixed that they cannot fall out. For oxygen and mixtures containing oxygen, the stoppers shall be made of an incombustible material.
- (1) Aerosol dispensers (16<sup>o</sup>) and non-refillable containers of gas under pressure (17<sup>o</sup>) must satisfy the following requirements: 2138
- (a) aerosol dispensers containing only a gas or a mixture of gases, and non-refillable containers for gas under pressure, must be made of metal. Other aerosol dispensers must be made of metal, a plastics material or glass. Receptacles made of metal and having an outside diameter of not less than 40 mm must have a concave bottom;
- (b) receptacles made of materials liable to shatter, such as glass and certain plastics materials, must be enclosed in a device (close-mesh wire netting, flexible cover made of a plastics material, etc.) affording protection against fragments and their dispersal. Receptacles with a capacity not exceeding 150 cm<sup>3</sup> and whose internal pressure at 20<sup>o</sup>C is below 1.5 kg/cm<sup>2</sup> are exempted from this requirement;

## Class Id

2138  
(contd)

- (c) the capacity of receptacles made of metal must not exceed 1,000 cm<sup>3</sup>; that of receptacles made of a plastics material or of glass must not exceed 220 cm<sup>3</sup>;
- (d) each model of receptacle must, before being put into service, satisfy a hydraulic pressure test carried out in conformity with Appendix A.2, marginal 3291. The internal pressure to be applied (test pressure) must be 1.5 times the internal pressure at 50°C, with a minimum of 10 kg/cm<sup>2</sup>;
- (e) the release valves of aerosol dispensers, and their dispersal devices, must ensure that the dispensers are so closed as to be leak-proof and must be protected against accidental opening. Valves and dispersal devices which close only by the action of the internal pressure are not to be accepted.

(2) The following gases are to be accepted as propellants, or as constituents of propellants, or as filler gases, for aerosol dispensers and as the contents of non-refillable containers for gas under pressure:

Oxygen, mixtures of oxygen with carbon dioxide, nitrogen, compressed air, the mixture of 20% nitrogen with 80% oxygen (3°); propane, cyclopropane, propene, butane, isobutane, butadiene, butene, isobutene (6°); mixtures A, A O, A 1, B, C (7°); dimethyl ether, chloroethane, vinyl chloride [8°(a)]; dichlorodifluoromethane, dichlorofluoromethane, chlorodifluoromethane, dichlorotetrafluoroethane, chlorodifluoroethane, chlorotrifluoroethane, chlorotrifluoroethylene, bromochlorodifluoromethane, 1,1-difluoroethane, octafluorocyclobutane [8°(b)]; mixtures F 1, F 2, F 3 [8°(c)]; carbon dioxide, nitrous oxide, ethane, ethylene (9°); sulphur hexafluoride, chlorotrifluoromethane, bromotrifluoromethane, trifluoromethane, vinyl fluoride and 1,1-difluoroethylene (10°).

2139

(1) The internal pressure at 50°C of aerosol dispensers and of non-refillable containers of gases under pressure must exceed neither two-thirds of the test pressure of the receptacle nor 12 kg/cm<sup>2</sup>.

## Class Id

(2) Aerosol dispensers and non-refillable containers of gas under pressure must be so filled that, at 50°C, the liquid phase does not exceed 95% of their capacity. The capacity of aerosol dispensers is the available volume in a closed dispenser fitted with the valve support, the valve and the dip tube. 2139 (contd)

(3) All aerosol dispensers and non-refillable containers for gas under pressure must satisfy a tightness (leakage) test in conformity with Appendix A.2, marginal 3292.

(1) Aerosol dispensers and non-refillable containers of gas under pressure must be placed in wooden cases or strong fibreboard or metal boxes; aerosol dispensers made of glass or a plastic material and liable to shatter shall be separated from one another by interposed sheets of fibreboard or of another suitable material. 2140

(2) A package must not weigh more than 30 kg.

b. Conditions governing metal receptacles

(These conditions are applicable neither to the aluminium-alloy bottles referred to in marginal 2135 (3), nor to the metal tubes mentioned in marginal 2136, nor to the receptacles mentioned in 2137 (1)(b), nor to the aerosol dispensers and non-refillable metal containers for gas under pressure referred to in marginal 2138).

1. Construction and fittings (see also marginal 2168)

(1) At the test pressure, the stress in the metal at the most severely stressed point of the receptacle (marginals 2145, 2149 and 2150) must not exceed three-quarters of the yield stress. By "yield stress" is meant the stress at which a permanent elongation of 2 % (i.e. 0.2% proof stress) of the gauge length on the test piece has been produced. 2141

(2) (a) Steel receptacles whose test pressure exceeds 60 kg/cm<sup>2</sup> must be of seamless construction or welded. For welded receptacles, steels (carbon or alloy) of fully satisfactory weldability must be used. Welded receptacles are to be accepted only on condition that the manufacturer guarantees the workmanship of the welding and that the competent authorities of the country of origin have given their approval.

## Class Id

2141  
(contd)

(b) Receptacles whose test pressure does not exceed  $60 \text{ kg/cm}^2$  must either conform to the provisions of sub-paragraph (a) above or be riveted or hard-soldered, on condition that the manufacturer guarantees the workmanship of the riveting and hard-soldering and that the competent authorities of the country of origin have given their approval.

(3) Aluminium-alloy receptacles must be seamless.

2142

(1) A distinction is made between the following types of receptacles:

- (a) cylinders with a capacity not exceeding 150 litres;
- (b) receptacles with a capacity of not less than 100 litres [with the exception of cylinders in conformity with sub-paragraph (a)] and not more than 1,000 litres (e.g. cylindrical receptacles equipped with rolling hoops, and receptacles on skids);
- (c) tanks (see Annex B);
- (d) assemblies, known as "frames" (or "baskets"), of cylinders in conformity with paragraph (1)(a) interconnected by a manifold and held firmly together by a metal fitting.

(2) (a) If, under the regulations of the country of departure, cylinders in conformity with sub-paragraph (1)(a) are required to be fitted with a device to prevent rolling, this device must not be integral with the valve cap [marginal 2143 (2)].

(b) Receptacles in conformity with paragraph (1)(b) which are capable of being rolled must be equipped with rolling hoops.

Other receptacles in conformity with paragraph (1)(b) must be fitted with a device (skids, rings, straps) which ensures that they can be safely handled by mechanical means and is so arranged as not to impair the strength of and not to cause undue stresses in the wall of the receptacle.

(c) Frames of cylinders in conformity with paragraph (1)(d) must be fitted with devices ensuring that they can be handled safely. The manifold and the master cock must be situated within the frame and be so fixed as to be protected against any damage.

(3) (a) With the exception of gases of 11° - 13°, gases of Class Id may be carried in cylinders in conformity with paragraph (1)(a).

## Class Id

Note: For fluorine (3°), see also marginal 2149 (3).

2142  
(contd)

(b) With the exception of fluorine (3°) and the gases of 11° - 13°, gases of Class Id may be carried in receptacles in conformity with paragraph (1)(b).

If dissolved acetylene (15°) is carried in receptacles in conformity with paragraph (1)(b), the capacity of the receptacles must not exceed 500 litres and the receptacles must not be capable of rolling.

(c) With the exception of gases of 11° - 13°, gases of Class Id may be carried in frames (or baskets) of cylinders in conformity with paragraph (1)(d), but the cylinders in one frame must all contain the same compressed gas, liquefied gas or gas dissolved under pressure.

The cylinders in a frame must not be capable of being isolated by means of cocks. However, in frames of cylinders for fluorine (3°) and acetylene (15°), each receptacle must be capable of being isolated by a cock.

(1) Openings for filling and emptying receptacles shall be fitted with clap valves or needle-valves. Valves of other types may, however, be accepted if they present equivalent guarantees of safety and have been approved in the country of origin. Nevertheless, whatever the type of valve adopted, its system of attachment must be strong and such that its satisfactory condition can be verified easily before each filling. 2143

Receptacles and tanks in conformity with marginal 2142 (1)(b) and (c) must not have more than two openings, for filling and emptying respectively, in addition to the manhole (if one is provided), which must be closed by an efficient closure, and to the necessary orifice for the removal of deposits. Nevertheless, such of these receptacles as are intended for the carriage of dissolved acetylene (15°) may have more than two openings for filling and emptying.

Similarly, receptacles and tanks in conformity with marginal 2142 (1)(b) and (c) and intended for the carriage of substances of 6° and 7° may be provided with other openings intended in particular for verifying the level of the liquid and the gauge pressure.

## Class Id

2143  
(contd)

(2) Valves shall be protected by steel caps having vents. Receptacles made of copper or of aluminium alloy may also be provided with caps made of the material of which the receptacle is made. Valves placed inside the neck of the receptacles and protected by a screw-threaded metal stopper, and receptacles which are carried packed in protective cases, shall not require a cap.

(3) The steel caps of receptacles containing fluorine (3°) or cyanogen chloride [8°(a)] must have no openings and shall, when being carried, be fitted with a gasket ensuring gas-tightness and made of a material not liable to attack by the contents of the receptacle.

2144

(1) In the case of receptacles containing boron trifluoride or fluorine (3°), liquefied ammonia or ammonia dissolved in water (5° and 14°), or methylamines or ethylamine [8°(a)], valves made of copper or of any other metal liable to be attacked by these gases are not to be accepted.

(2) The use of materials containing grease or oil for ensuring the tightness of joints or for maintaining the closure devices of receptacles used for oxygen, mixtures of oxygen with carbon dioxide containing not more than 20% carbon dioxide, compressed air, the mixture of 20% nitrogen and 80% oxygen, fluorine, mixtures of rare gases with oxygen (3°), nitrogen dioxide (5°) and nitrous oxide (9°) is prohibited.

(3) Receptacles for dissolved acetylene (15°) may also have stop valves taking yoke connectors. Metal parts of closure devices in contact with the contents must not contain more than 70% copper.

(4) Receptacles containing compressed oxygen (3°) and fitted in fish-tanks are likewise to be accepted if they are provided with an apparatus enabling the oxygen to escape gradually.

2. Official test of receptacles (see also Appendix A.2)

2145

(1) Metal receptacles must be subjected to initial and periodic tests under the supervision of an expert approved by the competent authority. The nature of these tests is specified in marginals 2146 and 2147.

## Class Id

(2) In order to ensure that the provisions of marginals 2134 and 2145 (contd) 2151 (2) are complied with, tests of receptacles intended to contain dissolved acetylene (15°) shall comprise, in addition, an examination of the nature of the porous material and the quantity of the solvent.

(1) The initial test of new or unused receptacles comprises: 2146

A. On an adequate sample of receptacles:

- (a) the test of the material of construction must include at least determination of the yield stress, the tensile strength, and the permanent elongation at fracture; the values yielded by these tests must comply with the national regulations;
- (b) measurement of the thickness at the thinnest point of the wall and calculation of the stress;
- (c) checking the homogeneity of the material for each manufacturing batch, and inspecting the external and internal condition of the receptacles;

B. For all receptacles:

- (d) a hydraulic pressure test in conformity with the provisions of marginals 2149 - 2151;
- (e) an inspection of the markings on the receptacles (see marginal 2148);

C. In addition, for receptacles intended for the carriage of dissolved acetylene (15°):

- (f) an inspection as required by the national regulations.

(2) Receptacles must withstand the test pressure without undergoing permanent deformation or exhibiting cracks.

(3) At the periodic inspections the following shall be repeated: the hydraulic pressure test, the inspection of the external and internal condition of the receptacle (e.g. by weighing, internal inspection, checks of wall thickness), verification of the equipment and markings and, if necessary, verification of the characteristics of the material by suitable tests.

## Class Id

2146  
(contd)

The periodic inspections shall be carried out:

- (a) every 2 years in the case of receptacles intended for the carriage of town gas [1°(b)], boron trifluoride, fluorine (3°), hydrogen bromide, hydrogen fluoride, hydrogen sulphide, chlorine, sulphur dioxide, nitrogen dioxide (5°), phosgene, cyanogen chloride [8°(a)] and liquefied hydrogen chloride (10°);
- (b) every 5 years in the case of receptacles intended for the carriage of the other compressed and liquefied gases, subject to the provisions of (c) below, <sup>in the case</sup> and of receptacles for ammonia dissolved under pressure (14°);
- (c) every 10 years in the case of receptacles intended for the carriage of gases of 6° and 7° if the receptacles have a capacity of not more than 150 litres and the country of origin does not prescribe a shorter interval.

2147

The external condition (corrosion, deformation) of, and the condition of the porous material (loosening, settlement) in, receptacles intended for the carriage of dissolved acetylene (15°) shall be verified every ten years. Sampling shall be performed by cutting up, if considered necessary, a suitable number of receptacles and inspecting them internally for corrosion and for any changes that may have occurred in the constituent materials and the porous material.

## 3. Marks on receptacles

2148

(1) Metal receptacles shall bear the following particulars in clearly legible and durable characters:

- (a) the name of the gas in full, the name or mark of the maker or owner, and the number of the receptacle [see also marginal 2132 (3)];
- (b) the tare of the receptacle, including such fittings and accessories as valves, metal stoppers, etc., but excluding the protective cap;
- (c) the test pressure (see marginals 2149 to 2151) and the date (month, year) of the last test undergone (see marginals 2146 and 2147);



## Class Id

- (d) the stamp of the expert who carried out the tests and inspections; in addition: 2148 (contd)
- (e) for compressed gases (1° - 3°): the maximum filling pressure allowed for the receptacle in question (see marginal 2149);
- (f) for liquefied gases (4° - 10°) and ammonia dissolved in water (14°): the maximum filling allowed, and the capacity;
- (g) for acetylene dissolved in a solvent (15°): the permitted filling pressure [see marginal 2151 (2)], and the weight of the empty receptacle, including the weight of the fittings and accessories, the porous material and the solvent.

(2) The marks shall be engraved either on a reinforced part of the receptacle or on a ring immovably fixed to the receptacle. In addition, the name of the substance may be indicated on the receptacle by an inscription in adherent and clearly visible paint.

(3) Cased receptacles shall be packed in such a manner that the test stamps can readily be found.

c. Test pressure and degree of filling of receptacles [see also marginal 2168 (a)2.]

(1) In the case of receptacles intended for the carriage of compressed gases of 1° - 3°, with the exception of fluorine, the internal pressure (test pressure) to be applied for the hydraulic pressure test must be at least one and a half times the filling pressure at 15°C indicated on the receptacle, but must not be less than 10 kg/cm<sup>2</sup>. 2149

(2) In the case of receptacles intended for the carriage of hydrogen of 1°(a), oxygen, mixtures of oxygen with carbon dioxide, nitrogen, compressed air, the mixture of 20% nitrogen and 80% oxygen, helium, neon, argon, krypton, mixtures of rare gases, mixtures of rare gases with oxygen, and mixtures of rare gases with nitrogen, of 3°, the filling pressure must not exceed 250 kg/cm<sup>2</sup> referred to a temperature of 15°C.

In the case of receptacles intended for the carriage of the other gases of 1° - 3°, with the exception of fluorine of 3° [see paragraph (3)], the filling pressure must not exceed 200 kg/cm<sup>2</sup> referred to a temperature of 15°C.

## Class Id

2149  
(contd)

(3) In the case of receptacles intended for the carriage of fluorine (3°), the internal pressure (test pressure) to be applied for the hydraulic pressure test must be equal to 200 kg/cm<sup>2</sup> and the filling pressure must not exceed 28 kg/cm<sup>2</sup> at a temperature of 15°C; in addition, no receptacle may contain more than 5 kg fluorine.

(4) The sender of compressed gases, other than oil gas (2°) contained in buoys or similar receptacles, may be required to verify the pressure in the receptacle by means of a pressure gauge.

2150

(1) In the case of receptacles intended for the carriage of liquefied gases of 4° - 10°, and in the case of those intended for the carriage of gases dissolved under pressure of 14° and 15°, the hydraulic pressure to be applied for the test (test pressure) must be not less than 10 kg/cm<sup>2</sup>.

(2) In the case of liquefied gases of 4° - 8°, the following values must be complied with for the minimum hydraulic pressure to be applied to the receptacles for the test (test pressure), and for the maximum degree of filling allowed<sup>\*/</sup>:

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<sup>\*/</sup> 1. The test pressures prescribed are at least equal to the vapour pressures of the liquids at 70°C, reduced by 1 kg/cm<sup>2</sup>, the minimum test pressure required being, however, 10 kg/cm<sup>2</sup>.

2. In view of the high degree of toxicity of phosgene (carbonyl chloride) and of cyanogen chloride [8°(a)], the minimum test pressure for these gases has been fixed at 20 kg/cm<sup>2</sup>. By reason of the use of the receptacles for mixtures F 1, the minimum test pressure for dichlorofluoromethane [8°(b)] has been fixed at 12 kg/cm<sup>2</sup>.

3. The maximum values prescribed for the degree of filling in kg/litre have been determined as follows: maximum degree of filling allowed = 0.95 times the density of the liquid phase at 50°C; in addition, the vapour phase must not disappear below 60°C.

Class Id				2150 (contd)
	<u>Item number</u>	<u>Minimum test pressure</u> kg/cm <sup>2</sup>	<u>Maximum weight of liquid per litre of capacity</u> kg	
Liquefied oil gas .....	4 <sup>o</sup>	40	0.37	
Hydrogen bromide .....	5 <sup>o</sup>	60	1.20	
Hydrogen fluoride .....	5 <sup>o</sup>	10	0.84	
Hydrogen sulphide .....	5 <sup>o</sup>	53	0.67	
Ammonia .....	5 <sup>o</sup>	33	0.53	
Chlorine .....	5 <sup>o</sup>	22	1.25	
Sulphur dioxide .....	5 <sup>o</sup>	14	1.23	
Nitrogen dioxide .....	5 <sup>o</sup>	10	1.30	
T gas .....	5 <sup>o</sup>	28	0.73	
Propane .....	6 <sup>o</sup>	26	0.42	
Cyclopropane .....	6 <sup>o</sup>	25	0.53	
Propene .....	6 <sup>o</sup>	30	0.43	
Butane .....	6 <sup>o</sup>	10	0.51	
Isobutane .....	6 <sup>o</sup>	10	0.49	
Butadiene .....	6 <sup>o</sup>	10	0.55	
Butene .....	6 <sup>o</sup>	10	0.52	
Isobutene .....	6 <sup>o</sup>	10	0.52	
Mixture A .....	7 <sup>o</sup>	10	0.50	
Mixture A 0 .....	7 <sup>o</sup>	15	0.47	
Mixture A 1 .....	7 <sup>o</sup>	20	0.46	
Mixture B .....	7 <sup>o</sup>	25	0.43	
Mixture C .....	7 <sup>o</sup>	30	0.42	
Dimethyl ether .....	8 <sup>o</sup> (a)	18	0.58	
Methyl vinyl ether .....	8 <sup>o</sup> (a)	10	0.67	
Chloromethane .....	8 <sup>o</sup> (a)	17	0.81	
Bromomethane .....	8 <sup>o</sup> (a)	10	1.51	
Chloroethane .....	8 <sup>o</sup> (a)	10	0.80	
Phosgene .....	8 <sup>o</sup> (a)	20	1.23	
Cyanogen chloride .....	8 <sup>o</sup> (a)	20	1.03	

## Class Id

2150  
(contd)

	<u>Item number</u>	<u>Minimum test pressure</u>	<u>Maximum weight of liquid per litre of capacity</u>
		kg/cm <sup>2</sup>	kg
Vinyl chloride .....	8°(a)	11	0.81
Vinyl bromide .....	8°(a)	10	1.37
Methylamine .....	8°(a)	13	0.58
Dimethylamine .....	8°(a)	10	0.59
Trimethylamine .....	8°(a)	10	0.56
Ethylamine .....	8°(a)	10	0.61
Ethylene oxide .....	8°(a)	10	0.78
Methanethiol .....	8°(a)	10	0.78
Dichlorodifluoromethane .....	8°(b)	18	1.15
Dichlorofluoromethane .....	8°(b)	12	1.23
Chlorodifluoromethane .....	8°(b)	29	1.03
Dichlorotetrafluoroethane .....	8°(b)	10	1.30
Chlorotrifluoroethane .....	8°(b)	10	1.20
Chlorodifluoroethane .....	8°(b)	10	0.99
Chlorotrifluoroethylene .....	8°(b)	19	1.13
Bromochlorodifluoromethane .....	8°(b)	10	1.61
1,1-difluoroethane .....	8°(b)	18	0.79
Octofluorocyclobutane .....	8°(b)	11	1.34
Mixture F 1 .....	8°(c)	12	1.23
Mixture F 2 .....	8°(c)	18	1.15
Mixture F 3 .....	8°(c)	29	1.03

(3) In the case of receptacles intended to contain liquefied gases of 9° and 10°, the degree of filling shall be such that the internal pressure at 65°C does not exceed the receptacle's test pressure. The following values must be complied with [see also under (4) and (5)]:

	Class Id		2150 (contd)
	<u>Item number</u>	<u>Minimum test pressure</u> kg/cm <sup>2</sup>	
Xenon .....	9°	130	1.24
Carbon dioxide, alone or mixed with ethylene oxide .....	9°	250	0.75
Nitrous oxide .....	9°	250	0.75
Ethane .....	9°	120	0.29
Ethylene .....	9°	225	0.34
Liquefied hydrogen chloride ...	10°	200	0.74
Sulphur hexafluoride .....	10°	70	1.04
Chlorotrifluoromethane .....	10°	100	0.83
Bromotrifluoromethane .....	10°	120	1.44
Trifluoromethane .....	10°	250	0.95
Vinyl fluoride .....	10°	250	0.64
1,1-difluoroethylene .....	10°	250	0.77

(4) For substances of 9° and 10° the use of receptacles tested at a lower pressure than that indicated under (3) for the substance in question is allowed, but the quantity of substance per receptacle must not exceed that which would, at 65°C, produce inside the receptacle a pressure equal to the test pressure.

(5) The degree of filling with carbon dioxide of coal-firing tubes (9°) shall comply with the rules laid down for the approval of the tubes by the government department which has approved them.

(1) In the case of gases dissolved under pressure of 14° and 15°, 2151 the following values must be complied with for the minimum hydraulic pressure to be applied to the receptacles for the test (test pressure), and for the maximum degree of filling allowed:

## Class Id

2151  
(contd)

	<u>Item number</u>	<u>Minimum test pressure</u> kg/cm <sup>2</sup>	<u>Maximum weight of liquid per litre of capacity</u> kg
Ammonia dissolved under pressure in water			
with more than 35% and not more than 40% ammonia .....	14 <sup>o</sup> (a)	10	0.80
with more than 40% and not more than 50% ammonia .....	14 <sup>o</sup> (b)	12	0.77
Dissolved acetylene .....	15 <sup>o</sup>	60	see paragraph (2)

(2) In the case of dissolved acetylene (15<sup>o</sup>), the filling pressure must not exceed 15 kg/cm<sup>2</sup> once equilibrium has been achieved at 15<sup>o</sup>C. The quantity of solvent, referred to a temperature of 15<sup>o</sup>C, must be such that the increase in volume which it undergoes when absorbing acetylene at the filling pressure leaves in the porous mass a free volume equal to not less than 12% of the receptacle's water capacity.

2152

3. Mixed packing

(1) Among the receptacles containing substances of this Class, only those containing the substances listed below may be included in the same package with one another:

- (a) ammonia, chlorine, sulphur dioxide, nitrogen dioxide (5<sup>o</sup>), cyclopropane (6<sup>o</sup>), bromomethane, chloromethane, phosgene [8<sup>o</sup>(a)], carbon dioxide, nitrous oxide, ethane and ethylene (9<sup>o</sup>); chlorine, however, must not be packed together with ammonia or with sulphur dioxide (5<sup>o</sup>). The gases must be packed in conformity with marginal 2135.
- (b) gases of 8<sup>o</sup> (except phosgene and cyanogen chloride) packed in conformity with marginal 2136.

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance or of articles of the same kind", substances of this Class, in quantities not exceeding 6 kg for all of the substances listed under the same item number or the same letter, may be

## Class Id

enclosed in the same package either with substances or articles of another item number or of another letter of the same Class, or with substances or articles belonging to other Classes (if mixed packing is likewise permitted in the case of such substances and articles), or with other goods, subject to the following special conditions.

2152  
(contd)

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions contained in marginals 2001 (5) and 2002 (6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

Special conditions:

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1° - 3°	Compressed gases	Mixed packing not allowed		
5°	Ammonia in thick-walled flame-sealed glass tubes	20 g		
	Chlorine	Mixed packing not allowed		
	Sulphur dioxide - in thick-walled flame-sealed glass tubes - in glass syphons - in seamless aluminium-alloy bottles	100 g 1.5 kg 100 g	1.5 kg	A package may contain up to 4 syphons if they are separated from one another by wooden partitions of a thickness equal to that of the sides of the case

## Class Id

2152  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
	Nitrogen dioxide - in thick-walled flame-sealed glass tubes - in metal receptacles	20 g Mixed packing not allowed		
	T gas, in thick-walled glass tubes or thick-walled metal tubes	150 g	5 kg	
6° - 8°	All gases (with the exception of phosgene and cyanogen chloride [8°(a)]), in thick-walled glass tubes or in thick-walled metal tubes [see marginal 2136 (1)]			
6°	Cyclopropane, in thick-walled flame-sealed glass tubes	20 g		
8°(a)	Bromomethane, chloroethane, both in thick-walled flame-sealed glass tubes			
	Phosgene in thick-walled flame-sealed glass tubes	100 g		
	Cyanogen chloride	Mixed packing not allowed		



## Class Id

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
9°	Carbon dioxide, nitrous oxide, ethane, ethylene, all in thick-walled flame-sealed glass tubes	3 g		
11°, 14° and 15°	Deeply-refrigerated liquefied gases, gases dissolved under pressure	Mixed packing not allowed		
16° - 17°	Aerosol dispensers and non-refillable containers of gas under pressure	Mixed packing allowed only with ordinary goods		

2152  
(contd)4. Marking and danger labels on packages (see Appendix A.9)

(1) Every package containing receptacles holding gases of 1° - 11°, 14° and 15° or cartridges for gases under pressure of 17° shall be marked legibly and indelibly with an indication of its contents, with the addition: "Class Id". This marking shall be in an official language of the country of departure, and also, if that language is not English, or French, or German, in English, French or German, unless agreements, if any, concluded between the countries concerned in the transport operation provide otherwise.

2153

(2) Packages containing aerosol dispensers of 16° shall be marked with the word "AEROSOL" in clearly legible and indelible characters.

(3) Where a consignment takes the form of a complete load, the markings referred to under (1) above are not mandatory.

(1) Packages which contain glass tubes holding liquefied gases listed in marginals 2135 and 2136 shall bear a label conforming to model No. 9.

2154

(2) Every package containing gases of 11° shall bear, on two opposite sides, labels conforming to model No. 8, and if the substances it contains are enclosed in glass receptacles [marginal 2137 (1)(a)] it shall, in addition, bear a label conforming to model No. 9.

## Class Id

2154  
(contd)

(3) Every package containing aerosol dispensers of 16<sup>o</sup>(b) or non-refillable containers of gas under pressure of 17<sup>o</sup>(a) shall bear a label conforming to model No. 2.

Packages containing aerosol dispensers of 16<sup>o</sup> made of materials liable to shatter shall, in addition, bear a label conforming to model No. 9.

2155

B. Particulars in the transport document

2156

(1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2131; it must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. Id, 1<sup>o</sup>(a), ADR].

(2) In the case of consignments of coal-firing tubes (9<sup>o</sup>) the description of the goods shall be followed by the words: "Tube approved on .... (date) by ..... (name of competent authority) of ..... (name of country)".

(3) In the case of consignments of gases liable to self-polymerization, such as methyl vinyl ether, vinyl chloride, vinyl bromide and ethylene oxide [8<sup>o</sup>(a)], the following must be certified in the transport document: "The necessary steps have been taken to prevent polymerization during carriage".

(4) In the case of consignments of articles of 16<sup>o</sup> and 17<sup>o</sup>, the sender shall certify as follows in the transport document: "The nature of the goods, the packing, and the packaging, are in conformity with the provisions of ADR".

(5) For tanks containing gases of 11<sup>o</sup>, the transport document shall bear one of the following entries, as appropriate:

"The tank is in permanent communication with the atmosphere"; and  
"The tank is closed by valves guaranteed to be incapable of opening before ..... (date agreed to by the carrier)".

## Class Id

(6) For tanks containing gases of 12° and 13°, the transport document shall bear the following entry: 2156 (contd)

"The tank is closed by valves guaranteed to be incapable of opening before ..... (date agreed to by the carrier)".

2157-  
2166

C. Empty packagings

(1) Receptacles and tanks of 18° shall be closed in the same manner as though they were full. 2167

(2) The description in the transport document must be: "Empty receptacle (or empty tank), Id. 18°, ADR (or RID)". This description must be underlined in red.

D. Transitional provisions

The following transitional provisions shall apply to such receptacles for compressed or liquefied gases or gases dissolved under pressure as are already in service at the time of the entry into force of this Annex: 2168

(a) receptacles are to be accepted for international carriage so long as the regulations of the contracting country in which tests identical with or similar to those laid down in marginal 2146 have been carried out so permit, and so long as intervals identical with or similar to those prescribed for the periodic inspections required by marginals 2146 (3) and 2147 are observed. However,

1. receptacles intended for the carriage of anhydrous hydrochloric acid (10°) are not to be accepted for carriage unless they conform to the provisions of ADR; and

## Class Id

2168  
(contd)

2. receptacles containing ammonia dissolved under pressure in water, of 14<sup>o</sup>(a), are not to be accepted for carriage unless they have been subjected to a test pressure of not less than 10 kg/cm<sup>2</sup> [see marginal 2151 (1)];
- (b) receptacles in conformity with marginal 2142 (1)(b) and (c) whose valves have attachment systems not in conformity with the provisions of marginal 2143 (1) may continue to be used until the date on which they are required to undergo the periodic inspection prescribed in marginal 2146 (3).

2169-  
2179

## CLASS Ie. SUBSTANCES WHICH GIVE OFF INFLAMMABLE GASES ON CONTACT WITH WATER

1. List of substances

Among the substances and articles covered by the heading of Class Ie, only those listed in marginal 2181 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR.

- 2180
- 1° (a) Alkali and alkaline-earth metals, e.g. sodium, potassium, calcium, as well as alkali metal alloys, alkaline-earth metal alloys and alloys of alkali and alkaline-earth metals;
- (b) alkali metal amalgams and alkaline-earth metal amalgams;
- (c) alkali metal dispersions.
- 2° (a) Calcium carbide and aluminium carbide;
- (b) alkali metal and alkaline-earth metal hydrides (e.g. lithium hydride, calcium hydride), mixed hydrides, and boron hydrides and aluminium hydrides of alkali metals and alkaline-earth metals;
- (c) alkali silicides;
- (d) calcium silicide, in powder, grains or lumps, containing more than 50% silicon, manganese calcium silicide (silico-manganese-calcium);
- (e) alloys of magnesium with manganese.
- 3° Amides of alkali metals and alkaline-earth metals, e.g. sodamide (sodium amide). See also marginal 2181a.
- Note: Calcium cyanamide is not subject to the provisions of ADR.
- 4° Trichlorosilane (silicochloroform).
- 5° Empty receptacles, uncleaned, and empty tanks, uncleaned, which have contained substances of Class Ie.

## Class Ie

2181a Sodamide ( $3^{\circ}$ ) in quantities not exceeding 200 g per package is not subject to the provisions for this Class contained in this Annex or in Annex B if it is packed in receptacles which are so closed as to be leak-proof and which cannot be attacked by the contents, and if these receptacles are packed with care in a strong, leak-proof wooden packaging with a leak-proof closure.

2. ProvisionsA. Packages1. General conditions of packing

2182 (1) Packagings shall be so closed and leak-proof as to prevent the ingress of moisture and any loss of the contents.

(2) The materials of which the receptacles and their closures are made must not be liable to attack by the contents or form harmful or dangerous compounds therewith. Receptacles must in all cases be free from moisture.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular, in the case of solids immersed in a liquid, receptacles and their closures must, unless the section headed "Packing of a single substance" provides otherwise, be able to withstand any pressure which, the presence of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage. Solid substances shall be firmly secured in their packagings, and inner packagings shall be firmly secured in outer packagings.

Unless otherwise specified in the section entitled "Packing of a single substance", inner packagings may be enclosed in outer packagings, either singly or in groups.

## Class Ie

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The thickness of the walls must in no case be less than 2 mm. 2182  
(contd)

The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage.

(5) Cushioning materials shall be suited to the nature of the contents.

2. Packing of a single substance

- (1) Substances of 1<sup>o</sup> shall be packed: 2183
- (a) in receptacles made of sheet-iron, lead-lined sheet-iron or tin-plate. For substances of 1<sup>o</sup>(b), however, receptacles made of lead-lined sheet-iron or of tin-plate are not to be accepted. These receptacles, with the exception of iron drums, must be placed in wooden packing cases or in protective iron hampers; or
- (b) not more than 1 kg per receptacle, in receptacles made of glass or stoneware. Not more than 5 of these receptacles shall be packed in a wooden packing case having a leak-proof lining of ordinary sheet-iron, lead-lined sheet-iron, or tin-plate, assembled by soldering. For glass receptacles containing quantities not exceeding 250 g, the lined wooden case may be replaced by an outer receptacle made of ordinary sheet-iron, lead-lined sheet-iron, or tin-plate. Glass receptacles shall be secured in the outer packagings by incombustible cushioning materials.

(2) If a substance of 1<sup>o</sup>(a) is not packed in a welded metal receptacle with a lid hermetically closed by soldering, then:

- (a) it must be completely covered by mineral oil whose flash-point is above 50°C, or be sufficiently sprinkled to ensure that the lumps are coated with this oil; or

## Class Ic

- 2183 (contd)
- (b) the air in the receptacle must be completely replaced by a protective gas (e.g. nitrogen) and the receptacle so closed as to be gas-tight; or
  - (c) the substance must be poured into the receptacle, which must be filled to the brim and so closed, after cooling, as to be gas-tight.
- (3) Iron receptacles must have sides not less than 1.25 mm thick. If, with their contents, they weigh more than 75 kg, they must be hard-soldered or welded. If they weigh more than 125 kg, they must in addition be fitted with end and rolling hoops or with rolling flanges.
- 2184
- (1) Substances of 2<sup>o</sup> shall be packed:
    - (a) in receptacles made of sheet-iron, lead-lined sheet-iron or tin-plate. For substances of 2<sup>o</sup>(b) and (c) a receptacle must not contain more than 10 kg. These receptacles, with the exception of iron drums, must be placed in wooden packing cases or in protective iron hampers; or
    - (b) not more than 1 kg per receptacle, in receptacles made of glass or stoneware or of a suitable plastics material. Not more than 5 of these receptacles shall be packed in a wooden packing case with a leak-proof lining of ordinary sheet-iron, lead-lined sheet-iron or tin-plate, assembled by soldering. For glass receptacles containing quantities not exceeding 250 g, the lined wooden case may be replaced by an outer receptacle made of ordinary sheet-iron, lead-lined sheet-iron or tin-plate. Glass receptacles shall be secured in the packing cases by incombustible cushioning materials.
  - (2) A package must not weigh more than 75 kg if it contains substances of 2<sup>o</sup>(b) or (c) and not more than 125 kg if it contains substances of 2<sup>o</sup>(d) or (e).
- 2185
- Amides (3<sup>o</sup>) shall be packed, not more than 10 kg per box or drum, in hermetically-closed metal boxes or drums, which shall be placed in wooden cases. A package must not weigh more than 75 kg.



## Class Ic

(1) Trichlorosinane (4<sup>o</sup>) must be packed in 2186  
receptacles made of corrosion-resistant steel and having a capacity not exceeding 500 litres. The receptacles must be hermetically closed; the closing device must be specially protected by a cap. The receptacles must be constructed as pressure vessels for a working pressure of 4 kg/cm<sup>2</sup> and be tested in conformity with the regulations governing pressure vessels in force in the country of departure. Receptacles with a capacity not exceeding 250 litres must have a wall thickness of not less than 2.5 mm, and those with a higher capacity a wall thickness of not less than 3 mm.

(2) If filling is based on weight, the degree of filling must not exceed 1.14 kg/l. If it is carried out by visual check, the degree of filling shall not exceed 84.5%.

3. Mixed packing

(1) The substances grouped under the same item 2187  
number may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be that laid down for the substances of the item number in question.

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance", substances of this Class, in quantities not exceeding 6 kg in the case of solids or 3 litres in the case of liquids for all of the substances listed under the same item number or the same letter, may be enclosed in the same package either with substances of another item number or of another letter of the same Class, or with dangerous substances belonging to other Classes (if mixed packing is likewise permitted in the case of such substances), or with other goods, subject to the following special conditions.

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions contained in marginals 2001(5) and 2002(6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

## Class Ie

2187  
(contd)Special conditions:

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1°(a)	Alkali and alkaline-earth metals (e.g. sodium, potassium, calcium, barium) - in fragile receptacles - in other receptacles	500 g 1 kg	500 g 1 kg	The limits of 500 g or 1 kg apply to alkali metals and alkaline-earth metals of 1°(a), and to alkali metal and alkaline-earth metal hydrides of 2°(b), in respect of the aggregate weight of these substances.
2°(a)	Calcium carbide	Mixed packing not allowed		Alkali metals and alkaline-earth metals, and substances of 2°(b), may not be packed together with acids, nor with liquids containing water.
2°(b)	Alkali metal and alkaline-earth metal hydrides (e.g. lithium hydride, calcium hydride), mixed hydrides, boron hydrides and aluminium hydrides - in fragile receptacles - in other receptacles	500 g 1 kg	500 g 1 kg	
4°	Trichlorosilane	Mixed packing not allowed		

4. Marking and danger labels on packages (see Appendix A.9)

2188

(1) Every package containing substances of Class Ie shall bear a label conforming to model No. 7.

(2) Every package containing trichlorosilane of 4° shall bear in addition a label conforming to model No. 2.

## Class Ia

- (3) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used. 2188 (contd)
- B. Particulars in the transport document 2189
- The description of the goods in the transport document must conform to one of the names underlined in marginal 2181. Where the name of the substance is not indicated in the case of 1<sup>o</sup>, the trade name must be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" /e.g. Ia 2<sup>o</sup> (a), ADR 2190-2197
- C. Empty packagings
- (1) Receptacles and tanks of 5<sup>o</sup> must be closed in same manner and be leak-proof in the same degree as though they were full. 2198
- (2) The description in the transport document must be: "Empty receptacle (or empty tank), Ia, 5<sup>o</sup>, ADR (or RID)". This description must be underlined in red. 2199



## CLASS II. SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION

1. List of substances

Among the substances and articles covered by the heading of Class II, 2200 only those listed in marginal 2201 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR.

- 1° White or yellow phosphorus. 2201
- 2° Compounds of phosphorus with alkali metals or alkaline-earth metals, e.g. sodium phosphide, calcium phosphide, strontium phosphide.  
Note: Compounds of phosphorus with the so-called heavy metals, such as iron, copper, tin, etc., but with the exception of zinc (zinc phosphide is a substance of Class IVa - see marginal 2401, 33°), are not subject to the provisions of ADR.
- 3° Zinc alkyls, magnesium alkyls, aluminium alkyls and aluminium diethyl chloride. See also marginal 2201a under (a).
- 4° Nitrocellulose-film waste, free from gelatine, in reels, sheets or strips.  
Note: Nitrocellulose-film waste free from gelatine is not to be accepted for carriage if it is dusty or includes dusty portions.
- 5° (a) Used rags and waste;  
 (b) Greasy or oily fabrics, wicks, cord or thread;  
 (c) The following greasy or oily substances: wool, hair (and horsehair), artificial wool, reclaimed wool (also called wool shoddy), cotton, recarded cotton, artificial fibres (rayon, etc.), silk, flax, hemp and jute, also in the form of spinning or weaving waste.  
 For (a), (b) and (c), see also marginal 2201a under (b).  
Note: Wetted substances of 5° (b) and (c) are not to be accepted for carriage.
- 6° (a) Dust and powder of aluminium or zinc and mixtures of dust or powder of aluminium and zinc, also when greasy or oily; powder of zirconium and titanium; dust from blast-furnace filters;

## Class II

2201  
(contd.)

- (b) Dust, powder and fine shavings of magnesium and of magnesium alloys with a magnesium content of more than 80%, all free from particles likely to promote ignition;
- (c) The following salts of dithionous (hydrosulphurous) acid ( $H_2S_2O_4$ ): dithionites (hydrosulphites) of sodium, potassium, calcium and zinc;
- (d) Metals in a pyrophoric form.

For (a), see also marginal 2201a under (b) and (c); for (b) and (c), see also marginal 2201a under (b).

7° Freshly calcined soot. See also marginal 2201a under (b).

8° Newly-quenched charcoal, powdered, granulated or in lumps.

See also marginal 2201a under (b) and Class IIIb, marginal 2331, 1°.

Note: By "newly-quenched charcoal" is meant:

in the case of charcoal in lumps, charcoal which has been quenched less than four days previously;

in the case of powdered charcoal and of granulated charcoal in a granule size of less than 8 mm, charcoal which has been quenched less than eight days previously and has been air-cooled in thin layers or by a process ensuring an equivalent degree of cooling.

9° Mixtures of granulated or porous combustible substances with constituents still liable to spontaneous oxidation, such as linseed oil or other natural drying oils, boiled or with added drying compounds, resin, resin oil, petroleum residues, etc. (e.g. the substance known as cork waste, lupuline), and oily residues from the bleaching of soya oil. See also marginal 2201a under (b) and Class IIIb, marginal 2331, 1°.

10° Paper, cardboard and products made of paper or cardboard (e.g. cardboard wrappings and cardboard rings), wood-fibre sheets, skeins of thread, fabrics, string, thread, spinning or weaving wastes, all impregnated with oils, greases, natural drying oils, boiled or with added drying compounds or other impregnating substances liable to spontaneous oxidation. See also marginal 2201a under (b) and Class IIIb, marginal 2331, 1°.

Note: Substances of 10° are not to be accepted for carriage if their humidity exceeds the hygroscopic humidity.

## Class II

- 11° The substance with an iron oxide base having been used for purifying lighting gas ( spent oxide of iron ). 2201 (contd)

Note: If the substance which has been used for purifying lighting gas (spent oxide of iron) is, after storage and aeration, no longer liable to spontaneous ignition, and if this is certified in the transport document by the entry: "Substance not liable to spontaneous ignition", it is not subject to the provisions of ADR.

- 12° Used yeast bags, uncleaned. See also marginal 2201a under (b).

- 13° Empty sodium nitrate bags made of a textile fabric.

Note: Textile bags from which all the nitrate impregnating them has been completely removed by washing are not subject to the provisions of ADR.

- 14° Empty iron drums, uncleaned, and empty tanks, uncleaned, which have contained phosphorus of 1°.

- 15° Empty receptacles, uncleaned, which have contained substances of 3°.

Note: re 14° and 15°: Empty packagings which have contained other substances of Class II are not subject to the provisions of ADR.

Dangerous substances handed over for carriage in conformity with the following provisions are subject neither to the provisions for this Class contained in this Annex nor to those contained in Annex B: 2201a

- (a) solutions of substances of 3° in a concentration not exceeding 10% in solvents with a boiling point not lower than 95°C, if their condition is such as to exclude any danger of spontaneous ignition and if this is certified in the transport document by the entry: "Substance not liable to spontaneous ignition"; see, however, Class IIIa;
- (b) substances of 5° - 10° and 12° (excluding, however, those of 6° (d)), if their condition is such as to exclude any danger of spontaneous ignition and if this is certified in the transport document by the entry: "Substance not liable to spontaneous ignition"; for the substances of 8° and certain substances of 9° and 10°, however, see Class IIb, marginal 2331, 1°;
- (c) dust and powder of aluminium or zinc [6° (a)], e.g. packed together with varnish for use in the manufacture of colours, if packed with care in quantities not exceeding 1 kg.

## Class II

2. ProvisionsA. Packages1. General conditions of packing

2202

(1) Packagings shall be so closed and arranged as to prevent any loss of the contents.

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents nor form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular, in the case of substances in the liquid state or immersed in a liquid or in solution, receptacles and their closures must, unless the section headed "Packing of a single substance or of articles of the same kind" provides otherwise, be able to withstand any pressure which, the pressure of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage. Solid substances shall be firmly secured in their packagings, and inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance or of articles of the same kind", inner packagings may be enclosed in outer packagings, either singly or in groups.

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The thickness of the walls must be not less than 3 mm in the case of receptacles which, with their contents, weigh more than 35 kg, and not less than 2 mm in the case of other receptacles.

The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage.



## Class II

(5) When receptacles made of glass, porcelain, stoneware or similar materials are prescribed or allowed, they must be secured by cushioning materials in protective packagings. 2202 (cont'd)

Cushioning materials shall be suited to the nature of the contents; in particular, they shall be dry and absorbent when the contents are liquid or might exude liquid.

2. Packing of a single substance or of articles of the same kind

(1) Phosphorus of 1<sup>o</sup> shall be packed: 2203

- (a) in leak-proof tin-plate receptacles hermetically closed and placed in wooden cases; or
- (b) in sheet-iron drums closing hermetically. Press-on lids shall not be allowed. The sheet-iron constituting the body, bottom and lid shall not be less than 1.5 mm thick. A package must not weigh more than 500 kg. If it weighs more than 100 kg, it shall be fitted with rolling hoops or strengthening ribs, and shall be welded; or
- (c) not more than 250 g per receptacle, in hermetically-closed glass receptacles secured by cushioning materials in leak-proof tin-plate receptacles closed by soldering and secured, likewise by cushioning materials, in wooden cases.

(2) Receptacles and drums containing phosphorus shall be filled with water.

(1) Substances of 2<sup>o</sup> shall be packed in leak-proof tin-plate receptacles hermetically closed and placed in wooden cases. 2204

(2) Substances of 2<sup>o</sup> may also be packed, not more than 2 kg per receptacle, in receptacles made of glass, porcelain, stoneware or similar materials, secured by cushioning materials in wooden cases.

(1) Substances of 3<sup>o</sup> shall be packed in receptacles made either of metal or of glass, porcelain, stoneware or similar materials, hermetically closed. Receptacles must not be filled beyond 90% of their capacity. 2205

## Class II

2205  
(contd)

(2) Metal receptacles shall be secured by cushioning materials in protective packagings which, if they are not closed, shall be covered. If the covering consists of readily-inflammable substances, it shall be rendered sufficiently fire-resistant to prevent its catching alight in contact with a flame. If the protective packaging is not closed, the package shall be fitted with means of handling and shall not weigh more than 75 kg.

(3) Receptacles made of glass, porcelain, stoneware or similar materials shall have a capacity of not more than 5 litres and shall be secured by cushioning materials in leak-proof sheet-metal receptacles hermetically closed.

(4) Substances of 3<sup>o</sup> may also be packed in hermetically-closed drums made of corrosion-resistant steel and having a capacity of not more than 300 litres and a wall thickness of not less than 3 mm. The drums must withstand a test pressure of 10 kg/cm<sup>2</sup> and satisfy the conditions of marginal 2141 (1) and (2)(b). The closure of the filling and emptying device must be ensured by a protective cap. Receptacles must not be filled beyond 90% of their capacity; however, with the liquid at a mean temperature of 50°C, a free space of 5% must remain for safety purposes. When handed over for carriage, the liquid must be under a layer of inert gas at a pressure not exceeding 0.5 kg/cm<sup>2</sup>. Receptacles shall be tested in conformity with the provisions of marginal 2146 (2) and (3). The tests shall be repeated every 5 years. The receptacles shall bear the following particulars in clearly legible and indelible characters:

1. the name of the substance in full, the name or mark of the maker or owner, and the number of the receptacle;
2. the tare of the receptacle, including fittings and accessories;
3. the test pressure, the date (month, year) of the last test undergone, and the stamp of the expert who carried out the tests and inspections;
4. the capacity of the receptacle and the maximum filling allowed;
5. the wording: "Do not open during carriage; liable to spontaneous ignition".

A package must not weigh more than 400 kg.

## Class II

(1) Substances of 4<sup>o</sup> shall be packed in bags placed in drums made of 2206 impermeable fibreboard or in receptacles made of zinc sheet or aluminium sheet.

The sides of metal receptacles shall be lined with fibreboard. The bottoms and lids of fibreboard drums and metal receptacles shall be lined with wood.

(2) Metal receptacles shall be fitted with closures or safety devices yielding when the internal pressure reaches a value not greater than 3 kg/cm<sup>2</sup>; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure.

(3) A package must not weigh more than 75 kg.

(1) Substances of 5<sup>o</sup> (a) shall be tightly compressed and be placed 2207 in leak-proof metal receptacles.

(2) Substances of 5<sup>o</sup> (b) and (c) shall be tightly compressed and be packed either in wooden or fibreboard cases or in paper or textile wrappings firmly secured.

(1) Substances of 6<sup>o</sup> (a) shall be enclosed in tightly-closing leak- 2208 proof receptacles made of wood or metal. However, zirconium shall be enclosed only in metal or glass receptacles, which shall be secured by cushioning materials in strong wooden cases. If the cushioning materials are inflammable, they shall be fireproofed.

(2) Substances of 6<sup>o</sup> (b) shall be enclosed in tightly-closing leak-proof iron drums or in wooden cases with a sheet-metal lining rendered leak-proof (by soldering, for example) or in boxes made of tin-plate or thin aluminium sheet and so closing as to be leak-proof; these drums, cases or boxes shall be placed in wooden cases. For substances of 6<sup>o</sup> (b) handed over individually for carriage in boxes made of tin-plate or aluminium sheet, a wrapping of corrugated fibreboard will suffice instead of a wooden case; a package of this nature must not weigh more than 12 kg.

(3) Substances of 6<sup>o</sup> (c) shall be packed in air-tight sheet-metal receptacles or air-tight iron drums. In the case of sheet-metal receptacles, a package must not weigh more than 50 kg.

## Class II

2208  
(contd)

(4) Substances of 6<sup>o</sup>(d) shall be packed in receptacles made of metal, glass or a suitable plastics material and so closing as to be gas-tight. The stoppers used for closure shall be held in position by an additional device (such as a cap, crown, seal or binding) capable of preventing any loosening during carriage. The substances shall be dispatched under a protective liquid (such as methanol) or a protective gas.

Metal receptacles shall be placed in a wooden packing case. A package must not weigh more than 50 kg.

Glass receptacles shall be secured by cushioning materials in fibreboard or metal packagings; the cushioning materials must be incombustible. Receptacles made of a plastics material shall be placed in fibreboard or metal packagings. Packagings containing receptacles made of glass or a plastics material shall be placed in a wooden packing case. A package must not weigh more than 25 kg.

2209

Substances of 7<sup>o</sup> - 10<sup>o</sup> and 12<sup>o</sup> shall be enclosed in tightly-closing packages. Wooden packagings used for substances of 7<sup>o</sup> and 8<sup>o</sup> shall be provided with a leak-proof lining.

2210

The substance having been used for purifying lighting gas (spent oxide of iron) (11<sup>o</sup>) shall be packed in tightly-closing sheet-metal receptacles.

2211

Empty sodium nitrate bags (13<sup>o</sup>) shall be made up into tightly-packed bundles securely fastened with string and placed either in a wooden case or in a wrapping consisting either of several thicknesses of stout paper or of waterproofed fabric.

3. Mixed packing

2212

(1) Substances grouped under the same item number may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be that laid down for the substances of the item number in question.

## Class II

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance or of articles of the same kind", substances of this Class, in quantities not exceeding 6 kg in the case of solids or 3 litres in the case of liquids for all of the substances listed under the same item number or the same letter, may be enclosed in the same package either with substances of another item number or of another letter of the same Class, or with dangerous substances belonging to other Classes (if mixed packing is likewise allowed in the case of such substances), or with other goods, subject to the following special conditions.

2212  
(contd)

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions of marginals 2001 (5) and 2002 (6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

Special conditions:

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1 <sup>o</sup> 2 <sup>o</sup> 3 <sup>o</sup>	White or yellow phosphorus Phosphides Zinc alkyls, etc.	Mixed packing not allowed		
6 <sup>o</sup> (a) (b) and (d)	Dust and powder of aluminium or zinc Dust, powder and fine shavings of magnesium Metals in a pyrophoric form	3 kg	3 kg	Must not be packed together with weakly-nitrated nitrocellulose and red phosphorus of Class IIIb, nor with bifluorides
4 <sup>o</sup> , 5 <sup>o</sup> 6 <sup>o</sup> (c) 7 <sup>o</sup> - 12 <sup>o</sup>	All substances			

4. Marking and danger labels on packages (See Appendix A.9)

(1) Every package containing substances of 1<sup>o</sup> - 4<sup>o</sup> and 6<sup>o</sup> shall bear a label conforming to model No. 2. 2213

## Class II

2213  
(contd)

(2) Drums containing phosphorus of 1<sup>o</sup> and having a screw-cap lid shall, unless they are fitted with a device maintaining them upright, bear in addition, high up in two diametrically opposite places, two labels conforming to model No. 8.

(3) Packages containing fragile receptacles not visible from the outside shall bear labels conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.

(4) In the case of consignments carried as a complete load, label No. 2, as prescribed under (1), need not be affixed to the packages if the vehicle bears the marking prescribed in Annex B, marginal 10 500.

2214

2215

B. Particulars in the transport document

The description of the goods in the transport document must conform to one of the names underlined in marginal 2201. Where the name of the substance is not indicated in the case of 2<sup>o</sup>, 3<sup>o</sup>, 9<sup>o</sup> and 10<sup>o</sup>, the trade name must be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. II, 5<sup>o</sup> (a), ADR].

2216 -

2222

2223

C. Empty packagings

(1) Receptacles and tanks of 14<sup>o</sup> and receptacles of 15<sup>o</sup> must be closed in the same manner and leak-proof in the same degree as though they were full.

(2) The description in the transport document must be: "Empty receptacle (or empty tank), II, 14<sup>o</sup> (or 15<sup>o</sup>), ADR (or RID)". This description must be underlined in red.

2224 -

2299

## CLASS IIIa. INFLAMMABLE LIQUIDS

1. List of substances

(1) Among the inflammable liquids and mixtures thereof, whether liquid or still pasty at a temperature not exceeding 15°C, the substances listed in marginal 2301 are subject to the provisions of this Annex and of Annex B. These substances to be accepted for carriage under certain conditions are to be considered as substances of ADR. 2300

(2) Inflammable liquids which at a temperature of 50°C have a vapour pressure not exceeding 3 kg/cm<sup>2</sup>, except those listed in other Classes, are deemed to be inflammable liquids within the meaning of ADR.

(3) Liquids of Class IIIa which are liable to form peroxides easily (as happens with ethers or with certain heterocyclic oxygenated substances) are not to be handed over for carriage unless their peroxide content, reckoned as hydrogen peroxide H<sub>2</sub>O<sub>2</sub>, does not exceed 0.3%.

(4) The peroxide content referred to above and the flash-point referred to below shall be determined as shown in Appendix A.3 (marginals 3300 - 3303).

(5) Substances of Class IIIa which polymerize easily are to be accepted for carriage only if the necessary precautions have been taken to prevent their polymerization during carriage.

(6) Solid substances soluble in liquids shall be deemed to include driers, fixed oils (boiled or blown linseed oils, etc.) or similar substances (nitrocellulose excepted) whose flash-point is above 100°C.

1° (a) Liquids not miscible, or only partially miscible, with water which have a flash-point below 21°C, also when they contain not more than 30% solids (nitrocellulose excepted) either dissolved, or held in suspension in the liquids, or both, e.g. crude petroleums and other crude oils; volatile products from the distillation of petroleum and of other crude oils or of coal, lignite, shale, wood and peat tars, e.g.: petroleum ether, pentanes, benzine, benzol and toluene; condensation products of natural gas; ethyl acetate (acetic ester), vinyl acetate, diethyl ether (sulphuric ether), methyl formate and other ethers 2301

## Class IIIa

2301  
(contd)'

and esters; carbon disulphide; acrylaldehyde (acrolein); certain chlorinated hydrocarbons /e.g. 1,2-dichloroethane and chloroprene (chlorobutadiene)7;

- (b) mixtures of liquids having a flash-point below 21°C and containing not more than 55% nitrocellulose with a nitrogen content not exceeding 12.6% (collodions, semi-collodions and other nitro-cellulose solutions).

For (a), see also marginal 2301a under (a), (b) and (d); for (b), see also marginal 2301a, under (a).

Note: For mixtures of liquids having a flash-point below 21°C and

- containing more than 55% nitrocellulose, whatever its nitrogen content, or

- containing not more than 55% nitrocellulose with a nitrogen content above 12.6%,

see Class Ia, marginal 2021, 1°, and Class IIb, marginal 2331, 7°(a).

- 2° Liquids not miscible, or only partially miscible, with water which have a flash-point below 21°C and contain more than 30% solids (nitrocellulose excepted) either dissolved, or held in suspension in the liquids, or both, e.g.: certain colours for rotogravures and for leathers, certain varnishes, certain enamel paints, and rubber solutions. See also marginal 2301a, under (c).
- 3° Liquids not miscible, or only partially miscible, with water which have a flash-point between 21°C and 55°C inclusive, also when they contain not more than 30% solids either dissolved, or held in suspension in the liquids, or both, e.g.: turpentine; semi-heavy products from the distillation of petroleum and of other crude oils, or of coal, lignite, shale, wood and peat tars, e.g. white spirit (turpentine substitute), heavy benzols, petroleum oils (for lighting, heating or engines), xylene, styrene, cumene, solvent naphtha; butanol; butyl acetate; pentyl acetate (amyl acetate); nitromethane (mononitromethane) and certain mononitro-paraffins; certain chlorinated hydrocarbons (e.g. chlorobenzene). See also marginal 2301a, under (c) and (d).



## Class IIIa

- 4° Liquids not miscible, or only partially miscible, with water which have a flash-point above 55°C but not exceeding 100°C, also when they contain not more than 30% solids either dissolved, or held in suspension in the liquids, or both, e.g.: certain tars and their distillation products: heating oils, diesel oils, certain gas oils; tetrahydronaphthalene (tetralin); nitrobenzene; certain chlorinated hydrocarbons (e.g. 1-chloro-2-ethylhexane). See also marginal 2301a, under (c) and (d). 2301 (contd)
- 5° Liquids miscible in all proportions with water which have a flash-point below 21°C, also when they contain not more than 30% solids either dissolved, or held in suspension in the liquids, or both, e.g.: methanol (methyl alcohol, wood spirit), denatured or not; ethanol (ethyl alcohol, ordinary alcohol), denatured or not; acetaldehyde; acetone and acetone mixtures; pyridine. See also marginal 2301a, under (a) and (c).
- 6° Empty receptacles, uncleaned, and empty tanks, uncleaned, which have contained inflammable liquids of Class IIIa.

Substances handed over for carriage in conformity with the following provisions are subject neither to the provisions for this Class contained in this Annex nor to those contained in Annex B: 2301a

- (a) liquids of 1° (except those mentioned under (b) below), and acetone and acetone mixtures (5°): in quantities not exceeding 200 g per receptacle, in receptacles made of sheet-metal, glass, porcelain, stoneware or a suitable plastics material, these receptacles, with a total content not exceeding 1 kg, being placed together in an outer packaging made of sheet-metal, wood or fibreboard and fragile receptacles being suitably secured in the packaging to prevent their breakage;
- (b) carbon disulphide, diethyl ether, petroleum ether, pentanes, methyl formate: 50 g per receptacle and 250 g per package, these substances being packed in the same way as those of (a);

## Class IIIa

- 2301a (contd)
- (c) liquids of 2° - 5°, except acetaldehyde, acetone and acetone mixtures: 1 kg per receptacle and 10 kg per package, these substances being packed in the same way as those of (a);
  - (d) the motor-fuel contained in the tanks of motor-driven vehicles or in closed auxiliary tanks firmly fixed to the vehicles. If there is a cock between the tank and the engine it must be closed; the electric circuit must also be disconnected. Motor cycles and motor-assisted pedal cycles whose tanks contain motor-fuel must be loaded upright on their wheels, secured against falling.

2. ProvisionsA. Packages1. General conditions of packing

- 2302
- (1) Receptacles shall be so closed and leak-proof as to prevent any loss of the contents, and particularly any evaporation.
  - (2) The materials of which the receptacles and their closures are made must not be liable to attack by the contents nor form harmful or dangerous compounds therewith.
  - (3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular, receptacles and their closures must, unless the section headed "Packing of a single substance" provides otherwise, be able to withstand any pressure which, the presence of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage (see also marginal 2305). Inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance", inner packagings may be enclosed in outer packagings, either singly or in groups.

## Class IIIa

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The walls must be not less than 3 mm thick in the case of receptacles weighing, with their contents, more than 35 kg and not less than 2 mm in the case of other receptacles.

2302  
(contd)

The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage.

(5) Cushioning materials shall be suited to the nature of the contents and, in particular, shall be absorbent. Suitable materials must be used to secure receptacles in the protective packaging; this securing must be carried out with care and be checked periodically (possibly before each fresh filling of the receptacle).

2. Packing of a single substance

(1) Substances of 1<sup>o</sup> - 5<sup>o</sup> must be packed in suitable receptacles made of metal or of glass, porcelain, stoneware or similar materials. Substances of 4<sup>o</sup> and corrosive liquids of 1<sup>o</sup>(a), 3<sup>o</sup> and 5<sup>o</sup> may also be packed in receptacles made of a suitable plastics material. [For the special provisions concerning chloroprene and nitromethane, see under (8) and (9), respectively, below.] 2303

(2) Fragile receptacles (glass, porcelain, stoneware or similar materials) may not contain more than the following quantities of substances of 1<sup>o</sup>:

carbon disulphide .....	1 litre;
diethyl ether, petroleum ether, pentanes .....	2 litres;
other substances of 1 <sup>o</sup> .....	5 litres.

(3) Tin-plate receptacles having a capacity not exceeding 10 litres must have a wall thickness of not less than 0.25 mm; those having a capacity exceeding 10 litres but not exceeding 60 litres must have a wall thickness of not less than 0.3 mm and their joints shall be double-seamed by wetting, or soldered, or produced by a process ensuring a similar degree of strength and tightness.

## Class IIIa

2303  
(contd)

(4) Receptacles made of sheet-steel /For tin-plate receptacles having a capacity not exceeding 60 litres, see also (3)] must be welded or hard-soldered, and the quantities of substances of 1<sup>o</sup> - 5<sup>o</sup> they may contain, according to the thickness of their walls, are as follows:

if the wall thickness is not less than 0.5 mm: not more than 30 litres;

if the wall thickness is not less than 0.7 mm: not more than 60 litres;

if the wall thickness is not less than 1.5 mm: over 60 litres.

Packages weighing more than 100 kg shall be fitted with rolling hoops.

(5) Receptacles made of sheet-metal other than steel must be designed and manufactured in such a way that they possess the same strength as the sheet-steel receptacles referred to under (4).

(6) Liquids whose vapour pressure at 50°C does not exceed 1.5 kg/cm<sup>2</sup>, with the exception of carbon disulphide, may also be carried in metal drums complying with the following provisions:

The body joints of the drums must be welded and the end joints welded or double-seamed by welting. The drums must be fitted with rolling hoops or strengthening ribs. When immersed in water, they must remain leak-proof at a manometric pressure of 0.2 kg/cm<sup>2</sup> at least. They must be of a type of construction which has withstood a test carried out by an approved body in conformity with appendix A.5, marginals 3500 - 3503, and must bear the mark given at the time of the test.

(7) For the carriage in non-returnable metal packagings (new packagings intended to be used only once) of inflammable products whose vapour pressure at 50°C does not exceed 1.1 kg/cm<sup>2</sup> it is not necessary, in the case of a package whose unit weight must not exceed 225 kg, for the end of the receptacle to be welded to the body and for the wall thickness to be greater than 1.25 mm, but the receptacle must be able to withstand, without

## Class IIIa

leakage, a hydraulic pressure of 0.3 kg/cm<sup>2</sup> at least, and its body and ends must be equipped with devices (such as ribs or rolling hoops), whether detachable or not, ensuring rigidity.

2303  
(contd)

(8) Chloroprene [1° (a)] shall be packed:

- (a) in hermetically-closed metal receptacles, suitably lined if necessary, having a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or other outer packaging of adequate strength; or
- (b) in sheet-steel canisters, welded or hard-soldered, having a capacity not exceeding 60 litres, hermetically closed and fitted with means of handling.

(9) Nitromethane (3°) must be contained:

- (a) in fragile receptacles containing not more than 1 litre; or
- (b) in sheet-steel receptacles in conformity with (4) above having a capacity not exceeding 10 litres; or
- (c) in metal drums each having two hermetic closures, one of them screw-threaded, each drum being fitted with rolling hoops and having a capacity not exceeding 200 litres.

(1) Fragile receptacles containing substances of 1° to 5°, receptacles made of a plastics material and containing corrosive liquids of 1°(a), 3° and 5°, tin-plate receptacles containing substances of 1° and 5°, tin-plate receptacles having a wall thickness of less than 0.5 mm and containing substances of 2° - 4°, and sheet-steel receptacles containing nitromethane in conformity with marginal 2303 (9) (b), shall be secured by cushioning materials in protective packagings. If receptacles made of a plastics material are secured separately in protective packagings, cushioning materials are not necessary.

2304

Protective packagings enclosing fragile receptacles containing substances of 1° and 5° and protective packagings enclosing receptacles containing nitromethane (3°) must have complete sides and be made of wood, sheet-metal or a similar material.

## Class IIIa

2304  
(contd)

The closures of fragile receptacles placed in open protective packagings must be provided with a protective cover shielding them from damage. If the packages are to be loaded on an open vehicle, the protective cover must be incapable of igniting on contact with a flame.

(2) The following are to be accepted for carriage without protective packaging:

- (a) receptacles made of a plastics material in conformity with marginal 2304 (1), containing substances of 4<sup>o</sup>;
- (b) receptacles made of tin-plate not less than 0.5 mm thick, containing substances of 2<sup>o</sup> - 4<sup>o</sup>;
- (c) sheet-metal receptacles in conformity with marginal 2303 (4) to (7);
- (d) metal canisters in conformity with marginal 2303 (8) (b) containing chloroprene [1<sup>o</sup> (a)];
- (e) metal drums in conformity with marginal 2303 (9) (c) containing nitromethane (3<sup>o</sup>).

(3) The following packages must not exceed the maximum weights indicated below:

- (a) packages of fragile receptacles containing substances of 1<sup>o</sup> ..... 30 kg;
- (b) packages of fragile receptacles containing substances of 2<sup>o</sup> - 5<sup>o</sup> ..... 75 kg;
- (c) packages of receptacles made of a plastics material and containing substances of 1<sup>o</sup>(a) and 3<sup>o</sup> - 5<sup>o</sup>, and of tin-plate receptacles containing substances of 1<sup>o</sup> - 5<sup>o</sup> ..... 75 kg;
- (d) packages of receptacles containing chloroprene in conformity with marginal 2303 (8) ..... 75 kg;
- (e) packages of sheet-steel receptacles containing nitromethane in conformity with marginal 2303 (9) (b) ..... 75 kg;
- (f) drums tested in conformity with marginal 2303 (6) ..... 250 kg;
- (g) receptacles in conformity with marginal 2303 (7) ..... 225 kg;
- (h) drums containing nitromethane in conformity with marginal 2303 (9) (c) ..... 275 kg;

## Class IIIa

(4) Packages other than cases and metal drums shall be fitted with means of handling. 2304 (contd)

Metal receptacles intended to contain liquids of 1<sup>o</sup>, nitromethane (3<sup>o</sup>), or acetaldehyde, acetone, or acetone mixtures (5<sup>o</sup>), shall not be filled beyond 93% of their capacity. Nevertheless, receptacles containing hydrocarbons other than petroleum ether, pentanes, benzene and toluene may be filled to 95% of their capacity. 2305

3. Mixed packing

(1) Substances grouped under the same item number may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be that laid down for the substances of the item number in question. 2306

(2) If smaller quantities are not prescribed in the section entitled "packing of a single substance", substances of this Class may be enclosed in the same package either with dangerous substances of other Classes (if mixed packing is likewise permitted in the case of such substances) or with other goods, as indicated below.

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions contained in marginals 2001 (5) and 2002 (6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

## Class IIIa

2306  
(contd)

Item no.	Description of substances	Maximum quantity			Special provisions
		per fragile receptacle	per other receptacle	per package	
1 <sup>o</sup> (a)	Carbon disulphide	0.3 litre	1 litre	1 litre	Liquids of Class IIIa must not be packed together with substances of Class II, hydrogen peroxide or perchloric acid of Class IIIC, or substances of Class V, 2 <sup>o</sup> (a), 3 <sup>o</sup> (a), 4 <sup>o</sup> , 7 <sup>o</sup> and 41 <sup>o</sup> .
1 <sup>o</sup> (a) and 1 <sup>o</sup> (b)	All substances except carbon disulphide	1 litre	5 litres	5 litres	
2 <sup>o</sup>	All substances	1 litre	5 litres	10 litres	
3 <sup>o</sup>	All substances	3 litres	5 litres	10 litres	
4 <sup>o</sup>	All substances	5 litres	5 litres	10 litres	
5 <sup>o</sup>	Liquids having a boiling point $\leq 50^{\circ}\text{C}$	1 litre	5 litres	5 litres	
	Other substances	3 litres	5 litres	10 litres	

4. Marking and danger labels on packages (see Appendix A.9)

2307

(1) Every package containing liquids of 1<sup>o</sup> and 2<sup>o</sup>, or acetaldehyde, acetone, or acetone mixtures (5<sup>o</sup>) shall bear a label conforming to model No. 2. In addition, every package containing acrylaldehyde or chloroprene (chlorobutadiene) [1<sup>o</sup>(a)] shall bear a label conforming to model No. 4.

(2) Packages containing methyl alcohol (5<sup>o</sup>) shall bear a label conforming to model No. 4.

(3) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.



## Class IIIa

(4) In the case of consignments carried as a complete load, labels Nos. 2 and 4, as prescribed under (1) and (2), need not be affixed to the packages if the vehicle bears the marking prescribed in Annex B, marginal 10 500. 2307 (contd)

2308

B. Particulars in the transport document

(1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2301. If the latter does not contain the name of the substance, the trade name shall be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. IIIa, 1<sup>o</sup>(a), ADR]. 2309

(2) In the case of all consignments of substances which polymerize easily, the following must be certified in the transport document: "The necessary steps have been taken to prevent polymerization during carriage".

2310  
2315C. Empty packagings

(1) Receptacles and tanks of 6<sup>o</sup> must be closed in the same manner and leak-proof in the same degree as though they were full. 2316

(2) The description in the transport document must be: "Empty receptacle (or empty tank), IIIa, 6<sup>o</sup> ADR (or RID)". This description must be underlined in red.

(3) Receptacles of 6<sup>o</sup> which have contained methyl alcohol (5<sup>o</sup>) shall bear a label conforming to model No. 4 (see Appendix A.9).

2317  
2329



## CLASS IIIb. INFLAMMABLE SOLIDS

1. List of substances

Among the substances covered by the heading of Class IIIb, those listed in marginal 2331 are subject to the provisions of this Annex and of Annex B. These substances to be accepted for carriage under certain conditions are to be considered as substances of ADR. 2330

1° Substances which can easily be ignited by sparks, such as wood flour, sawdust, wood shavings, wood fibre, wood charcoal, wood parings and wood cellulose, old paper and waste paper, paper fibres, cane (except Spanish broom), reeds, hay, straw, also when damp (including maize, rice and flax straw), vegetable textile substances and waste of vegetable textile substances, cork in powder or granular form, expanded or not, with or without an admixture of tar or of other substances not subject to spontaneous oxidation, and cork waste in small lumps. See also Class II, marginal 2201, 8° - 10°, and marginal 2201a, under (b). 2331

Note: 1. These substances are included in the list only for the purposes of the prohibitions on mixed loading. For this purpose the provisions of marginal 2346 (1) apply. No other clause, either of this Annex or of Annex B, is applicable to them.

2. Hay still having a degree of humidity which might lead to fermentation is not to be accepted for carriage.

3. Wrappings and slabs of expanded cork, manufactured under pressure, with or without an admixture of tar or of other substances not subject to spontaneous oxidation, are not subject to any of the provisions of ADR.

4. Cork impregnated with substances still subject to spontaneous oxidation is a substance of Class II (see marginal 2201, 9°).

2° (a) Sulphur (including flowers of sulphur);

(b) Sulphur in the molten state.

3° Celloidin, produced by incomplete evaporation of the alcohol contained in collodien and consisting mainly of collodion cotton.

4° Celluloid in slabs, sheets, rods or tubes, and fabrics coated with nitrocellulose.

## Class IIIB

2331  
(contd)

5° Film celluloid, i.e. the raw material for films, without emulsion, in rolls, and developed celluloid films.

6° Celluloid waste and celluloid-film waste.

Note: Nitrocellulose-film waste, free from gelatine, in reels, sheets or strips, is a substance of Class II (see marginal 2201, 4°).

7° (a) Weakly nitrated nitrocellulose (such as colloidion cotton), i.e. with a nitrogen content not exceeding 12.6%, well stabilized and containing in addition not less than 25% water or alcohol (methyl, ethyl, normal propyl or isopropyl, butyl or amyl alcohol, or mixtures thereof), also if denatured, solvent naphtha, benzol, toluene, xylene, mixtures of denatured alcohol and xylene, mixtures of water and alcohol, or alcohol containing camphor in solution;

Note: 1. Nitrocellulose with a nitrogen content exceeding 12.6% is a substance of Class Ia (see marginal 2021, 1°).

2. When the nitrocellulose is wetted with denatured alcohol, the denaturing substance must not have a detrimental effect on the stability of the nitrocellulose.

(b) Plasticized nitrocellulose, non-pigmented, containing not less than 18% plasticizer (butyl phthalate or a plasticizer at least equivalent in effect) and in which the nitrocellulose has a nitrogen content not exceeding 12.6%; the nitrocellulose may be in the form of chips;

Note: Plasticized nitrocellulose, non-pigmented, containing not less than 12% and less than 18% butyl phthalate or a plasticizer at least equivalent in effect is a substance of Class Ia (see marginal 2021, 4°).

(c) Plasticized nitrocellulose, pigmented, containing not less than 18% plasticizer (butyl phthalate or a plasticizer at least equivalent in effect), in which the nitrocellulose has a nitrogen content not exceeding 12.6% and which contains not less than 40% nitrocellulose; the nitrocellulose may be in the form of chips.

Note: Plasticized nitrocellulose, pigmented, containing less than 40% nitrocellulose is not subject to the provisions of ADR.

## Class IIIb

For (a), (b) and (c): weakly-nitrated nitrocellulose and plasticized nitrocellulose, pigmented or not, are not to be accepted for carriage unless they satisfy the stability and safety conditions of Appendix A.1 or the conditions set forth above regarding the nature and quantity of the additional substances.

2331  
(contd)

For (a), see also Appendix A.1, marginal 3101; for (b) and (c), see also Appendix A.1, marginal 3102, 1.

- 8° Red phosphorus (amorphous), phosphorus sesquisulphide and phosphorus pentasulphide.

Note: Phosphorus pentasulphide not free from white or yellow phosphorus is not to be accepted for carriage.

- 9° Ground rubber, rubber dust.

- 10° Dust of coal, lignite, lignite coke and peat, artificially prepared (e.g. by pulverization or other processes), and coke from carbonized lignite rendered inert (i.e. not liable to spontaneous ignition).

Note: 1. Natural dusts obtained as residues in the production of coal, coke, lignite or peat are not subject to the provisions of ADR.

2. Coke from carbonized lignite not rendered completely inert is not to be accepted for carriage.

- 11° (a) Crude naphthalene with a melting point below 75°C;  
(b) Pure naphthalene and crude naphthalene with a melting point of 75°C or over;  
(c) Naphthalene in the melted state.

For (a) and (b), see also marginal 2331a.

Naphthalene in balls or flakes [11° (a) and (b)] is subject neither to the provisions for this Class contained in this Annex nor to those contained in Annex B if it is packed, not more than 1 kg per box, in tightly-closed fibreboard or wooden boxes and these boxes are enclosed, not more than 10 per case, in wooden cases. 2331a

## Class IIIb

2. ProvisionsA. Packages1. General conditions of packing

2332 (1) Packagings shall be so closed and arranged as to prevent any loss of the contents.

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents or form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. Solid substances shall be firmly secured in their packagings, and inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance", inner packagings may be enclosed in outer packagings, either singly or in groups.

(4) Cushioning materials shall be suited to the nature of the contents; in particular, they must be absorbent when the contents are liquid or might exude liquid.

2. Packing of a single substance

2333 (1) Sulphur of 2° (a) shall be packed in stout bags made of paper or of closely-woven jute.

(2) Sulphur in the melted state, of 2° (b), may not be carried otherwise than in tanks.

2334 Celloidin (3°) shall be so packed as to prevent its desiccation.

2335 (1) Celluloid in slabs, sheets, rods or tubes, and fabrics coated with nitrocellulose, (4°), shall be enclosed:

(a) in firmly-closed wooden packagings, or

(b) in strong paper wrappings which shall be placed

1. in crates; or

2. between frames made of boards, the edges of the frames extending beyond the paper wrapping and the frames being bound together with iron bands; or

3. in wrappings of closely-woven fabric.

## Clas: IIIB

(2) A package must not weigh more than: 2335  
(contd)  
75 kg in the case of celluloid in slabs, sheets or tubes and of fabrics coated with nitrocellulose, if the outer packaging is made of fabric in conformity with (1) (b) 3;

120 kg in all other cases.

Film celluloid in rolls and developed celluloid films (5°) 2336  
shall be enclosed in wooden packagings or in fibreboard boxes.

(1) Celluloid waste and celluloid-film waste (6°) shall be 2337  
enclosed in wooden packagings or in two strong bags made of closely-woven jute, the bags being fireproofed so as not to ignite even on contact with a flame and having strong and continuous seams. These bags shall be placed one inside the other; after filling, their openings shall be separately and several times folded over and closely stitched so as to prevent any escape of the contents. However, celluloid waste may be packed in a single bag if the celluloid waste is first packed in strong packing paper or in a suitable plastics material and it is certified in the transport document that the celluloid waste does not contain any waste in the form of dust.

(2) Packages having a raw-canvas or jute packaging must not weigh more than 40 kg in single packaging nor more than 80 kg in double packaging.

(3) For the particulars in the transport document, see marginal 2346 (2).

(1) Substances of 7° (a) shall be packed: 2338  
(a) in wooden receptacles or in drums made of impermeable fibreboard; these receptacles and drums shall have a lining impermeable to the liquids they contain; their closures must be leak-proof; or  
(b) in bags impermeable to the vapours from the liquids they contain (e.g. bags made of rubber or of a suitable plastics material not readily inflammable), placed in a wooden case or in a metal receptacle; or  
(c) in zinc-lined or lead-lined iron drums; or

## Class IIb

2338  
(contd)

(d) in receptacles made of tin-plate, zinc sheet or aluminium sheet and secured by cushioning materials in wooden cases.

(2) Nitrocellulose of 7° (c), if wetted exclusively with water, may be packed in fibreboard drums; this fibreboard must have undergone a special treatment to render it completely impermeable; the closures of the drums shall be water-vapour proof.

(3) Nitrocellulose of 7° (a), with added xylone, may not be packed otherwise than in metal receptacles.

(4) Substances of 7° (b) and (c) shall be packed:

- (a) in wooden packagings lined with stout paper or zinc sheet or aluminium sheet; or
- (b) in strong fibreboard drums or, provided that the substances are dust-free and that this is certified in the transport document, in fibreboard cases which have been rendered impermeable; or
- (c) in sheet-metal packagings.

(5) For substances of 7°, metal receptacles must be so constructed that, by reason of the method of assembly of their walls, of their mode of closure, or of the presence of a safety device, they yield when the internal pressure reaches a value not greater than  $3 \text{ kg/cm}^2$ ; the presence of these closures or safety devices must not impair the strength of the receptacle nor impair its closure.

(6) A package must not weigh more than 75 kg or, if it can be rolled, not more than 300 kg; however, a fibreboard drum must not weigh more than 75 kg and a fibreboard case not more than 35 kg.

(7) For the particulars in the transport document, see marginal 2346 (3).

2339

(1) Red phosphorus and phosphorus pentasulphide (8°) shall be packed:

- (a) in receptacles made of sheet iron or tin-plate, which shall be placed in a strong wooden case; a package must not weigh more than 100 kg; or
- (b) in receptacles made of glass or stoneware not less than 3 mm thick, or of a suitable plastics material, each containing not more than 12.5 kg



## Class IIIB

- of substance. These receptacles shall be secured with cushioning materials in a strong wooden case; a package must not weigh more than 100 kg; or
- (c) in metal receptacles which, if with their contents they weigh more than 200 kg, shall be fitted with reinforcing hoops at their ends, and with rolling hoops.
- (2) Phosphorus sesquisulphide (8°) shall be packed in leak-proof metal receptacles, which shall be secured by cushioning materials in wooden cases with closely-fitting sides. A package must not weigh more than 75 kg.
- Substances of 9° shall be packed in firmly-closing leak-proof receptacles. 2340
- (1) Substances of 10° shall be packed in metal or wooden receptacles or in strong bags. 2341
- (2) Wooden receptacles and bags are not, however, to be accepted for coal dust, lignite dust or peat dust artificially prepared unless the dust has been completely cooled after drying by heat.
- (3) For the particulars in the transport document, see marginal 2346 (4).
- (1) Naphthalene of 11° (a) shall be packed in firmly-closed wooden or metal receptacles. 2342
- (2) Naphthalene of 11° (b) shall be packed in wooden or metal receptacles, or in stout fibreboard cases, or in strong bags made of textile or of four-ply paper or of a suitable plastics material.
- Where fibreboard cases are used, a package must not weigh more than 30 kg.
- (3) Naphthalene in the melted state [11° (c)] must not be carried otherwise than in tanks.
3. Mixed packing
- (1) Substances grouped under the same item number may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be 2343

2339  
(contd)

## Class IIIb

2343 that laid down for the substances of the item number in question. A  
(contd) package containing celluloid rods and tubes packed together in a textile wrapping must not weigh more than 75 kg.

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance", substances of this Class, in quantities not exceeding 6 kg for all of the substances listed under the same item number or the same letter, may be enclosed in the same package either with substances of another item number or of another letter of the same Class, or with dangerous substances belonging to other Classes (if mixed packing is likewise allowed in the case of such substances), or with other goods, subject to the following special conditions.

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions contained in marginals 2001 (5) and 2002 (6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

Special conditions

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
2°(a)	Sulphur	5 kg	5 kg	Must not be packed together with chlorates, permanganates, perchlorates, or peroxides (other than solutions of hydrogen peroxide)
7°(a)	Weakly-nitrated nitro-cellulose (such as collodion cotton)	100 g	1 kg	Must not be packed together with substances of Classes II and IIIc
8°	Red (amorphous) phosphorus	5 kg	5 kg	
8°	Phosphorus sesquisulphide	mixed packing not allowed		

## Class IIIB

4. Marking and danger labels on packages (see Appendix A.9) 2344

(1) Every package containing substances of 4<sup>o</sup> - 8<sup>o</sup> must bear a label conforming to model No. 2.

(2) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.

(3) In the case of consignments carried as a complete load, label No. 2 need not be affixed to the packages.

2345

B. Particulars in the transport document

(1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2331. Where the name of the substance is not indicated in the case of 1<sup>o</sup>, the trade name must be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. IIIB, 7<sup>o</sup> (a), ADR]. 2346

(2) In the case of celluloid waste (6<sup>o</sup>) packed in stout packing paper or in a suitable plastics material and placed, so packed, in bags made of closely-woven raw canvas or jute, the following must be certified in the transport document: "Contains no waste in dust form".

(3) In the case of substances of 7<sup>o</sup> (b) and (c) packed in fibre-board cases, the following must be certified in the transport document: "Substances free from dust".

## Class IIIb

2346 (contd) (4) In the case of coal dust, lignite dust or peat dust ( $10^{\circ}$ ) artificially prepared and packed in wooden receptacles or in bags [see marginal 2341 (2)], the following must be certified in the transport document: "Substances completely cooled after drying by heat".

2347 -  
2353

C. Empty packagings

2354 No provisions.

2355 -  
2369

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## CLASS IIIc. OXIDIZING SUBSTANCES

1. List of substances

Among the substances and articles covered by the heading of Class IIIc, those listed in marginal 2371 are subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR.

2370

Note: Unless specifically listed in Class Ia or Class Ic, mixtures of oxidizing substances with combustible substances are not to be accepted for carriage if they are capable of exploding on contact with a flame or are more sensitive to shock and to friction than dinitrobenzene.

- 1° Stabilized aqueous solutions of hydrogen peroxide containing more than 60% hydrogen peroxide and stabilized hydrogen peroxide.

2371

Note: 1. For aqueous solutions of hydrogen peroxide containing not more than 60% hydrogen peroxide, see marginal 2501, 41°.

2. Aqueous solutions of hydrogen peroxide containing more than 60% hydrogen peroxide, not stabilized, and hydrogen peroxide, not stabilized, are not to be accepted for carriage.

- 2° Tetranitromethane, free from combustible impurities.

Note: Tetranitromethane not free from combustible impurities is not to be accepted for carriage.

- 3° Perchloric acid in aqueous solutions containing more than 50% but not more than 72.5% perchloric acid ( $\text{HClO}_4$ ).

See also marginal 2371a, under (a).

Note: Perchloric acid in aqueous solutions containing not more than 50% perchloric acid ( $\text{HClO}_4$ ) is a substance of Class V (see marginal 2501, 4°). Aqueous solutions of perchloric acid containing more than 72.5% perchloric acid are not to be accepted for carriage; the same applies to mixtures of perchloric acid with any liquid other than water.

- 4° (a) Chlorates; inorganic chlorate weed-killers consisting of mixtures of sodium chlorate, potassium chlorate or calcium chlorate with a hygroscopic chloride (such as magnesium chloride or calcium chloride);

Note: Ammonium chlorate is not to be accepted for carriage.

## Class IIIc

2371  
(contd)

- (b) Perchlorates (with the exception of ammonium perchlorate, see 5°);
- (c) Sodium and potassium chlorites;
- (d) Mixtures of chlorates, perchlorates and chlorites of (a), (b) and (c) with one another.

For (a), (b), (c) and (d), see also marginal 2371a, under (b).

5° Ammonium perchlorate. See also marginal 2371a, under (b).

6° (a) Ammonium nitrate not containing combustible substances in a higher proportion than 0.4%;

Note: Ammonium nitrate containing more than 0.4% combustible substances is not to be accepted for carriage unless it is a constituent of an explosive of 12° or 14° of marginal 2021.

- (b) Mixtures of ammonium nitrate with ammonium sulphate or ammonium phosphate containing more than 40% nitrate but not more than 0.4% combustible substances;
- (c) Mixtures of ammonium nitrate with an inert substance (e.g. infusorial earth, calcium carbonate, potassium chloride) containing more than 65% nitrate but not more than 0.4% combustible substances.

For (a), (b) and (c), see also marginal 2371a, under (b).

Note: 1. Mixtures of ammonium nitrate with ammonium sulphate or ammonium phosphate containing not more than 40% nitrate, and mixtures of ammonium nitrate with an inert inorganic substance containing not more than 65% nitrate, are not subject to the provisions of ADR.

2. In the mixtures referred to under (c), only inorganic substances which are neither combustible nor oxidizing may be considered as inert.

3. Compound fertilizers in which the total content of nitrogen as nitrate and as ammonia does not exceed 14% or in which the nitrogen content as nitrate does not exceed 7% are not subject to the provisions of ADR.

7° (a) Sodium nitrate;

(b) Mixtures of ammonium nitrate with nitrates of sodium, potassium, calcium or magnesium;

(c) Barium nitrate, lead nitrate.

For (a), (b) and (c), see also marginal 2371a, under (b).

Note: 1. If they do not contain more than 10% ammonium nitrate, mixtures of ammonium nitrate with calcium nitrate or with magnesium nitrate or with both are not subject to the provisions of ADR.

## Class IIIc

2. Empty textile bags which have contained sodium nitrate and have not been entirely freed from the nitrate impregnating them are articles of Class II (see marginal 2201, 13°).

2371  
(contd)

8° Inorganic nitrites. See also marginal 2371a, under (b).

Note: Ammonium nitrite and mixtures of an inorganic nitrite with an ammonium salt are not to be accepted for carriage.

9° (a) Peroxides of alkali metals and mixtures containing peroxides of alkali metals which are not more dangerous than sodium peroxide;

(b) Dioxides and other peroxides of alkaline-earth metals, e.g. barium dioxide;

(c) Permanganates of sodium, potassium, calcium and barium.

For (a), (b) and (c), see also marginal 2371a, under (b).

Note: Ammonium permanganate, and mixtures of a permanganate with an ammonium salt, are not to be accepted for carriage.

10° Chromium trioxide (chromic anhydride; also called chromic acid).

See also marginal 2371a, under (b).

11° Empty packagings, uncleaned, and empty tanks, uncleaned, which have contained substances of Class IIIc.

Note: Empty packagings and empty tanks which have contained a chlorate, a perchlorate, a chlorite (4° and 5°), an inorganic nitrite (8°) or substances of 9° and 10°, with residues from their previous contents adhering to the outside, are not to be accepted for carriage.

Substances handed over for carriage in conformity with the following provisions are subject neither to the provisions for this Class contained in this Annex nor to those contained in Annex B.

2371a

(a) substances of 3°, in quantities not exceeding 200 g per receptacle, on condition that they are packed in receptacles so closed as to be leak-proof and not capable of being attacked by the contents, and that the receptacles are packed, not more than 10 per case, in a wooden case with inert absorbent cushioning materials;

## Class IIIc

2371a (contd) (b) substances of 4° - 10°, in quantities not exceeding 10 kg, packed not more than 2 kg per receptacle in receptacles so closed as to be leak-proof and not capable of being attacked by the contents, these receptacles being enclosed in strong, leak-proof packagings made of wood or sheet-metal and having leak-proof closures.

2. ProvisionsA. Packages1. General conditions of packing

2372 (1) Receptacles shall be so closed and arranged as to prevent any loss of the contents.

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents, or cause the contents to decompose, or form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular, where substances are in the liquid state, receptacles and their closures must, unless the section headed "Packing of a single substance" provides otherwise, be able to withstand any pressure which, the presence of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage. Unless otherwise specified in the section entitled "Packing of a single substance", inner packagings may be enclosed in outer packagings, either singly or in groups.

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The walls must be not less than 3 mm thick in the case of receptacles weighing, with their contents, more than 35 kg and not less than 2 mm in the case of other receptacles.



## Class IIIC

The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage.

2372  
(contd)

(5) When receptacles made of glass, porcelain, stoneware or similar materials are prescribed or allowed, they must be secured by cushioning materials in protective packagings. Cushioning materials must be incombustible (asbestos, glass wool, absorbent earth, infusorial earth, etc.) and incapable of forming dangerous compounds with the contents of the receptacles. If the contents are liquid, the cushioning materials shall also be absorbent and proportionate in quantity to the volume of the liquid; this interior absorbent layer must not, however, be less than 4 cm thick at any point.

2. Packing of a single substance

(1) Aqueous solutions of hydrogen peroxide, and hydrogen peroxide, of 1<sup>o</sup>, shall be packed in drums or other receptacles made of aluminium of at least 99.5% purity or of special steel not liable to cause the hydrogen peroxide to decompose. These receptacles shall be fitted with means of handling; they must be able to remain upright in a stable fashion and must:

2373

- (a) be fitted in their upper part with a closing device ensuring equality of the internal and the atmospheric pressure; this closing device must in all circumstances prevent any escape of the liquid and any entry of foreign matter into the receptacle and must be protected by a vented cap; or
- (b) be able to withstand an internal pressure of 2.5 kg/cm<sup>2</sup> and be fitted in the upper part with a safety device yielding when the excess of internal pressure is 1 kg/cm<sup>2</sup> at most.

(2) Receptacles shall not be filled beyond 90% of their capacity.

(3) A package must not weigh more than 90 kg.

Tetranitromethane (2<sup>o</sup>) shall be contained in bottles made of glass, porcelain, stoneware or similar materials or of a suitable plastics material, with incombustible stoppers, placed inside a wooden case with complete sides;

2374

## Class IIIc

2374 fragile receptacles shall be secured therein by absorbent-earth cushioning.  
(contd) Receptacles shall not be filled beyond 93% of their capacity.

2375 Perchloric acid in aqueous solutions (3<sup>o</sup>) shall be contained in glass receptacles, which shall be filled to not more than 93% of their capacity. The receptacles shall be secured by absorbent and incombustible cushioning materials in incombustible protective packagings impermeable to liquids and capable of retaining the contents of the receptacles. The closures of the receptacles shall be protected by caps if the protective packagings are not completely closed.

Glass bottles closed by glass stoppers may also be secured by absorbent and incombustible cushioning materials in wooden cases with complete sides.

Packages containing fragile receptacles and carried otherwise than as a complete load must not weigh more than 75 kg and shall be fitted with means of handling.

2376 (1) Substances of 4<sup>o</sup> and 5<sup>o</sup> and solutions of substances of 4<sup>o</sup> shall be packed in receptacles made of glass, of a suitable plastics material, or of metal; solid substances of 4<sup>o</sup> (b) may also be enclosed in hardwood casks.

(2) Fragile receptacles and receptacles made of a plastics material must be secured by cushioning materials in wooden or metal protective packagings. They may also be secured separately by incombustible cushioning materials in non-fragile intermediate receptacles which must in turn be firmly placed or secured by cushioning materials in protective packagings. Each receptacle must contain not more than 5 kg of substance. In the case of receptacles whose contents are liquid, the cushioning materials must be absorbent.

(3) In the case of receptacles made of a plastics material and containing solutions of substances of 4<sup>o</sup>, the protective packagings may be dispensed with if the walls are not less than 4 mm thick at every point, the walls are strengthened by strong reinforcing rims, the ends are strengthened, the upper part is provided with two strong handholds, and the opening is fitted with a screw-threaded closure.

## Class IIIc

(4) Receptacles for liquids shall not be filled beyond 95% of their capacity. 2376  
(contd)

(5) Packages containing fragile receptacles or receptacles made of a plastics material [see (2) and (3)], if they contain liquids, and packages containing fragile receptacles or receptacles made of a plastics material [see (2)], if they contain only solid substances and are carried otherwise than as a complete load, must not weigh more than 75 kg. Packages carried otherwise than as a complete load shall be fitted with means of handling.

(6) Packages which can be rolled must not weigh more than 400 kg; if they weigh more than 275 kg they shall be fitted with rolling hoops.

(7) Receptacles containing solid chlorates other than those referred to under (8) must not contain any combustible material other than a small pad of waxed paper.

(8) If the chlorate is in the form of tablets, with or without a suitable binder, and is packed in bottles containing not more than 200 g, a sufficient quantity of cotton-wool may be used to prevent excessive movement of the tablets in the bottle. The bottles shall be packed in fibreboard boxes placed in an intermediate packaging separate from the outer packaging. An intermediate packaging may not contain more than 1 kg or a package more than 6 kg of chlorate.

(1) Substances of 6<sup>o</sup>, 7<sup>o</sup>, and 8<sup>o</sup> shall be packed: 2377

- (a) in drums or cases; or
- (b) in strong bags made of closely-woven fabric or of stout paper of at least five plies or, in quantities not exceeding 50 kg, in bags made of a suitable plastics material sufficiently thick and strong to prevent any loss of the contents.

If the substance is more hygroscopic than sodium nitrate, bags made of closely-woven fabric or of stout paper of five plies must be lined with a suitable plastics material or be rendered impermeable by suitable means.

Packages which can be rolled must not weigh more than 400 kg; if they weigh more than 275 kg they shall be fitted with rolling hoops.

(1) Substances of 9<sup>o</sup> (a) shall be packed: 2378

- (a) in steel drums; or

## Class IIIc

2378  
(contd)

(b) in receptacles made of sheet-metal, lead-lined sheet-iron, or tin-plate, secured in wooden packing cases having a metal lining rendered leak-proof, e.g. by soldering.

When carried as a complete load, substances of 9<sup>o</sup> (a) may be packed in tin-plate receptacles placed solely in protective iron hampers.

(2) Receptacles containing substances of 9<sup>o</sup> (a) must be so closed and leak-proof as to prevent moisture from entering.

(3) Substances of 9<sup>o</sup> (b) and (c) shall be packed:

(a) in incombustible receptacles fitted with an incombustible hermetic closure. If the incombustible receptacles are fragile, each shall be secured separately by cushioning materials in a wooden case lined with stout paper; or

(b) in hardwood casks with closely-fitting staves, lined with stout paper.

(4) Packages containing fragile receptacles and carried otherwise than as a complete load must not weigh more than 75 kg and shall be fitted with means of handling.

Packages capable of rolling must not weigh more than 400 kg; they must be fitted with rolling hoops if they weigh more than 275 kg.

2379

(1) Chromium trioxide (10<sup>o</sup>) shall be packed:

(a) in receptacles made of glass, porcelain, stoneware or similar materials, tightly stoppered, and secured in a wooden case by inert and absorbent cushioning materials; or

(b) in metal drums.

(2) Packages containing fragile receptacles carried otherwise than as a complete load must not weigh more than 75 kg and shall be fitted with means of handling.

Packages capable of rolling must not weigh more than 400 kg; they must be fitted with rolling hoops if they weigh more than 275 kg.

3. Mixed packing

2380

(1) Substances grouped under the same letter may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be that laid down for the substances of the item number in question.

## Class IIIc

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance", substances of this Class, in quantities not exceeding 6 kg in the case of solids or 3 litres in the case of liquids for all of the substances listed under the same item number or the same letter, may be enclosed in the same package either with substances of another item number or of another letter of the same Class, or with dangerous substances belonging to other Classes (if mixed packing is likewise allowed in the case of such substances), or with other goods, subject to the following special conditions.

2380  
(contd)

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions of marginals 2001 (5) and 2002 (6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

Special conditions:

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1 <sup>o</sup>	Hydrogen peroxide and aqueous solutions of hydrogen peroxide containing more than 60% hydrogen peroxide.	Mixed packing not allowed.		
2 <sup>o</sup>	Tetranitromethane			
3 <sup>o</sup>	Perchloric acid			
4 <sup>o</sup>	Solutions of substances of 4 <sup>o</sup>			

## Class IIIc

2380  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
4° (a)	Chlorates			<p>Must not be packed together with weakly-nitrated nitrocellulose, red phosphorus, bifluorides, liquid halogenated irritants, hydrochloric acid, sulphuric acid, chlorosulphonic acid, acetic acid, benzoic acid, salicylic acid, formic acid, nitric acid, free sulphonic acids, mixed nitrating acids, sulphur, hydrazine.</p> <p>Must be separated from uncombined carbon (in any form), hypophosphites, ammonia and its compounds, triethanolamine, aniline, xylidine, toluidine, or inflammable liquids having a flash-point below 21°C.</p>
	- in fragile receptacles	1 kg	2.75 kg	
	- in other receptacles	5 kg	5 kg	
4° (b) and 5°	Perchlorates	5 kg	5 kg	<p>Must not be packed together with weakly-nitrated nitrocellulose, red phosphorus, bifluorides, liquid halogenated</p>

## Class IIIc

2380  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
				irritants, hydrochloric acid, sulphuric acid, chlorosulphonic acid, nitric acid, mixed nitrating acids; aniline, pyridine, xylidine, toluidine, sulphur, hydrazine
4 <sup>o</sup> (c) and (d), 6 <sup>o</sup> , 7 <sup>o</sup> , 8 <sup>o</sup>	All substances			Must not be packed together with weakly-nitrated nitrocellulose or red phosphorus.
9 <sup>o</sup> (a) and (b)	Peroxides - in fragile receptacles - in other receptacles	500 g 5 kg	2.5 kg 5 kg	Same substances prohibited as in the case of perchlorates, and also: aluminium dust, powder or granules, acetic acid; aqueous liquids, inflammable liquids of Classes IIIa and IVa, substances of Class IIIb; metallic peroxides must not be packed in the same package with solutions of hydrogen peroxide.

## Class IIIc

2380  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
				The limitation of 2.5 kg applies to peroxides of 9 <sup>o</sup> (a) and (b) for all of these substances. The use of sawdust or other organic filling materials is prohibited.
9 <sup>o</sup> (c)	Permanganates	5 kg	5 kg	Same substances prohibited as in the case of chlorates, and also: solutions of hydrogen peroxide, glycerine, glycols. Must be separated from the same substances as indicated in the case of chlorates.
10 <sup>o</sup>	Chromic anhydride (chromic acid)	4.5 kg	4.5 kg	The use of sawdust or other organic filling materials is prohibited.

4. Marking and danger labels on packages (see Appendix A.9)

2381

(1) Every package containing substances of Class IIIc shall bear a label conforming to model No. 3. Packages containing substances of 3<sup>o</sup> must, in addition, bear a label conforming to model No. 5.

(2) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the



## Class IIIc

case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used. 2381 (contd)

(3) In the case of consignments carried as a complete load, labels Nos. 3 and 5, as prescribed under (1), need not be affixed to the packages if the vehicle bears the marking prescribed in Annex B, marginal 10 500.

2382.

B. Particulars in the transport document

The description of the goods in the transport document must conform to one of the names underlined in marginal 2371; it must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. IIIc, 4<sup>o</sup> (a), ADR]. 2383

C. Empty packagings2384-  
2390

(1) Packagings and tanks of 11<sup>o</sup> must be closed in the same manner and leak-proof in the same degree as though they were full. 2391

(2) The description in the transport document must be: "Empty packaging, IIIc, 11<sup>o</sup>, ADR (or RID)". This description must be underlined in red.

(3) Empty textile bags, uncleaned, which have contained sodium nitrate [7<sup>o</sup>(a)] are subject to the provisions of Class II (see marginal 2211).

2392-  
2399



CLASS IVa. TOXIC SUBSTANCES1. List of substances

(1) Among the substances and articles covered by the heading of class IVa, those which are listed in marginal 2401 or are covered by a collective heading of that marginal are subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR. 2400

(2) Substances of Class IVa which polymerize easily are not to be accepted for carriage unless the necessary precautions have been taken to prevent their polymerization during carriage.

(3) The flash-point referred to below shall be determined in the manner described in Appendix A.3.

A. Toxic substances having a flash-point below 21°C and a boiling point below 200°C 2401

1° Hydrocyanic acid and inflammable volatile substances having a similar toxic effect, such as:

- (a) hydrocyanic acid containing not more than 3% water (absorbed by an inert porous substance or in the liquid state), on condition that the filling of the receptacles was carried out less than one year previously;

Note: Hydrocyanic acid not satisfying these conditions is not to be accepted for carriage.

- (b) aqueous solutions of hydrocyanic acid containing not more than 20% hydrocyanic acid (HCN).

Note: Solutions of hydrocyanic acid containing more than 20% hydrocyanic acid (HCN) are not to be accepted for carriage.

2° Nitriles (organic cyanides), such as:

- (a) acrylonitrile;
- (b) acetonitrile (methyl cyanide);
- (c) isobutyronitrile (isobutyric nitrile).

3° Other nitrogenous organic substances having a toxicity not lower than that of ethyleneimine containing not more than 0.003% total chlorine and its aqueous solutions.

Note: Ethyleneimine of any other nature is not to be accepted for carriage.

## Class IVa

- 2401 (contd) 4° Halogenated organic substances, such as:
- (a) allyl chloride;
  - (b) methyl chloroformate;
  - (c) ethyl chloroformate.
- 5° Metal carbonyls, such as:
- (a) nickel carbonyl (nickel tetracarbonyl);
  - (b) iron carbonyl (iron pentacarbonyl)
- B. Toxic substances having a flash-point of 21°C or over, and non-inflammable toxic substances, both having a boiling point below 200°C
- 11° Nitrogenous organic substances, such as:
- (a) 2 - cyanopropan-2-ol (acetone cyanohydrin);
  - (b) aniline
- 12° Halogenated organic substances, such as:
- (a) 1-chloro-2,3-epoxypropane (epichlorohydrin);
  - (b) glycol chlorohydrin (2-chloroethanol);
  - (c) acetylene tetrachloride (1,1,2,2-tetrachloroethane);
  - (d) chloropicrin;
- Note: Mixtures of chloropicrin with methyl chloride or methyl bromide are substances of Class Id if the vapour pressure of the mixture at 50°C exceeds 3 kg/cm<sup>2</sup> [see marginal 2131, 8° (a)].
- (e) trichloromethanesulphenyl chloride;
  - (f) 2,2-dichlorodiethyl ether, (chloroethyl ether, 2-chloroethyl ether).
- 13° Oxygenated organic substances, such as:
- (a) allyl alcohol;
  - (b) dimethyl sulphate;
  - (c) phenol.
- 14° Lead alkyls, such as tetraethyl lead, tetramethyl lead and mixtures of lead alkyls with halogenated organic compounds, e.g. ethyl fluid.
- C. Toxic organic substances having a boiling point of 200°C or over
- 21° Nitrogenous organic substances, such as:
- (a) 2-bromophenylacetonitrile (bromobenzyl cyanide);
  - (b) phenylcarbylamine chloride;
  - (c) 2,4-diisocyanatotoluene
  - (d) allyl isothiocyanate;

## Class IVa

- 2401  
(contd)
- (e) Chloroanilines;
- (f) mononitroanilines and dinitroanilines;
- (g) naphthylamines;
- (h) 2,4-diaminotoluene;
- (i) dinitrobenzenes;
- (k) chloronitrobenzenes;
- (l) mononitrotoluenes;
- (m) dinitrotoluenes;
- (n) nitroxylenes;
- (o) toluidines;
- (p) xylidines
- 22° Oxygenated organic substances not covered by 21° and 23°, such as:
- (a) cresols;
- (b) xlenols
- 23° Halogenated organic substances not covered by 21°, such as:
- (a) xylyl bromide;
- (b) phenacyl chloride (w-chloroacetophenone);
- (c) phenacyl bromide (w-bromoacetophenone);
- (d) 4-chloroacetophenone (methyl p-chlorophenylketone);
- (e) symmetrical dichloroacetone
- D. Inorganic substances which may release toxic gases on contact with acids (but see under E for silicon alloys)
- 31° Inorganic cyanides:
- (a) cyanides and complex cyanides in a solid form;
- (b) solutions of inorganic cyanides;
- (c) preparations of inorganic cyanides.
- Note: Ferrocyanides and ferricyanides are not subject to the provisions of ADR.
- 32° The following azides:
- (a) sodium azide;
- (b) barium azide with not less than 50% water or alcohols, and aqueous solutions of barium azide.
- Note: Barium azide in the dry state or with less than 50% water or alcohols is not to be accepted for carriage.

## Class IVa

2401  
(contd)33° Zinc phosphide

Note: Zinc phosphide capable of spontaneous ignition or, under the effect of moisture, of releasing toxic gases is not to be accepted for carriage.

E. Silicon alloys capable of releasing toxic gases

- 41° (a) Ferro-silicon and mangano-silicon with more than 30% and less than 70% silicon;
- (b) ferro-silicon alloys with aluminium, manganese, calcium or more than one of these metals, with a total content of silicon and of elements other than iron and manganese greater than 30% but less than 70%.

all the substances of 41° having been for not less than three days in a dry place open to the air.

Note: 1. Ferro-silicon and mangano-silicon briquettes, whatever their silicon content, are not subject to the provisions of ADR.

2. Substances of 41° are not subject to the provisions of ADR if they are not liable to release dangerous gases under the effect of moisture during carriage and the sender so certifies in the transport document.

3. Substances of 41° which have not been stored for not less than three days in a dry place open to the air are not to be accepted for carriage.

F. Other toxic inorganic substances

51° Beryllium in powder form; beryllium compounds in powder form.

52° Arsenical compounds, such as:

- (a) oxides of arsenic;
- (b) sulphides of arsenic.

Note: With regard to arsenical substances and preparations used as pesticides, see under 81° (i), 82° (i) and 83° (i).

53° Mercury compounds, such as:

Mercuric chloride (corrosive sublimate), except cinnabar and mercurous chloride (calomel).

Note: With regard to mercurial substances and preparations used as pesticides, see under 81° (f), 82° (f) and 83° (f).

54° Thallium compounds

Note: With regard to substances and preparations containing thallium and used as pesticides, see under 81° (h), 82° (h) and 83° (h).

## Class IVa

- G. Halogenated organic substances having a harmful or irritant effect 2401  
(contd)
- 61° Halogenated organic substances, volatile, inflammable or non-inflammable, having a flash-point of 21°C or over and a boiling point below 200°C, such as:
- (a) ethylene dibromide (symmetrical dibromoethane);
  - (b) chloroacetone;
  - (c) bromoacetone;
  - (d) 1,2-dibromobutan-3-one;
  - (e) methyl chloroacetate;
  - (f) ethyl chloroacetate;
  - (g) methyl bromoacetate;
  - (h) ethyl bromoacetate;
  - (i) 1,1-dichloro-1-nitroethane;
  - (k) benzyl chloride;
  - (l) 1-chloro-1-nitropropane.
- 62° Halogenated organic substances of low volatility having a boiling point of 200°C or over and not covered by 23°, such as:
- (a) benzyl iodide;
  - (b) acetylene tetrabromide (1,1,2,2-tetrabromoethane).
- H. Inorganic substances having a harmful effect
- 71° Barium compounds, such as barium oxide, barium hydroxide, barium sulphide and other barium salts (except barium sulphate and barium titanate).
- Note: Barium chlorate, perchlorate, nitrate, nitrite, dioxide and permanganate are substances of Class IIIc [see marginal 2371 under 4° (a) and (b), 7° (c), 8° and 9° (b) and (c)].
- 72° Lead compounds, such as lead oxides, lead salts including lead acetate, lead pigments (e.g. white lead and lead chromate), except lead titanate and lead sulphide (galena).
- Note: Lead chlorate, lead perchlorate and lead nitrate are substances of Class IIIc [see marginal 2371, 4° (a) and (b) and 7° (c)].
- 73° Residues and wastes containing compounds of antimony or of lead or of both, e.g. ashes of lead or of antimony or of lead and antimony; lead sludges containing less than 3% free acid.
- Note: Lead sludges containing 3% or more free acid are substances of Class V [see marginal 2501, 1° (e)].

## Class IVa

- 2401 (contd) 74° Vanadium compounds in powder form, such as vanadium pentoxide and the vanadates.  
Note: Vanadium chlorate and vanadium perchlorate are substances of Class IIIc [see marginal 2371, 4° (a) and (b)]
- 75° Antimony compounds, such as antimony oxides and antimony salts, except stibnite.  
Note: Antimony chlorate and antimony perchlorate are substances of Class IIIc [see marginal 2371, 4° (a) and (b)]  
Antimony pentachloride, antimony trichloride and antimony pentafluoride are substances of Class V [see marginal 2501, 11° (a), 12° and 15° (b)]
- I. Substances and preparations used as pesticides
- 81° Substances and preparations presenting a risk of very severe poisoning:
- (a) Organo-phosphorus compounds, such as: azinphos-ethyl, azinphos-methyl, demeton-O+S, dimcfox, endothion, HETP, mecarbam, methylparathion, mevinphos, parathion, phosphamidon, sulfotep and TEPP, and preparations containing more than 10% of these substances.
  - (b) Halogenated organic compounds, such as: aldrin, dieldrin, heptachlor, and preparations containing more than 10% of these substances.
  - (c) Nitrogenous organic compounds, such as: 4,6-dinitrophenol, dinosob, dinitrophenyl acetate, dinitro-o-cresol, and preparations containing more than 50% of these substances.
  - (d) Carbamates and derivatives of urea, such as: ANTU, isolan, and preparations containing more than 25% of these substances.
  - (e) Alkaloids, such as: nicotine, brucine, strychnine, or their salts, and preparations containing more than 10% of these substances.
  - (f) Organic compounds of metals, such as:
    1. organic mercurial compounds, and preparations containing more than 5% of these substances;
    2. trialkyl and triaryl compounds of tin, and preparations containing more than 25% of these substances.
  - (g) Other organic compounds, such as: cumachlor, sodium fluoracetate, fluoracetamide, pindone, warfarin, and preparations containing more than 5% of these substances.
  - (h) Inorganic compounds of metals, such as: thallium compounds, and preparations containing more than 10% of these substances.



## Class IVa

- (i) Other inorganic compounds, such as: compounds of arsenic, and preparations containing more than 10% of these substances. 2401 (contd)
- 82° Substances and preparations presenting a risk of severe poisoning:
- (a) Organo- compounds, such as:
1. demeton - O+S - methyl, dioxathion, ethion, fenthion, phenkanton, thiometon, and preparations containing more than 25% of these substances;
  2. preparations of azinphos-ethyl, azinphos-methyl, demeton-O+S, dimefox, endothion, HETP, mecarbam, methylparathion, mevinphos, parathion, phosphamidon, sulfotep and TEPP, containing more than 2.5% but not more than 10% active substance.
- (b) Halogenated organic compounds, such as:
1. toxaphene, pentachlorophenol, and preparations containing more than 20% of these substances;
  2. gamma-BHC (gammexane), DDT, and preparations containing more than 50% of these substances.
- (c) Preparations of nitrogenous organic compounds, such as:
1. preparations of 4,6-dinitrophenol, dinoseb, dinitrophenyl acetate and dinitro-o-cresol, containing more than 10% but not more than 50% active substance;
  2. preparations of binapacryl, containing more than 50% active substance.
- (d) Carbamates and derivatives of urea, such as:
1. dimethan, urbazid, and preparations containing more than 25% of these substances;
  2. preparations of ANTU and isolan, containing more than 5% but not more than 25% active substance.
- (e) Preparations of alkaloids, such as: preparations of nicotine, brucine, and strychnine, or their salts, containing more than 2.5% but not more than 10% active substance.
- (f) Preparations of organic compounds of metals, such as:
1. organic mercurial preparations, containing more than 1% but not more than 5% active substance;

## Class IVa

2401  
(contd)

2. preparations of trialkyl and triaryl compounds of tin, containing more than 5% but not more than 25% active substance.
- (g) Preparations of other organic compounds, such as:
1. preparations of cumachlor, sodium fluoracetate, pindone and warfarin, containing more than 1% but not more than 5% active substance;
  2. preparations of fluoracetamide, containing not more than 5% active substance.
- (h) Preparations of inorganic compounds of metals, such as: preparations of thallium compounds, containing more than 2.5% but not more than 10% active substance.
- (i) Preparations of other inorganic compounds, such as: preparations of compounds of arsenic, containing more than 2.5% but not more than 10% active substance.
- 83° Harmful substances and preparations:
- (a) Organo-phosphorus compounds, such as:
1. diazinon, dimethoate, trichlorfon, malathion, and preparations containing more than 5% of these substances;
  2. preparations of demeton-O+S-methyl, diaxathion, ethion, fenthion, phenkapton and thiometon, containing more than 2.5% but not more than 25% active substance;
  3. preparations of azinphos-ethyl, azinphos-methyl, demeton-O+S, dimefox, endothon, HETP, mecarbam, methylparathion, mevinphos, parathion, phosphamidon, sulfotep and TEPP, containing not more than 2.5% active substance.
- (b) Preparations of halogenated organic compounds, such as:
1. preparations of toxaphene and pentachlorophenol, containing more than 5% but not more than 20% active substance;
  2. preparations of gamma-BHC (gammexane) and DDT, containing more than 10% but not more than 50% active substance;
  3. preparations of aldrin, dieldrin and heptachlor, containing more than 2.5% but not more than 10% active substance.

## Class IVa

- (c) Preparations of nitrogenous organic compounds, such as: 2401  
(contd)
1. preparations of binapacryl, containing more than 10% but not more than 50% active substance;
  2. preparations of 4,6-dinitrophenol, dinoseb, dinitrophenyl acetate and dinitro-o-cresol, containing more than 2.5% but not more than 10% active substance.
- (d) Preparations of carbamates and derivatives of urea, such as:
1. preparations of ANTU and isolan, containing more than 1% but not more than 5% active substance;
  2. preparations of dimethan and urbazid, containing more than 2.5% but not more than 25% active substance.
- (e) Preparations of alkaloids, such as: preparations of nicotine, brucine and strychnine, or their salts, containing not more than 2.5% active substance.
- (f) Preparations of organic compounds of metals, such as:
1. preparations of organic mercurial compounds, containing not more than 1% active substance;
  2. preparations of trialkyl and triaryl compounds of tin, containing more than 1% but not more than 5% active substance.
- (g) Preparations of other organic compounds, such as: preparations of cumachlor, sodium fluoracetate, pindone and warfarin, containing not more than 1% active substance.
- (h) Preparations of inorganic compounds of metals, such as: preparations of thallium compounds, containing not more than 2.5% active substance.
- (i) Preparations of other inorganic compounds, such as: preparations of compounds of arsenic, containing not more than 2.5% active substance.
- 84.<sup>o</sup> (a) cereal grains and seeds impregnated with one or more of the pesticides or other toxic substances of Class IVa, used as pesticides;
- (b) dressed seeds treated with pesticides or with other toxic substances of Class IVa, but not used as pesticides.

## Class IVa

- 2401 K. Empty packagings:  
(contd)
- 91° Empty packagings, uncleaned, empty tanks, uncleaned, and empty bags, uncleaned, which have contained substances of 1° - 5°, 11° - 14°, 21° - 23°, 31° - 33°, 41°, 51° - 54°, 81° and 82°.
- 92° Empty packagings, uncleaned, empty tanks, uncleaned, and empty bags, uncleaned, which have contained substances of 61°, 62°, 71° - 75°, 83° and 84°.
- Note: 91° and 92°. Empty packagings with residues from their previous contents adhering to the outside are not to be accepted for carriage.

2. ProvisionsA. Packages1. General conditions of packing

2402

(1) Packagings shall be so closed and arranged as to prevent any loss of the contents. For the special provision relating to substances of 41° see marginal 2418.

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents or form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular, where substances are in the liquid state or in solution, or have been wetted by a liquid, the receptacles and their closures must, unless the section headed "packing of a single substance" provides otherwise, be able to withstand any pressure which, the presence of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage. Inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance", inner packagings may be enclosed in outer packagings, either singly or in groups.

## Class IVa

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The thickness of the walls must be not less than 3 mm in the case of receptacles which, with their contents, weigh more than 35 kg, and not less than 2 mm in the case of other receptacles.

2402  
(contd)

The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage, unless the said closure comprises two plugs, one placed over the other, one of them being screw-threaded.

(5) When receptacles made of glass, porcelain, stoneware or similar materials are prescribed or allowed, they must be secured by cushioning materials in protective packagings. Cushioning materials shall be suited to the nature of the contents; in particular, they shall be absorbent when the contents are liquid.

(6) When handed over for carriage, packages must not be contaminated on the outside by toxic substances.

2. Packing of a single substance

2403

(1) Hydrocyanic acid and inflammable volatile substances having a similar toxic effect  $\overline{I}^{\circ}(a)$  shall be packed:

- (a) when completely absorbed by an inert porous material: in strong sheet-steel boxes, with a capacity of not more than 7.5 litres, entirely filled with the porous material, which must be of such a nature that it does not shake down or form dangerous spaces, even after prolonged use or under impact, at temperatures up to 50°C. The boxes must be able to withstand a pressure of 6 kg/cm<sup>2</sup> and must, when filled at 15°C, still be leak-proof at 50°C. The date of filling shall be stamped on the lid of each box. The boxes shall be placed in packing cases with sides not less than 18 mm thick in such a manner that they cannot come into contact with one another. The total capacity of the boxes in one packing case must not exceed 120 litres and the package must not weigh more than 120 kg;

## Class IVa

2403  
(contd)

- (b) when liquid but not absorbed by a porous material: in carbon-steel receptacles. These shall conform to the spirit of the provisions relating to such receptacles in Class Id, marginals 2141, 2142(1), 2143 2145 and 2148, with the following derogations and special requirements;

The internal pressure to be applied for the hydraulic pressure test must be 100 kg/cm<sup>2</sup>.

The pressure test shall be repeated every two years, when a meticulous inspection of the inside of the receptacle shall also be carried out and the receptacle's weight determined.

In addition to the marks prescribed in marginal 2148(1)(a)-(c) and (e)-(g), the receptacles must bear the date (month, year) of the most recent filling.

The maximum filling allowed for the receptacles is 0.55 kg liquid per litre of capacity.

- (c) With regard to the particulars in the transport document, see marginal 2434(2)

(2) Aqueous solutions of hydrocyanic acid [1°(b)] shall be packed in flame-sealed glass ampoules containing not more than 50 g, or in glass-stoppered glass bottles so closed as to be leak-proof and containing not more than 250 g. The ampoules and bottles shall be secured by absorbent cushioning materials in soft-soldered tin-plate boxes or in protective cases with a soft-soldered tin-plate lining. A package comprising a tin-plate box must not weigh more than 15 kg or contain more than 3 kg hydrocyanic acid solution; a package comprising a case must not weigh more than 75 kg.

2404

(1) Substances of 2° shall be packed:

- (a) 1. in sheet-steel canisters with walls not less than 1 mm thick and a capacity not exceeding 60 litres, the openings being closed by two plugs, one placed over the other, one of them being screw-threaded. The sheet-steel canisters must have welded lengthwise seams, two reinforcing ribs in the walls, and a protective rim below the joint recessed at the bottom. Canisters with a capacity of 40 to 60 litres must have their bottoms welded on and be fitted with means of handling on the side; or

## Class IVa

2. in all-welded steel drums with walls not less than 1.25 mm thick, fitted with rolling hoops and reinforcing ribs and having the openings closed by two plugs, one placed over the other, one of them being screw-threaded; 2404  
(contd)
- (b) acrylonitrile may also be packed:
1. in aluminium bottles of a capacity not exceeding 2 litres, secured by infusorial-earth cushioning in sheet-metal receptacles whose lids shall be firmly stuck down by means of suitable adhesive strips. The sheet-metal receptacles shall be placed, with filling material, in wooden cases. A package must not weigh more than 75 kg; or
  2. in non-returnable metal drums (new packagings intended to be used only once); these drums, whose walls shall not be less than 1.2 mm thick, shall be provided with a screw-threaded plug fitted with a gasket. The plug shall be situated on one of the ends and be protected by the rim of the drum. The drums may have a body with ends recessed, the joints being strengthened by chimb reinforcements; if they do not possess rolling hoops they must be provided with reinforcing ribs. A package must not weigh more than 200 kg. Carriage in non-returnable drums shall take place only as a complete load on open vehicles; or
  3. in non-returnable steel drums (new packagings intended to be used only once) having sides made of sheet steel 1.24 mm thick, ends made of sheet steel 1.5 mm thick, and a tare weight of 22.5 kg; the drums must be provided with reinforcing ribs. The body seam shall be welded and the ends shall be double-seamed by welting to the body, with a polyethylene liner inserted. Two screw-plug closure units, one of 50.8 mm (2") and one of 19.05 mm (3/4"), shall be double-seamed by welting to one of the ends, with a synthetic-rubber liner inserted. Thin sheet-steel caps shall be placed over the closure units;

## Class IVa

2404  
(contd)

(c) acetonitrile may also be packed in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 1 litre, with the openings closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be secured by absorbent cushioning materials in a wooden case or some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling.

(2) Receptacles containing acrylonitrile or acetonitrile must not be filled beyond 93%, and receptacles containing isobutyronitrile not beyond 92%, of their capacity.

2405

(1) Substances of 3° shall be packed in receptacles made of sheet-steel of sufficient thickness, which shall be closed by a screw-threaded bung or plug rendered leak-proof both to liquid and to vapour by means of a suitable gasket. The receptacles must be capable of withstanding an internal pressure of 3 kg/cm<sup>2</sup>. Each receptacle shall be secured by absorbent cushioning materials in a strong and leak-proof protective metal packaging. The protective packaging shall be hermetically closed and its closure shall be secured against any inadvertent opening. The degree of filling shall not exceed 0.67 kg per litre of capacity of the receptacle.

(2) A package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling.

2406

Substances of 4° shall be packed:

(a) in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres, with the openings closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be secured by absorbent cushioning materials in a wooden case or some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 93% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or



## Class IVa

- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 93% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (c) in metal receptacles having, if necessary, a suitable lining, the receptacles having a capacity not exceeding 15 litres and having the openings closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be secured by absorbent cushioning material, in a wooden case or some other outer packaging of sufficient strength. The receptacles must not be filled beyond 93% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in welded metal drums having, if necessary, a suitable lining, the drums having the openings closed by two plugs, one placed over the other, one of them being screw-threaded. The drums must not be filled beyond 93% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be equipped with rolling hoops; or
- (e) in receptacles made of strong black sheet-iron or tin-plate and hermetically closed. A tin-plate receptacle must not, with its contents, weigh more than 6 kg. These receptacles shall be secured by absorbent cushioning materials, either singly or in groups, in a wooden packing case. Such a package must not weigh more than 75 kg.

2406  
(contd)

(1) Substances of 5<sup>o</sup> shall be packed in metal receptacles. The receptacles must be fitted with completely leak-proof closing devices, which shall be secured against mechanical damage by protective caps. Steel receptacles must have walls not less than 3 mm thick and receptacles made of other materials must have walls at least thick enough to ensure equivalent mechanical strength. A package must not contain more than 25 kg of liquid. The maximum filling allowed shall be 1 kg of liquid per litre of capacity.

2407

## Class IVa.

2407  
(contd)

(2) Receptacles shall be tested before being put into service for the first time. The test pressure to be applied for the hydraulic pressure test shall be not less than 10 kg/cm<sup>2</sup>. The pressure test shall be repeated every five years and shall include a meticulous inspection of the inside of the receptacle and a check of the tare weight. Metal receptacles shall bear the following particulars in clearly legible and indelible characters:

- (a) the name of the product in full (the names of both substances may also be shown side by side);
- (b) the name of the owner of the receptacle;
- (c) the tare of the receptacle, including such fittings and accessories as valves, protective caps, etc.;
- (d) the date (month, year) of the acceptance test and the subsequent tests and the expert's stamp;
- (e) the maximum permissible filling per receptacle in kg;
- (f) the internal pressure (test pressure) to be applied for the hydraulic pressure test.

2408

(1) Substances of 11<sup>o</sup>(a) shall be packed:

- (a) in sheet-steel canisters with walls not less than 1 mm thick and a capacity not exceeding 60 litres, the openings being closed by two plugs, one placed over the other, one of them being screw-threaded. The sheet-steel canisters must have welded lengthwise seams, two reinforcing ribs in the walls, and a protective rim below the joint recessed at the bottom. Canisters with a capacity of 40 to 60 litres must have their bottoms welded on and be fitted with means of handling on the side; or
- (b) in all-welded steel drums with walls not less than 1.25 mm thick, fitted with rolling hoops and reinforcing ribs and having the openings closed by two plugs, one placed over the other, one of them being screw-threaded.

(2) Substances of 11<sup>o</sup>(b) shall be packed:

## Class IVa

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in metal receptacles having, if necessary, a suitable lining, the receptacles having a capacity not exceeding 15 litres and having the openings closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be secured by absorbent cushioning materials in a wooden case or some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg.
- (1) Substances of 12<sup>o</sup>(a) and (b) shall be packed: 2409
- (a) not more than 5 litres per bottle, in glass bottles placed separately, with absorbent materials, in a strong tin-plate receptacle; in the case of 1-chloro-2,3-epoxypropane, black sheet-iron may be used instead of tin-plate. The receptacles shall be secured by absorbent cushioning materials in a wooden packing case. A package must not weigh more than 75 kg; or

2408  
(contd)

## Class IVa

2409  
(contd)

- (b) not more than 5 litres per receptacle, in receptacles, made of stout tin-plate, with leak-proof closures; in the case of 1-chloro-2,3-epoxypropane black sheet-iron may be used instead of tin-plate. The receptacles shall be secured by absorbent cushioning materials or wood-wool cushioning in a wooden packing case. A package must not weigh more than 75 kg; or
- (c) in welded steel drums with the openings closed by two plugs, one placed over the other, one of them being screw-threaded, the drums being fitted with rolling hoops. In the case of glycol chlorohydrin (2-chloroethanol) it is also permissible to use welded canisters with the openings closed by two plugs, one placed over the other, one of them being screw-threaded the canisters being fitted with means of handling, being made of sheet steel 1 mm thick galvanized on both sides, and having a capacity not exceeding 60 litres;
- (d) the receptacles must not be filled beyond 93% of their capacity.
- (2) Substances of 12° (c) shall be packed:
- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware, or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or

## Class IVa

- (c) in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 95% of their capacity; or
- (d) in hermetically-closed metal drums having, if necessary, a suitable inner lining. The drums must not be filled beyond 95% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.
- (3) Substances of 12<sup>o</sup>(d) and (e) shall be packed:
- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (c) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or

2409  
(contd)

## Class IVa

2409  
(contd)

- (d) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.

(4) Substances of 12° (e) may also be packed in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 95% of their capacity.

(5) Substances of 12° (f) shall be packed:

- (a) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 93% of their capacity. Such a package must not weigh more than 100 kg; or
- (b) in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 93% of their capacity; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 93% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.

2410

(1) Substances of 13° (a) and (b) shall be packed:

- (a) in flame-sealed glass ampoules or in hermetically-closed glass bottles; for this purpose a stopper made of cork coated with paraffin wax, or a ground-glass stopper, may be used. The ampoules and bottles must not be filled beyond 93% of their capacity and must not weigh, with their contents, more than 3 kg. They shall be wrapped in corrugated fibre-board and secured by a sufficient quantity of inert and absorbent cushioning materials (infusorial earth or similar materials) in soft-soldered tin-plate boxes or in wooden cases lined with a tin-plate lining assembled by soft soldering. A package comprising a tin-plate box must not weigh more than 15 kg and a package comprising a wooden case not more than 75 kg; or

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- (b) in soldered or seamless sheet-metal receptacles or in receptacles made of a suitable plastics material. These receptacles shall be hermetically closed; they must not be filled beyond 93% of their capacity and must not weigh, with their contents, more than 50 kg; if they are made of thin sheet-metal, e.g. tin-plate, they must not weigh, with their contents, more than 6 kg. The sheet-metal or plastics receptacles shall be secured by a sufficient quantity of inert and absorbent cushioning materials (e.g. infusorial earth or similar materials) in protective receptacles fitted with means of handling. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed welded or seamless metal drums fitted with end bands and rolling hoops and not filled beyond 93% of their capacity.
- (2) Substances of 13<sup>o</sup> (c) shall be packed:
- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg; or

2470  
(contd)

## Class IVa

- 2410 (contd) (e) in bags made of a suitable plastics material, so closed as to be leak-proof, and placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg.
- 2411 Substances of 14<sup>o</sup> shall be packed:
- (a) in welded steel drums with openings closed by two plugs, one placed over the other, one of them being screw-threaded, the drums being fitted with rolling hoops. The drums must not be filled beyond 95% of their capacity; or
- (b) in receptacles made of strong black sheet-iron or of tin-plate and hermetically closed. A tin-plate receptacle must not, with its contents, weigh more than 6 kg. These receptacles shall be secured by absorbent cushioning materials in a wooden packing case. Such a package must not weigh more than 75 kg.
- 2412 (1) Substances of 21<sup>o</sup> (a), (b), (c) and (d), and liquids of 21<sup>o</sup> (e) and (f), shall be packed:
- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or



## Class IVa

- (c) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. Those receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.

2412  
(contd)

(2) Substances of 21<sup>o</sup> (b), (c) and (d) and liquids of 21<sup>o</sup> (e) and (f) may also be packed in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 95% of their capacity.

(3) Substances of 21<sup>o</sup> (e) and (f) in the solid state, and substances of 21<sup>o</sup> (g), (h), (i) and (k), shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or

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2412  
(contd)

(c) in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.

(4) Substances of 21° (e) and (f) in the solid state, and substances of 21° (g) and (h), may also be packed:

- (a) in bags made of a suitable plastics material, so closed as to be leak-proof, and placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg.

(5) Substances of 21° (g) may also be packed in hermetically-closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. Those receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength.

(6) Substances of 21° (l), (m), (n), (o) and (p) shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or

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- (c) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 95% of their capacity; or
- (e) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.

2412  
(contd)

(7) 4 - nitrotoluene  $\sqrt{21^\circ}$  (1) may also be packed:

- (a) in bags made of a suitable plastics material, so closed as to be leak-proof, and placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg; or
- (c) in bags made of stout paper of four plies, lined with a bag made of a suitable plastics material, so closed as to be leak-proof. Such a package must not weigh more than 55 kg.

(8) Substances of  $21^\circ$  (c) in flakes may also be packed in bags made of stout paper of four plies, lined with a bag made of a suitable plastics material and so closed as to be leak-proof. Such a package must not weigh more than 55 kg.

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2413

Substances of 22° shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically-closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength; or
- (e) in bags made of a suitable plastics material, so closed as to be leak-proof, and placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (f) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg.

2414

(1) Liquids of 23° shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95%

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of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or,

2414  
(contd)

- (b) in flame-sealed glass ampoules containing not more than 100g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (c) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If they weigh, with their contents, more than 275 kg, they shall be fitted with rolling hoops.

(2) Solids of 23° shall be packed in the same way as substances of 22°.

(1) Substances of 31° (a) and solid preparations of 31° (c) shall be packed.

2415

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or

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2415  
(contd)

- (b) in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically-closed receptacles, made of a suitable plastics material of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength; or
- (e) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg.

(2) Substances of 31° (b) and liquid preparations of 31° (c) shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or

## Class IVa

- (c) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. 2415  
(contd)  
These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 95% of their capacity; or
- (e) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops.

(1) Sodium azide [32° (a)] shall be packed in receptacles made of black sheet-iron or tin-plate. 2416

(2) Substances of 32° (b) shall be packed in receptacles made of glass or of a suitable plastics material. A receptacle must not contain more than 10 kg of barium azide nor more than 20 litres of barium azide solution. The receptacles shall be secured separately, by absorbent cushioning materials, in cases or in iron hampers with complete sides; the volume of the cushioning material must be at least equal to that of the content of the receptacle. Where hampers are used, the cushioning materials, if readily inflammable, shall be fireproofed sufficiently to prevent ignition on contact with a flame.

Zinc phosphide (33°) shall be packed in metal receptacles secured in wooden cases. A package must not weigh more than 75 kg. 2417

Substances of 41° shall be enclosed in wooden or metal packagings which may be fitted with a device allowing gases to escape. 2418  
Finely granulated substances may also be packed in bags.

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2419

Substances of 51° shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically-closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength; or
- (e) in bags made of a suitable plastics material, so closed as to be leak-proof, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (f) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg.



## Class IVa

(1) Substances of 52<sup>o</sup> shall be packed:

2420

- (a) in hermetically closed receptacles made of glass, porcelain, stone-ware, or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each; receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. The receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically-closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength; or
- (e) in bags made of a suitable plastics material, so closed as to be leak-proof, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (f) in receptacles made of wood or paperboard, lined with a vapour-tight plastics material and hermetically closed. Such a package must not weigh more than 75 kg; or
- (g) in hermetically-closed metal receptacles. Such a package must not weigh more than 75 kg.

## Class IVa

2420  
(contd)

(2) When forwarded as a complete load, the substances may also be packed:

- (a) in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg; or
- (b) in bags made of stout paper of four plies, lined with a bag made of a suitable plastics material, so closed as to be leak-proof. Such a package must not weigh more than 55 kg.

2421

(1) Solids of 53° shall be packed:

- (a) not more than 10 kg per bag, in bags made of paper of two plies; or
- (b) in bags made of a suitable plastics material, or
- (c) in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material; or
- (d) in steel receptacles or in strong wooden casks or in wooden cases fitted with strengthening bands.

Re (a), (b) and (c): The receptacles and bags shall be secured by cushioning materials in wooden outer packagings.

(2) Liquids or substances in solution of 53° shall be packed:

- (a) in receptacles made of glass, porcelain, stoneware or similar materials. These receptacles shall be secured by cushioning materials in protective packagings which, if not cases, shall be fitted with means of handling; or
- (b) in metal receptacles.

(3) A package containing fragile receptacles or bags made of a plastics material must not weigh more than 75 kg.

2422

Thallium compounds (54°) shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics

## Class IVa

material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or

2422  
(contd)

- (b) in tin-plate receptacles; or
- (c) in wooden cases fitted with strengthening bands; or
- (d) in wooden casks fitted with iron hoops or strong wooden hoops.

(1) Substances of 61° and 62°, other than those of 61° (1), shall be packed: 2423

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in flame-sealed glass ampoules containing not more than 100 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (c) in hermetically-closed metal receptacles having, if necessary, a suitable lining, and having a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or

## Class IVa

2423  
(contd)

- (d) in hermetically-closed canisters made of a suitable metal, welded or hard-soldered, having a capacity not exceeding 60 litres, and fitted with means of handling. The canisters must not be filled beyond 95% of their capacity; or
- (e) in hermetically-closed metal drums having, if necessary, a suitable lining. The drums must not be filled beyond 95% of their capacity. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (f) in hermetically-closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles must not be filled beyond 95% of their capacity.

(2) Substances of 61<sup>o</sup> (1) shall be packed:

- (a) in all-welded steel drums with walls not less than 1.25 mm thick, fitted with rolling hoops and reinforcing ribs and having the openings closed by two plugs, one placed over the other, one of them being screw-threaded; or
- (b) in sheet-steel canisters with walls not less than 1 mm thick and a capacity not exceeding 60 litres, the openings being closed by two plugs, one placed over the other, one of them being screw-threaded. The sheet-steel canisters must have welded lengthwise seams, two reinforcing ribs in the walls, and a protective rim below the joint recessed at the bottom. Canisters with a capacity of 40 to 60 litres must have their bottoms welded on and be fitted with means of handling on the side; or
- (c) in aluminium bottles of a capacity not exceeding 2 litres, secured by infusorial-earth cushioning in sheet-metal receptacles whose lids shall be firmly stuck down by means of suitable adhesive strips. The sheet-metal receptacles shall be placed, with filling materials, in wooden cases. A package must not weigh more than 75 kg; or

## Class IVa

- (d) in non-returnable metal drums (now packagings intended to be used only once); these drums, whose walls shall be not less than 1.2 mm thick, shall be provided with a screw-threaded plug fitted with a gasket. The plug shall be situated in one of the ends of the drum and be protected by the rim. The drums may have a body with ends recessed, the joints being strengthened by chime reinforcements; if they do not possess rolling hoops they must be provided with reinforcing ribs. A package must not weigh more than 200 kg. Carriage in non-returnable drums shall take place only as a complete load on open vehicles; or
- (e) in non-returnable steel drums (now packagings intended to be used only once) having sides made of sheet steel 1.24 mm thick, ends made of sheet steel 1.5 mm thick, and a tare weight of 22.5 kg; the drums must be provided with reinforcing ribs. The body seam shall be welded and the ends shall be double-seamed by welding to the body, with a polyethylene liner inserted. Two screw-plug closure units, one of 50.8 mm (2") and one of 19.05 mm ( $\frac{3}{4}$ " ), shall be double-seamed by welding to one of the ends, with a synthetic-rubber liner inserted. Thin sheet-steel caps shall be placed over the closure units.

2423  
(contd)

(3) The receptacles referred to under (2)(a) to (c) must not be filled beyond 93% of their capacity.

Substances of 71<sup>o</sup> shall be packed:

2424

- (a) in iron or wooden packagings; or
- (b) in bags made of stout paper of at least two plies, or made of jute, lined with a bag made of a suitable plastics material, so closed as to be leak-proof.

(1) Substances of 72<sup>o</sup> and 73<sup>o</sup> shall be packed:

2425

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics

## Class IVa

2425  
(contd)

material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or

- (b) in steel or wooden packagings; or
- (c) in bags made of stout paper of at least 2 plies. However, bags for lead acetate must be made:
  - 1. of hemp lined with a suitable plastics material or with stout crepe paper stuck on with bitumen; such a bag, with its contents, must not weigh more than 30 kg; or
  - 2. of stout paper of at least two plies, lined with a bag made of a suitable plastics material; such a bag, with its contents, must not weigh more than 30 kg; or
  - 3. of stout paper of at least five plies, lined with a bag made of a suitable plastics material; such a bag, with its contents, must not weigh more than 55 kg; or
  - 4. of stout paper of at least three plies, placed in jute bags; such a bag, with its contents, must not weigh more than 55 kg; or
- (d) in bags made of a suitable plastics material, so closed as to be leak-proof, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg.

(2) Substances of 72<sup>o</sup> may also be packed in receptacles made of tin-plate or of sheet-steel.

2426

Substances of 74<sup>o</sup> and 75<sup>o</sup> shall be packed:

- (a) in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics

## Class IVa

material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or

2426  
(contd)

- (b) in steel or wooden packagings; or
- (c) in bags made of stout paper of at least 2 plies, or in jute bags; or
- (d) in receptacles made of tin-plate or sheet-steel.

Pesticides of 81° shall be packed:

2427

- (a) in solid or paste form:
  - 1. in hermetically-closed receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, which must not contain more than 5 kg each. Receptacles made of plastics material may, if forwarded as a complete load, contain up to 10 kg of substance. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
  - 2. in hermetically-closed metal receptacles having, if necessary, a suitable lining and which must not contain more than 15 kg each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
  - 3. in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
  - 4. in hermetically-closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength; or

## Class IVa

2427.  
(contd)

5. in bags made of a suitable plastics material, so closed as to be leak-proof, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
  6. in receptacles made of wood or paperboard, lined with a vapour-tight plastics material and hermetically closed. Such a package must not weigh more than 75 kg; or
  7. in hermetically-closed metal receptacles. Such a package must not weigh more than 75 kg;
  8. arsenical compounds forwarded as a complete load may also be packed in hermetically-closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg;
  9. preparations may also be enclosed in packagings ready for use, which shall be firmly packed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg;
- (b) in liquid form:
1. in receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, of a capacity not exceeding 5 litres, with the openings closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 93% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or



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2. in flame-sealed glass ampoules containing not more than 50 g, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The ampoules must not be filled beyond 93% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
3. in metal receptacles having, if necessary, a suitable lining, the receptacles having a capacity not exceeding 15 litres and having the openings closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles must not be filled beyond 93% of their capacity. Such a package must not weigh more than 100 kg; or
4. in canisters made of a suitable metal, welded or hard-soldered, with walls not less than 0.5 mm thick and a capacity not exceeding 60 litres, the openings being closed by two plugs, one placed over the other, one of them being screw-threaded, the canisters being fitted with means of handling. The canisters must not be filled beyond 93% of their capacity; or
5. in hermetically-closed metal drums having, if necessary, a suitable lining. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops. The drums must not be filled beyond 93% of their capacity; or
6. in receptacles made of a suitable plastics material, of a capacity not exceeding 60 litres, the openings being closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles must not be filled beyond 93% of their capacity.

2427  
(contd)

## Class IVa

2428

Pesticides of 82° shall be packed:

(a) in solid form:

1. in the same way as solids of 81°;
2. when forwarded as a complete load, also in bags made of stout paper of four plies, lined with a bag made of a suitable plastics material, so closed as to be leak-proof. Such a package must not weigh more than 55 kg;

(b) in liquid form:

in the same way as liquids of 81°.

2429

Pesticides of 83° shall be packed:

(a) in solid form:

1. in the same way as solids of 81°; or
2. in jute bags rendered impermeable to moisture by a lining made of a suitable material, stuck on with bitumen, or in jute bags lined with a bag made of a suitable plastics material, so closed as to be leak-proof. Such a package must not weigh more than 55 kg; or
3. in the case of preparations, and of other pesticides if they are forwarded as a complete load, in bags made of stout paper of four plies, lined with a bag made of a suitable plastics material and hermetically closed. Such a package must not weigh more than 55 kg; or
4. in the case of solid arsenical compounds:
  - i. in double-walled wooden casks lined with stout paper; or
  - ii. in fibreboard boxes placed in a wooden case; or
  - iii. not more than 12.5 kg per bag, in double bags, made of stout paper or of a suitable plastics material, which shall be placed either in a wooden case lined with stout paper or tightly in a stout case made of double-faced corrugated

## Class IVa

fibreboard or of solid fibreboard of equivalent strength, the case being lined with stout paper. All joints and flaps shall be covered over with adhesive strips. A package comprising a fibreboard case must not weigh more than 30 kg.

2429  
(contd)

5. in the case of arsenical compounds forwarded as a complete load:
- i. in ordinary wooden packagings lined with stout paper; or
  - ii. not more than 25 kg per bag, in two-ply paper bags, or in bags made of a suitable plastics material, which shall be placed separately in bags made of jute or of a similar material lined with crepe paper; or
  - iii. in bags made of paper of at least three plies or in two-ply paper bags lined with a bag made of a suitable plastics material. Such a package must not weigh more than 20 kg; or
  - iv. in two-ply paper bags or in bags made of a suitable plastics material, which shall be placed in four-ply paper bags. Such a package must not weigh more than 60 kg.

In cases as referred to under iii. and iv. above, each consignment must be accompanied by empty bags in the proportion of 1 for every 20 bags containing arsenical substances, these empty bags being intended to accommodate such quantity of substances as may escape from bags damaged during carriage.

## (b) in liquid form:

1. in the same way as liquids of 81°; or
2. in the case of preparations:
  - i. in hermetically-closed cylindrical receptacles made of glass, porcelain, stoneware or similar materials, of a capacity not exceeding 25 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other

## Class IVa

2429  
(contd)

outer packaging of sufficient strength. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or

ii. in hermetically-closed glass carboys, of a capacity not exceeding 25 litres, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength, or which shall be well secured in iron or wicker hampers. The carboys must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or

iii. in receptacles, made of a suitable plastics material, with walls not less than 4 mm thick and a capacity not exceeding 60 litres, the openings being closed by two plugs, one placed over the other, one of them being screw-threaded, the receptacles having no protective packaging if the competent authority of the country of departure so allows. The receptacles must not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg.

2430

Substances of 84° shall be packed:

- (a) in the same way as solids of 81°; or
- (b) in the case of substances of 84° (a) very conspicuously coloured, in bags made of paper of at least two plies, or of a suitable plastics material, which shall be placed in textile bags; or
- (c) in the case of substances of 84° (b), in closely-woven jute bags.

2431

3. Mixed packing

(1) Substances grouped under the same item number may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be that laid down for the substances of the item number in question.

## Class IVa

(2) If smaller quantities are not prescribed in the section headed "Packing of a single substance", substances of this Class, in quantities not exceeding 6 kg in the case of solids or 3 litres in the case of liquids for all of the substances listed under the same item number or the same letter, may be enclosed in the same package either with substances of another item number or of another letter of the same Class, or with dangerous substances belonging to other Classes (if mixed packing is likewise allowed in the case of such substances), or with other goods, subject to the following special conditions:

2431  
(contd)

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions of marginals 2001 (5) and 2002 (6) and (7) must be observed.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

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2431  
(contd)Special conditions:

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1°(a)	Hydrocyanic acid	Mixed packing not allowed		
1°(b)	Solutions of hydrocyanic acid containing not more than 4% hydrocyanic acid (solutions containing more than 4% are prohibited)	1 litre	1 litre	Must not be packed together with any other acid
2°	Acrylonitrile, acetonitrile, isobutyronitrile	1 litre	1 litre	Must not be packed together with substances of Classes IIIc and V. Glass receptacles must be secured by cushioning materials in protective receptacles
5°(a)	Nickel carbonyl	Mixed packing not allowed		
11°(a)	2-cyanopropan-2-ol	1 litre	1 litre	Must not be packed together with substances of Classes IIIc and V. Glass receptacles must be secured by cushioning materials in protective receptacles
13°(b)	Dimethyl sulphate	1 litre	3 litres	
31°(a)	Cyanides in a solid form - in fragile receptacles - in other receptacles	500 g 5 kg	500 g 5 kg	Must not be packed together with substances of an acid nature
31°(b)	Solutions of inorganic cyanides	1 litre	3 litres	
41°(b)	Ferro-silicon alloys with aluminium	2.5 kg	2.5 kg	

## Class IVa

4. Marking and danger labels on packages (see Appendix A.9)

2432

(1) Every package containing substances of 1° - 5°, 11° - 14°, 21° - 23°, 31° - 33°, 41°, 51° - 54°, 81° and 82° shall bear a label conforming to model No. 4; packages containing substances of 2°, 4° (a), 5° and 11° (a) shall bear, in addition, a label conforming to model No. 2. Every package containing substances of 61°, 62°, 71° - 75°, 83° and 84° shall bear a label conforming to model No. 4A.

(2) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.

(3) In the case of consignments forwarded as a complete load, labels Nos. 2, 4 or 4A need not be affixed to the packages if the vehicle bears the marking prescribed in Annex B, marginal 10 500.

2433

B. Particulars in the transport document

(1) In the case of substances which are referred to by name in the 2434 list of substances (marginal 2401), the description of the goods in the transport document must conform to the name underlined in marginal 2401. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. IVa, 1°(a), ADR]

In the case of substances which are not referred to by name in the list of substances (marginal 2401), the trade name or the chemical name must be used. This description must be underlined in red and followed by particulars of the Class and item number (together with the letter, if any) of the substance presenting a comparable degree of danger, and the initials "ADR" or "RID" [e.g. IVa, 21°(n), ADR].

## Class IVa

2434  
(contd)

(2) In the case of hydrocyanic acid [1<sup>o</sup>(a)] the following must be certified in the transport document: "The nature of the goods, and the packaging, are in conformity with the provisions of ADR".

(3) In the case of substances of 41<sup>o</sup>, the following must be certified in the transport document: "Stored in the open air and in a dry place for not less than three days".

(4) In the case of consignments of substances which polymerize easily, the following must be certified in the transport document: "The necessary steps have been taken to prevent polymerization during carriage".

2435-  
2442C. Empty packagings

2443

(1) Bags of 91<sup>o</sup> and 92<sup>o</sup> must be packed in cases or in impermeable bags preventing any loss of substances.

(2) Other packagings and tanks of 91<sup>o</sup> and 92<sup>o</sup> must be closed in the same manner and leak-proof in the same degree as though they were full.

(3) Packagings of 91<sup>o</sup> forwarded otherwise than as a complete load, tanks, and packed bags of 91<sup>o</sup> shall bear labels conforming to model No. 4; packed bags of 92<sup>o</sup> shall bear labels conforming to model No. 4 A (see Appendix A.9).

(4) The description in the transport document must be: "Empty packaging, IVa, 91<sup>o</sup> (or 92<sup>o</sup>), ADR (or RID)". This description must be underlined in red.

2444-  
2449



## CLASS IVb. RADIOACTIVE SUBSTANCES

Introductory Notes

1. Radioactive substances whose specific activity does not exceed 0.002 microcurie per gramme are not subject to the provisions of Class IVb.
2. Radionuclides are divided into eight groups, as specified in Appendix A.6, marginal 3600.
3. Every radionuclide not listed in the aforesaid marginal 3600, but whose identity is known, is to be classified according to its atomic number and physical half-life, in conformity with Appendix A.6, marginal 3601.

Every radionuclide whose identity is not known is to be classified in Group I.

4. (a) Mixed fission products, as produced by the fission of fissile substances, are to be classified in Group II; the activity of such mixtures is the total activity of all the radionuclides present.
- (b) A mixture belonging to only one radioactive decay chain and in which the proportions of the radionuclides are natural is to be considered as consisting of a single radionuclide.

The Group and activity are those of the first member of the chain present unless a radionuclide X has a half-life longer than that of the first member and an activity greater than that of any other member including the first at any time during carriage; in such a case, the Group in which the mixture is to be classified is the Group of the said radionuclide X, and the activity of the mixture is the maximum activity of that radionuclide during carriage.

- (c) In the case of a mixture belonging to only one radioactive decay chain and in which the proportions of the radionuclides are greater than the natural proportions as a result of artificial physical or chemical enrichment, the member or members of the chain which are present in proportions greater than the natural proportions are to be treated as separate radionuclides; the rest of the chain is to be treated as under (b) above.

## CLASS IVb

5. The activity of uranium and natural thorium shall be as calculated by using the activity-mass relationships given in Appendix A.6, marginal 3602.

6. If the identity and activity of each radionuclide are known, the admissible activity of each radionuclide shall be such that the sum of  $F_1 + F_2 + \dots + F_8$  is not greater than unity; in which sum

$$F_1 = \frac{\text{total activity of the radionuclides of Group I}}{\text{applicable activity limit per package for radionuclides of Group I}}$$

$$F_2 = \frac{\text{total activity of the radionuclides of Group II}}{\text{applicable activity limit per package for radionuclides of Group II}}$$

and so on up to

$$F_8 = \frac{\text{total activity of the radionuclides of Group VIII}}{\text{applicable activity limit per package for radionuclides of Group VIII}}$$

Note: The mixtures referred to in 4 (b) above are to be considered as a single radionuclide.

7. For the purpose of applying the above formula in cases where the identities of all the radionuclides are known but the respective activities of all or some of them are not known, the radionuclides whose respective activities are not known are all to be classified in the most restrictive Group among those to which the radionuclides as a whole belong (their total activity must necessarily be known, either directly or by subtracting the total activity of the radionuclides whose respective activities are known from the total activity of the contents of the package).

If the identity of all or some of the radionuclides is not known, the said radionuclides are to be classified in Group I, as indicated in 3 above.

## Class IVb

1. List of Substances

Among the substances and articles covered by the heading of Class IVb, only those listed in marginal 2451 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR. 2450

Note: 1. Radioactive substances which may explode on contact with a flame or which are more sensitive to shock or to friction than dinitrobenzene are not to be accepted for carriage.

2. Radioactive substances which have a critical temperature lower than 50°C or, at this temperature, a vapour pressure greater than 3 kg/cm<sup>2</sup>, must be contained in receptacles which likewise meet the requirements of marginals 2132 and 2141 to 2148.

3. Radioactive substances which are liable to spontaneous ignition must be contained in packagings the design of which has been approved by the competent authority referred to in marginal 2452(7)(a). This authority shall make out a certificate attesting that the design has been approved and specifying by a detailed description the substance for which the packaging may be used.

4. The following are to be considered to be radioactive substances in a special form:

(a) radioactive substances in the form of a solid mass

- (i) which either has no over-all dimension of less than 0.5 mm or has at least one dimension of not less than 5 mm;
- (ii) which does not melt, sublime or ignite at temperatures not exceeding 538°C;
- (iii) which neither breaks nor crumbles upon application of the percussion test laid down for the sample capsule in Appendix A.6, marginal 3662 (2);
- (iv) which does not dissolve or convert into dispersible reaction products at a rate exceeding 50 microgrammes per gramme of substance when immersed for one week in water at 20°C having a pH value between 6 and 8 and a conductivity not exceeding 10 micromhos/cm;
- (v) which does not convert into dispersible reaction products at a rate exceeding 50 microgrammes per gramme of substance when exposed for one week to air at 30°C;

and

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(contd)

- b) other radioactive substances contained in a capsule
- (i) which either has no over-all dimension of less than 0.5 mm or has at least one dimension of not less than 5 mm;
  - (ii) which is constructed of materials that meet the requirements stated in (a)(ii) to (v) above, except that the temperature referred to in (a)(ii) shall be 800°C;
  - (iii) the design of which is shown to meet the requirements of Appendix 6, marginal 3662.

5. Radioactive substances whose activity per package exceeds the following values are to be considered to be large sources:

- (a) 5000 Ci in the case of substances in a special form meeting either the definition in Note 4 (a) above; or the definition in Note 4 (b) above when the capsule is not used as a containment vessel within the meaning of marginal 2452(3)(a);
- (b) in the case of other substances

Group	I	II	III	IV	V	VI	VII	VIII
Activity	20 Ci	20 Ci	200 Ci	200 Ci	5000 Ci	50 000 Ci	50 000 Ci	50 000 Ci

6. For the purposes of ADR, plutonium-239, plutonium-241, uranium-233, uranium-235 and all substances containing any one of these radionuclides are to be considered to be fissile substances. All other radioactive substances are to be considered to be non-fissile.

- 2451
- 1° (a) Non-fissile radioactive substances, other than those of 1°(b), 2° and 5°;
  - (b) Non-fissile radioactive substances in a special form (see Note 4 to marginal 2450) other than those of 2° and 5°.
- For (a) and (b), see also marginal 2451a.
- 2° Non-fissile radioactive substances constituting large sources (see Note 5 to marginal 2450).
  - 3° Fissile radioactive substances not covered by 4° or 5°. See also marginal 2451a.

## Class IVb

- 4° Fissile radioactive substances constituting large sources. 2451  
5° Radioactive substances of low specific activity [see marginal 2457(1)]. (contd)  
See also marginal 2451a.  
6° Empty packagings which have contained radioactive substances. See also  
marginal 2451a, under 2. C.

Substances and articles handed over for carriage in conformity 2451a  
with the provisions set forth in 1 below and in 2.A, B, C or D below, as  
applicable, are subject neither to the provisions for this Class contained  
in this Annex nor to those contained in Annex B other than those of  
marginal 42 302(1) and (2).

1. (a) The dose rate at any point on the external surface of the package  
does not exceed 0.5 mR/h or equivalent [see marginal 2453 (1)(c) 2,  
Note 7];  
(b) the non-fixed radioactive contamination on any external surface  
of the package does not exceed the levels laid down in  
Appendix A.6, marginal 3604;  
(c) the package contains no other goods other than articles, instru-  
ments or apparatus connected with the use of these substances;  
(d) apart from articles of 2.D., the package does not contain more than  
15 g of uranium-233 or 15 g of uranium-235 or 15 g of plutonium-239  
or 15 g of plutonium-241 or 15 g of any combination of these  
radionuclides.
2. A. Radioactive substances whose activity does not exceed:
  - (i) per package:
    - 0.01 mCi in the case of radionuclides of Group I; or
    - 0.1 mCi in the case of radionuclides of Group II; or
    - 1 mCi in the case of radionuclides of Groups III, IV, V  
or VI or of radioactive substances in a special form, as  
defined in marginal 2450, Note 4 (a); or
    - 25 Ci in the case of radionuclides of Groups VII or VIII;

## Class IVb

2451a  
(contd)

(ii) in the case of tritium in the form of tritium oxides, in aqueous solution, a concentration of 0.5 mCi per millilitre; on condition that these substances are packed in such a way that there can be no leakage in normal carriage.

The receptacle designed to prevent the escape of radioactive substances during carriage must bear the marking "RADIOACTIVE" in capital letters where it can be seen before the receptacle is opened.

The transport document shall bear the words: "Substances of Class IVb, 2451a, ADR, (or RID)"

Note: Radioactive substances having some other dangerous characteristic shall also be subject to the provisions of the relevant Class.

- B. Pieces of apparatus such as watches, electronic tubes or instruments, or other manufactured articles in which radioactive substances are incorporated in a form not easily dispersible (this requirement does not apply to substances of Group VII) and whose activity per apparatus, instrument or article does not exceed:
- 0.1 mCi in the case of radionuclides of Group I; or
  - 1 mCi in the case of radionuclides of Group II; or
  - 10 mCi in the case of radionuclides of Group III; or
  - 50 mCi in the case of radionuclides of Group IV or of radioactive substances in a special form, as defined in marginal 2450, Note 4(a); or
  - 1 Ci in the case of radionuclides of Groups V or VI; or
  - 25 Ci in the case of radionuclides of Groups VII or VIII;
- on condition that:
- (i) such pieces of apparatus, instruments or articles are firmly secured in strong packagings;
  - (ii) the dose rate at a distance of 10 cm from the apparatus, instrument or article before packing does not exceed 10 mR/h or equivalent;

## Class IVb

(iii) the total activity per package does not exceed:

2451a  
(contd)

- 1 mCi in the case of radionuclides of Group I; or
- 50 mCi in the case of radionuclides of Group II; or
- 3 Ci in the case of radionuclides of Groups III or IV; or
- 20 Ci in the case of radioactive substances in a special form, as defined in marginal 2450, Note 4(a); or
- 1 Ci in the case of radionuclides of Groups V or VI; or
- 200 Ci in the case of radionuclides of Groups VII or VIII.

The transport document shall bear the words: "Substances of Class IVb, 2451a, ADR (or RID)"

- C. Empty packagings which have contained radioactive substances ( $6^\circ$ ), on condition that they are in good condition, cleaned internally and closed as though they were full.
- The packaging shall bear the words: "Empty packaging having contained radioactive substances". The markings prescribed in marginal 2452(5)(d) and (6)(c), and the labels prescribed in marginal 2459(1) and (3), must no longer be visible.
- The transport document shall bear the words "Empty packaging, IVb, 2451a, ADR (or RID)".
- D. Manufactured articles, other than fuel elements, in which the sole radioactive substance is natural or depleted uranium (e.g. packaging in which uranium is used for shielding radioactive substances) on condition that:
- (i) the surface of the uranium is covered by an inactive metal sheath; and that
  - (ii) the activity per article does not exceed 3 curies.

## Class IVb

2. ProvisionsA. Packages1. General conditions of packing

2452

(1) Packagings for substances of 1<sup>o</sup> to 5<sup>o</sup> must be of Type A or Type B, the specifications for which are set out under (2) to (6) below. However, for substances of 5<sup>o</sup> see also marginal 2457.

(2) (a) All components necessary to ensure compliance with the provisions of this Class concerning packaging are considered to be part of the packaging.

The packaging may, in particular, comprise one or more receptacles, an absorbent material, structural components for spacing, a radiation shield, and devices for cooling, for absorbing mechanical shocks, and for thermal insulation. In the case of substances of 2<sup>o</sup> and 4<sup>o</sup> these components and devices may include the vehicle and stowage system when these are an integral part of the packaging.

Any item added to the package at the time of carriage and not an integral part of the packaging must not be of such nature as to reduce the safety of the packaging.

(b) In choosing materials used for the manufacture of packagings, account must be taken of the variations in temperature which the packages might undergo during carriage or storage. For this purpose, temperatures of -40°C and +70°C are acceptable limits.

(c) The packaging must be such that any acceleration, vibration, or oscillation occurring during carriage cannot impair the effectiveness of the closing devices of the various receptacles or damage the packaging as a whole. In particular, nuts and bolts must not be able to work loose and the other securing devices must not be able to open accidentally.



## Class IVb

(3) (a) The packaging must include a leak-proof containment vessel kept closed by a reliable closing device. 2452  
(contd)

Note: By "containment vessel" is meant the receptacle provided to ensure retention of the radioactive substance even if the receptacles inside the vessel break or leak. By "reliable closing device" is meant a device which cannot open by itself, can only be opened intentionally, and will withstand the effect of a possible increase of pressure inside the vessel.

The design of the containment vessel must take the radiolytic decomposition of liquids and other vulnerable materials into account.

(b) The containment vessel and its closing devices must be made of materials capable of withstanding any corrosive action of the contents.

(c) The containment vessel must be of sufficient strength to remain leak-proof if the ambient pressure is reduced to 0.5 atmosphere (absolute).

(d) If the containment vessel is not integral with the rest of the packaging, it must be fitted with a reliable closing device completely independent of the packaging.

(e) The packaging must be so designed that no increase in internal pressure can cause the containment vessel to break. A containment vessel intended to contain liquids or gases must be made of metal.

(f) The containment vessel must, if necessary, be provided with a radiation shield either outside or inside. The containment vessel may also be so designed as itself to constitute such a shield.

(g) If the containment vessel is surrounded by a radiation shield, the shield must be so designed that the vessel cannot escape from it. If the shield and the vessel together form a unit that is not integral with the rest of the packaging, the shield must be fitted with a reliable closing device completely independent of the packaging.

## Class IVb

2452  
(contd)

(h) Where attenuation of the radiation is obtained wholly or partly by maintaining the distance between the containment vessel and the outer casing of the packaging, the packaging must be so designed that this distance is maintained.

(i) Packaging which includes thermal insulation for the purpose of conforming to the provisions governing packagings of Type B [marginal 2452(6)(a)] must be so designed that the thermal insulation remains, or the parts of the packaging intended to provide this insulation remain, effective in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3649.

(4)(a) The smallest external dimension of a package must not be less than 10 centimetres.

(b) Packages must be so designed that they can be easily handled and properly secured during carriage.

(c) Packages whose gross weight is between 10 and 50 kg must be fitted with handholds for manual handling.

(d) Packages whose gross weight exceeds 50 kg must be so designed that they can be safely handled by mechanical means.

(e) The lifting attachments provided on a package must conform to normal safety standards. Safety margins allowing for "snatch lifting" must be provided.

(f) Lifting attachments other than those referred to in (e) above, and any other feature on the outer surface of the packaging which could be used to lift the package, must either be completely covered or removed for carriage or be designed to support the whole weight of the package with a sufficient safety margin for "snatch lifting".

## Class IVb

(g) So far as possible, the outside of the packaging must be free from projections. Devices such as safety valves and cocks must be recessed or protected by steel covers. The outer surfaces must also, so far as is possible in practice, be so designed and finished that they can be easily decontaminated.

2452  
(contd)

(h) Every package must bear on the outside a device, such as a seal, which cannot break easily and by means of which unlawful opening of the package can be detected.

(i) Non-fixed radioactive contamination on every part of the outer surface of the package must be kept at the lowest level possible and shall not in any case exceed the levels specified in the table in Appendix A.6, marginal 3604.

Type-A packagings

(5) (a) A packaging of Type A must be able to prevent any loss or dispersal of the radioactive contents and must retain its shielding properties in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646.

(b) A packaging of Type A intended for the carriage of liquids must in addition be able to prevent any loss or dispersal of the radioactive contents in the conditions resulting from the test prescribed in Appendix A.6, marginal 3647, unless the containment vessel contains a sufficient quantity of absorbent material to absorb twice the volume of the liquid contents and one of the following conditions is fulfilled:

1. the absorbent substance is inside the protective shield; or
2. the absorbent substance is outside the shield and it can be shown that if the liquid contents are absorbed by that substance the dose rate will not exceed 1000 mR/h or equivalent at the surface of the package.

## Class IVb

2452  
(contd)

(c) A packaging of Type A intended for the carriage of tritium of Group VII having an activity exceeding 200 Ci or of other gases having an activity exceeding 20 Ci must in addition be able to prevent any loss or dispersal of the contents if the containment vessel is subjected separately to the test prescribed in Appendix A.6, marginal 3647.

(d) In a packaging of Type A intended for the carriage of gamma emitters having an activity exceeding 3 Ci and including a shield made of a material having a melting point below 815°C, the radioactive substance must be inside a closed steel vessel (which may be the containment vessel). No external dimension of this vessel shall be less than 5 cm and its wall thickness shall be at least 2 mm.

Note: For the purposes of this provision, only radioactive substances more than 10 per cent of whose disintegrations comprise a gamma emission of an energy exceeding 100 keV are considered to be gamma emitters.

The outer surface of the steel vessel or, if this vessel is inside a shield made of a material having a melting point above 815°C, the outer surface of the shield must bear conspicuously the trefoil symbol appearing on the labels, together with the word "RADIOACTIVE" in capital letters not less than 1 cm high, the whole being engraved, stamped, or reproduced by other means resistant to fire and water.

(e) Every package comprising a packaging of Type A must bear on its outer surface the words "Type A" inscribed in a conspicuous and durable manner. A packaging whose design is subject to approval [see marginal 2456(11)] must, in addition, bear an identification mark [see marginal 2456(11)(d)] and a marking by which each packaging can be individually identified [see marginal 2456(11)(e)] inscribed in a conspicuous and durable manner on its outer surface.

## Class IVb

Type-B packagings2452  
(contd)

(6) (a) A packaging of Type B must, in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651,

- (i) prevent any loss or dispersal of the radioactive contents;
- (ii) retain its shielding properties sufficiently to ensure that the radiation level at 1 m from the surface of the packaging will not exceed 1000 mR/h if the package contains a sufficient quantity of iridium-192 to emit, before the tests, radiation of 10 mR/h at 1 m from the surface of the package. If a packaging of Type B is intended for a particular radionuclide, that radionuclide may be used instead of iridium-192 as the emitter of reference.

(b) A packaging of Type B must, in addition, be such that the containment vessel remains leak-proof when the packaging is immersed in water to a depth of 15 m.

(c) Every packaging of Type B must bear, conspicuously engraved, stamped or reproduced by any other means resistant to fire and to water on the outer surface of the outermost fire-resistant and water-resistant receptacle, the trefoil symbol appearing on the labels.

(d) Every package consisting of a Type-B packaging must bear, inscribed on its outer surface in a conspicuous and durable manner, the words "Type B", the identification mark [see (7)(c)(ii)], the indication enabling each packaging to be individually identified [see (7)(c)(iii)] and, if the design of the package is subject to approval in conformity with marginal 2456(11), the identification mark prescribed in (11)(d) of that marginal.

## Class IVb

2452  
(contd)

(7) The following provisions govern the approval of designs for Type-B packagings:

- (a) Type-B packaging designs prepared in a country which is a Party to ADR must be approved by the competent authority of that country; if the country in which the design was prepared is not a Party to ADR, carriage may take place on condition that:
  - (i) the country in question has certified that the packaging complies with the technical requirements of ADR and the certificate is validated by the competent authority of the first ADR country reached by the consignment;
  - (ii) if no certificate has been supplied, the packaging design is approved by the competent authority of the first ADR country reached by the consignment;
- (b) the application for approval must include:
  - (i) a qualitative description of the proposed contents, specifying in particular their physical and chemical state and the nature of the radiation emitted;
  - (ii) a detailed description of the design, accompanied by accurate drawings and specifications of the materials and methods of construction used;
  - (iii) a report on the tests carried out and the results obtained, or proof by calculation that the design satisfies the conditions laid down, or any other pertinent evidence;
  - (iv) the operating instructions proposed by the designer for application by users when approval has been obtained;
- (c) (i) the competent authority shall issue a certificate for each design approved or validated. The certificate shall specify any special restrictions on use which arise from the nature of the contents, and shall include all specific instructions for the use of the packaging in question;

## Class IVb

- (ii) when a packaging design prepared in a country which is a Party to ADR is approved, the competent authority shall assign to that design an identification mark consisting of:
- the distinguishing sign of the country<sup>\*/</sup> of the competent authority; and
  - the approval number (in uninterrupted numerical sequence);
- (iii) the aforesaid identification mark must be accompanied by an indication enabling each packaging manufactured in conformity with the approved design to be individually identified; the competent authority shall grant approval only on condition that the designer issues the said indication and notifies the competent authority thereof;
- (d) the manufacturer, the sender or the user of a packaging of an approved design must be able to furnish a complete certification to the competent authority that the methods and materials used in making the packaging conform to the standards approved for the design; the competent authority may carry out inspections of the packaging even during its manufacture.

2452  
(contd)

(1) Packages must belong to one of the following three Categories: 2453

- (a) Category I - WHITE, if the dose rate of the radiation emanating from the package does not at any time during carriage exceed 0.5 mR/h or equivalent at any point on the outer surface of the package [see also under (b)];
- (b) Category II - YELLOW, if the limit indicated in sub-paragraph (a) above is exceeded, or if, whether that limit is exceeded or not, the package belongs to Nuclear Safety Class II [see marginal 2456(5)], and:
1. the dose rate of the radiation emanating from the package does not at any time during carriage exceed:

<sup>\*/</sup> The signs referred to are the national distinguishing signs for motor vehicles in international traffic.

## Class IVb

2453  
(contd)

- (i) 10 mR/h or equivalent at any point on the outer surface of the package;
  - (ii) 0.5 mR/h or equivalent at a distance of 1 metre from the centre of the package<sup>\*/</sup>;
2. the transport index [see (4) and (5) below] does not at any time during carriage exceed 0.5;
- (c) Category III - YELLOW, if one at least of the limits indicated in (b) above is exceeded and:
1. the dose rate of the radiation emanating from the package does not at any time during carriage exceed:
    - (i) 200 mR/h or equivalent at any point on the outer surface of the package;
    - (ii) 10 mR/h or equivalent at a distance of 1 metre from the centre of the package<sup>\*/</sup> [see, however, under (2) below];
  2. the transport index [see (4) and (5) below] does not at any time during carriage exceed 10 [see, however, under (2) below].

Note: The unit of measurement of the dose rate is the milliroentgen per hour or equivalent. The number of "milliroentgens per hour (mR/h) or equivalent" is the sum of the following values:

- (a) in the case of gamma and/or X-rays: the number of milliroentgens per hour;
- (b) in the case of beta radiation: the number of millirads per hour in air;
- (c) in the case of neutrons: the number of "milliroentgens per hour or equivalent", calculated in accordance with Appendix A.6, marginal 3603, or the number of millirems per hour.

<sup>\*/</sup> If one of the over-all external dimensions of the package exceeds 2 m, this dose rate must not be exceeded either at the surface at the end of the long axis of the package or at 1 m from the long axis.



## Class IVb

(2) The limits prescribed under (c)1(ii) and 2 above may be exceeded on condition that the package is carried as a complete load.

2453  
(contd)

(3) Measurements of dose rate must be made with a suitable instrument. The value thus obtained shall be deemed to be the real dose rate. However, neutron fluxes may be either computed or measured.

(4) For packages not belonging to Nuclear Safety Class II, the measured value of the effect of the radiation emanating from packages of Category II - YELLOW and Category III - YELLOW shall be indicated by a transport index. The transport index is:

- (a) the number expressing the maximum dose rate in mR/h or equivalent at 1 metre from the centre of the package; or
- (b) if one of the over-all external dimensions of the package exceeds 2 metres, the number expressing whichever of the following two values is the higher:
  - (i) the maximum dose rate in mR/h or equivalent at the surface at the end of the long axis of the package; and
  - (ii) the maximum dose rate in mR/h or equivalent at 1 metre from the long axis.

(5) In the case of a package of Nuclear Safety Class II, the transport index is defined as the larger of the following two values:

- (a) the number expressing the maximum dose rate referred to under (4)(a) or (b) above; and
- (b) the number obtained by dividing 50 by the "permissible number" for such packages [see marginal 2456 (10) (b)].

(6) The figure expressing the transport index must be rounded upwards to the first decimal.

## Class IVb

2. Packing of a single substance

2454

(1) Substances of 1<sup>o</sup>(a) shall be contained in packagings of Type A or Type B. The maximum activity per package is limited to the quantities indicated below:

(a) Type-A packagings:

<u>Group</u>	I	II	III	IV	V	VI	VII	VIII
<u>Activity</u>	1 mCi	50 mCi	3Ci	20Ci	20Ci	1000Ci	1000Ci	1000Ci

(b) Type-B packagings:

<u>Group</u>	I	II	III	IV	V	VI	VII	VIII
<u>Activity</u>	20Ci	20Ci	200Ci	200Ci	5000Ci	50 000Ci	50 000Ci	50 000Ci

(2) Substances of 1<sup>o</sup>(b) shall be contained in packagings of Type A or Type B. The maximum activity per package is limited:

(a) for Type-A packagings: to 20 Ci;

(b) for Type-B packagings: to 5000 Ci;

on condition that, in the case of a substance not complying with the definition in Note 4(a) to marginal 2450 but complying with that in Note 4(b), the capsule is not used as a containment vessel. If the capsule is used as a containment vessel, the maximum activity is limited to the values listed under(1) (a) and (b) above.

(3) Every design of capsule shall be subject to approval by the competent authority of the country in which it was designed. On approval as aforesaid a certificate shall be issued attesting that the design complies with the requirements of this Class and specifying the nature of the radioactive substance which may be contained in capsules of that design.

The manufacturer, the sender or the user of a radioactive substance in a capsule of an approved design must be able to furnish to the competent authority a complete certification that the methods and materials used in making the capsule conform to the standards approved for the design.

## Class IVb

(1) Substances of 2° shall be contained in packagings of Type B which must, in addition, satisfy the following conditions: 2455

- (a) the materials of the packaging and all components and internal structures must be physically and chemically compatible with one another and with the contents of the package;
- (b) every package whose containment vessel, in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651, shows a pressure producing in the material of which the vessel is made a stress exceeding its yield stress at the temperature which it would probably reach during the tests must be fitted with a pressure-relief system;
- (c) all valves, other than pressure-relief valves, through which the radioactive contents or the primary heat-transfer medium could escape and cause external contamination must be protected against any unauthorized manipulation and be provided with additional leak-proof protection capable of retaining any leakage from the valve;

Note: By "primary heat-transfer medium" is meant any gas, liquid or solid, other than the radioactive source, inside the containment vessel.

- (d) the packaging must be so designed that no lifting device fixed to the package can, when used as intended, produce in any material of the packaging a stress exceeding one-third of its yield stress;
- (e) every retaining device fixed to the package must be so designed that the forces developing therein during carriage will not prevent the package from satisfying the provisions of this Class.

(2) The package must be so designed and made that:

- (a) the heat generated inside the package by the radioactive substances it contains will not, at any time during carriage, reduce the effectiveness of the packaging. Particular attention shall be paid to effects of heat which may:

## Class IVb

2455  
(contd)

- (i) alter the arrangement, geometrical form or physical state of the contents or, if the substance is enclosed in a metal vessel or a receptacle, cause the metal vessel, the receptacle or the substance to melt;
  - (ii) reduce the effectiveness of the packaging through cracking due to thermal stresses or through melting of the radiation shield;
  - (iii) accelerate corrosion in the presence of moisture.
- (b) the temperature of the accessible surfaces of the package does not exceed 50°C. However, this limit shall be 82°C if the package is carried as a complete load.

(3) For the purposes of paragraphs (1) and (2) above, the package shall be assumed to be at ambient temperature, sheltered from wind and directly exposed to the sun, account being taken of diurnal variations of insolation. However, for the purposes of paragraph (2)(b) the package shall be assumed to be in the shade.

Any device intended to intercept solar radiation shall be deemed to be part of the package if it is shown either that such a device will retain its effectiveness in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646, or that its continued effectiveness can be ensured by the supplementary requirements to be met during carriage which are specified in the certificate of approval of the consignment [see (9)(c)]

Approval of package designs

- (4) A design which complies with all the following provisions must be approved by the competent authority designated in marginal 2452(7)(a):
- (a) the package must satisfy the requirement of marginal 2452(6)(a)(i) in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651;

## Class IVb

- (b) the design must satisfy the requirement under (a) without the use of filters;
- (c) a package containing a primary heat-transfer medium must not use a system allowing continuous pressure relief during carriage;
- (d) the package must not comprise any containment-vessel venting device which would release radioactive substances into the environment in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651;
- (e) if the maximum normal operating pressure of the containment vessel, added to any differential pressure below atmospheric pressure at mean sea-level to which it may be subjected, exceeds  $0.35 \text{ kg/cm}^2$ , the containment vessel must be capable of withstanding a pressure at least equal to one-and-one-half times the sum of these pressures. The stress at this pressure, at the highest operating temperature expected, must not exceed 75 per cent of the yield stress or 40 per cent of the breaking strength of the material of which the containment vessel is made;
- Note: By "maximum normal operating pressure" is meant the highest pressure above atmospheric pressure at mean sea level which can arise inside the containment vessel in conditions of temperature and solar radiation corresponding to ambient conditions during carriage and based on a period of one year.
- (f) if, at the maximum normal operating pressure, the package is subjected to the thermal test prescribed in Appendix A.6, marginal 3650, the pressure in the containment vessel must not exceed that corresponding to the yield stress of the material of which the vessel is made at the highest temperature which the vessel may reach during the test;
- (g) in the case of a package requiring the use of a primary heat-transfer medium or containing a gaseous or liquid source, the maximum normal operating pressure must not exceed  $7 \text{ kg/cm}^2$ ;

2455  
(contd)

## Class IVb

2455  
(contd)

- (h) in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3648 to 3651, a package comprising a primary heat-transfer medium must not lose more than the lesser of the following amounts of that medium in one week:
- if the medium is in the form of a gas or a vapour, 0.1 per cent by volume, or 5 litres at 0°C and at a pressure of 760 mm of mercury;
  - if the medium is liquid, 0.1 per cent by volume or 0.5 litre;
- (i) absence of leakage from the source in normal conditions must not depend upon a mechanical cooling system;
- (k) an ancillary external cooling device must not be used to satisfy the requirement of (c);
- (l) in the case of a package comprising a liquid primary heat-transfer medium or containing a radioactive substance in liquid form, the containment vessel must remain undamaged at a temperature of -40°C.

Notes: 1. For the purposes of the conditions laid down in (2) and (3) and of the above requirements concerning pressure, it is assumed that the ambient conditions are as follows:

- (1) temperature : 38°C;
- (ii) insolation:
  - packages with flat surfaces:
    - if carried horizontally:
      - base: nil;
      - other surfaces : 800 cal/cm<sup>2</sup> during 12 hours per day;
    - if not carried horizontally:
      - 200 cal/cm<sup>2</sup> during 12 hours per day;
  - packages with curved surfaces:
    - 400 cal/cm<sup>2</sup> during 12 hours per day.

2. However, for packages which are to be carried only between certain specified countries, conditions other than those stated in Note 1 above may be allowed if the competent authority of each of the countries concerned consents thereto. Similarly, in such cases a temperature differing from that specified in sub-paragraph (1) of this paragraph may be allowed by agreement among the competent authorities.

## Class IVb

(5) (a) The application for approval of package designs conforming to paragraph (4) must include, in addition to the particulars prescribed in marginal 2452(7)(b), a detailed description of the proposed contents and complete evidence that the design in question satisfies the provisions of this marginal. If the package is designed to withstand a maximum normal operating pressure exceeding  $1.05 \text{ kg/cm}^2$ , the application for approval must, with respect to the materials used in the manufacture of the containment vessel, state in particular the specifications, the samples to be taken and the tests to be performed. 2455  
(contd)

(b) The certificate of the competent authority shall include, in addition to the particulars referred to in marginal 2452(7)(c), a detailed description of the authorized contents and any appropriate information concerning the assumed ambient conditions (temperature, solar radiation) on which the approval is based [see paragraph (4), Note 2].

(6) (a) If a package design does not comply with all the requirements of paragraph (4) it must be approved by the competent authority referred to in marginal 2452(7)(a) and by the competent authority of each country in whose territory the package is to be carried.

(b) Such a design shall be deemed to satisfy the requirements of marginal 2452(6)(a)(i) if, in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651, the activity which can be liberated in one week in the form of contaminated gas, vapour or liquid coming from the primary heat-transfer medium or from the space originally occupied by that medium does not exceed the following values:\*/

Group	Activity	Group	Activity	Group	Activity
I	1 mCi	III	3 Ci	V	20 Ci
II	50 mCi	IV	20 Ci	VI	1000 Ci

\*/ In the case of rare gases, the Group is that in which they are classified when uncompressed. Tritium and its compounds are considered as belonging to Group IV.

## Class IVb

2455  
(contd)

(c) Where such a package is designed to liberate contaminated gas or vapour coming from the gaseous or liquid primary heat-transfer medium by continuous venting in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646, and taking into account the ambient conditions assumed during carriage (temperature, solar radiation), the activity thus liberated must not exceed the following rates:\*/

Group	Maximum rate	Group	Maximum rate	Group	Maximum rate
I	0,05 $\mu$ Ci/h	III	0.15 mCi/h	V	1 $\mu$ Ci/h
II	2,5 $\mu$ Ci/h	IV	1 mCi/h	VI	0.05 Ci/h

Such a package must be carried only as a complete load.

(7) In addition to the requirements of (5), the following requirements apply to the approval of packages conforming to the conditions laid down in (6):

- (a) the application for approval must expressly state, where appropriate, the maximum and minimum ambient conditions (temperature, solar radiation) which can be expected to be encountered during carriage and which have been taken into account in the design; it must also specify the additional requirements to be complied with during carriage\*\*/;
- (b) the certificate of the competent authority must state the additional requirements to be complied with during carriage\*\*/. The approval by the competent authority of each country in whose territory

\*/ In the case of rare gases, the Group is that in which they are classified when uncompressed. Tritium and its compounds are considered as belonging to Group IV.

\*\*/ i.e. measures during carriage which, while not prescribed in the ordinary way by this marginal, are considered necessary to ensure the safety of the package during carriage; in particular, any human intervention to measure temperature or pressure or to carry out periodic pressure reduction. These measures must also allow for the possibility of an unexpected delay.



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the package is to be carried may take the form of validation of the certificate issued by the competent authority referred to in marginal 2452(7)(a). Every competent authority giving its approval in this form must specify any <sup>\*</sup>other additional requirements compliance with which during carriage it considers necessary.

2455  
(contd)

Approval of carriage and prior notification

(8) The following provisions apply to approval of the carriage of packages whose design satisfies the requirements stated in (4):

- (a) the consignment must be approved by the competent authority of its country of origin. However, if that country is not a Party to ADR, the first ADR country reached by the consignment shall be deemed to be its country of origin;
- (b) the application for approval must contain:
- either a detailed certification by the manufacturer, the sender or the user that the methods and materials used in making the packaging conform to the specifications of the approved design, or a document, issued by the competent authority of the country in which the packaging was manufactured, certifying that that authority has received such detailed certification from the manufacturer, the sender or the user; and
  - all the information necessary to show that the consignment complies with the relevant requirements; in addition, any special loading, unloading or handling procedures must be specified where appropriate;
- (c) when approving a consignment, the competent authority shall issue a certificate:
- (1) specifying the measures which the sender must take before handing over the consignment for carriage; and

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<sup>\*</sup>/ i.e. measures during carriage which, while not prescribed in the ordinary way by this marginal, are considered necessary to ensure the safety of the package during carriage; in particular, any human intervention to measure temperature or pressure or to carry out periodic pressure reduction. These measures must also allow for the possibility of an unexpected delay.

## Class IVb

2455  
(contd)

- (ii) attesting that no additional requirements to be complied with during carriage are necessary<sup>\*/</sup>;
- (d) arrangements must be made in advance with the carriers concerned so that they can take the necessary steps for carriage in good time;
- (e) the consignment must be notified in advance to the competent authority of each of the countries in which the package is to be carried. The notification must contain the information necessary to enable the competent authority to identify the consignment.

(9) Approval of the carriage of packages covered by (6) is governed by the following provisions in addition to the provisions of (8) other than (8)(c)(ii):

- (a) carriage must be approved by every competent authority whose certificate of approval of the package design, or whose validation, both as referred to in (7)(b), lays down additional requirements to be complied with during carriage<sup>\*/</sup>, except such authority as may have waived the right of approval of carriage at the time when the package design was approved;
- (b) the application for approval of carriage must specify the mode of carriage, the transport equipment, the intended route, and any additional requirements under (7)(b) to be complied with during carriage;
- (c) the certificate of approval of carriage issued by a competent authority must state the additional requirements, to be complied with during carriage, which it has prescribed under (7)(b). The approval by a competent authority may take the form of validation of the certificate issued by another competent authority.

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<sup>\*/</sup> i.e. measures during carriage which, while not prescribed in the ordinary way by this marginal, are considered necessary to ensure the safety of the package during carriage; in particular any human intervention to measure temperature or pressure or to carry out periodic pressure reduction. These measures must also allow for the possibility of an unexpected delay.

## Class IVb

(10) If a consignment passes through countries whose languages differ, any additional requirements prescribed under (9)(c) to be complied with during carriage shall be drawn up in an official language of the country of origin of the consignment [see (8)(a) above] and in an official language of each of the countries whose competent authority has prescribed such requirements.

2455  
(contd)

Provisions to be complied with before handing over for carriage

(11) Before a packaging is put into service for the first time, the sender shall make sure by tests:

- (a) that the shielding and heat-transfer characteristics of the packaging meet the specifications of the approved design;
- (b) if the containment vessel of a packaging has been designed to withstand a maximum normal operating pressure exceeding  $0.35 \text{ kg/cm}^2$ , that the containment vessel of each packaging, manufactured in conformity with the approved design, meets the prescribed specifications.

(12) Before handing each consignment over for carriage the sender shall:

- (a) hold the package until the temperature of the system has reached equilibrium, unless it has been established to the satisfaction of the competent authority that the conditions of equilibrium will be in conformity with the requirements of this marginal;
- (b) make sure, in the case of packages other than those referred to in (6)(c), that the closure of the package is sufficiently effective to prevent any leakage of contaminated gas or vapour from the primary heat-transfer medium from exceeding the following rates<sup>\*/</sup>:

Group	Maximum rate	Group	Maximum rate	Group	Maximum rate
I	0,001 $\mu\text{Ci/h}$	III	3 $\mu\text{Ci/h}$	V	0.02 $\text{mCi/h}$
II	0,05 $\mu\text{Ci/h}$	IV	0.02 $\text{mCi/h}$	VI	1 $\text{mCi/h}$

<sup>\*/</sup> In the case of rare gases, the Group is that in which they are classified when uncompressed. Tritium and its compounds are considered as belonging to Group IV.

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2456 (1) Substances of 3<sup>o</sup> and 4<sup>o</sup> shall, except in the cases referred to in (2), be packed in conformity with the provisions of (3) to (13) below.

In addition:

- (a) substances of 3<sup>o</sup> shall be packed either in conformity with the provisions of marginal 2454(1) or, in the case of radioactive substances in a special form in accordance with marginal 2450, Note 4, in conformity with the provisions of marginal 2454(2);
- (b) substances of 4<sup>o</sup> shall be packed in conformity with the provisions of marginal 2455(1) to (7), (11) and (12).

Notes re (b) 1. Special cases of irradiated fuels:

in connexion with marginal 2455(1)(a), the design of the containment vessel must allow for the production of gas by radiolysis and by chemical reaction between the fuel elements and any liquid primary heat-transfer medium;

in connexion with marginal 2455(5)(a), the sender must furnish a certificate, issued by the competent authority of the country in which the fuel was irradiated, confirming, on the basis of the information available to that authority regarding the fuel after irradiation, any assumptions made, in analysing the safety requirements, concerning the behaviour of the fuel.

2. In connexion with marginal 2455(11)(a), concerning provisions to be complied with before handing over for carriage, if neutron absorbers are necessary to prevent criticality, the sender must carry out neutron multiplication tests to ensure that the poisoning is adequate.

(2) The provisions of paragraphs (3) to (13) below are not applicable:

- (a) to packages each containing not more than a total of 15 g of uranium-233 or 15 g of uranium-235 or 15 g of plutonium-239 or 15 g of plutonium-241 or 15 g of any combination of these radionuclides;
- (b) to packages containing natural or depleted uranium, whether irradiated or not, in whatever quantity;

## Class IVb

- (c) to packages containing homogeneous hydrogeneous solutions or mixtures in which the only fissile component is one of the following elements:
- (i) U-233 or U-235 when the atomic ratio H:U-233 or H:U-235 is greater than 5200, which in common aqueous solutions corresponds to a concentration of U-233 or U-235 of less than 5 g per litre; or
  - (ii) plutonium when the atomic ratio H:Pu is greater than 7600, which in common aqueous solutions corresponds to a concentration of plutonium of less than 3.5 g per litre;

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(contd)

on condition that the maximum quantities of fissile substance per package do not exceed:

U-235: 800 g; U-233: 500 g; Pu: 500 g.

If the package contains several fissile substances, the ratio of hydrogen atoms to fissile atoms must be greater than 7600 and the maximum quantity of fissile substance must not exceed 500 g per package;

- (d) to packages containing substances in which the only fissile component is enriched uranium whose uranium-235 content does not exceed 1 per cent of the total weight of uranium and is homogeneously distributed in the substance, a further condition being that this substance is not arranged in lattice form in the package.

General provisions relating to nuclear safety

(3) All fissible substances must be so packed and dispatched that criticality cannot be reached in any foreseeable circumstances of carriage. In particular, the following possibilities must be taken into account:

- (a) penetration of water into the packages;
- (b) loss of effectiveness by built-in neutron absorbers or moderators;
- (c) a change in the arrangement of the contents leading to greater reactivity either inside the packaging or, through leakage of the contents, outside the packaging;

## Class IVb

- 2456  
(contd)
- (d) reduction of spaces between packages or between contents;
  - (e) immersion of packages in water or burial in snow; and
  - (f) intermingling of packages.

(4) In the case of an irradiated nuclear fuel or of unspecified fissile substances, the following assumptions shall be made:

- (a) Irradiated nuclear fuel. A nuclear fuel whose degree of irradiation is not known and whose reactivity decreases with burn-up shall be considered as non-irradiated for purposes of criticality-risk verification. If the reactivity increases with burn-up, the fuel shall be considered as irradiated fuel in a state of maximum reactivity. If the degree of irradiation is known, the reactivity of the fuel can be evaluated accordingly.
- (b) Unspecified fissile substances (such as residues or scrap). In the case of fissile substances whose enrichment, mass, concentration, moderating ratio, or density is not known or cannot be determined, each unknown parameter shall be ascribed the value giving maximum reactivity in the foreseeable conditions.

(5) Packages of fissile substances other than the packages referred to in (2) above must be of one of the following Classes:

- (a) Nuclear Safety Class I: packages not presenting any nuclear risk, whatever their number and arrangement, in any foreseeable circumstances of carriage;
- (b) Nuclear Safety Class II: packages not presenting any nuclear risk if limited in number, whatever their arrangement and in any foreseeable circumstances of carriage;
- (c) Nuclear Safety Class III: packages which, while not presenting any nuclear risk, cannot be considered to be packages of Nuclear Safety Class I or II.

## Class IVb

Special provisions relating to packages of Nuclear Safety Class I2456  
(contd)

(6) All packages of Nuclear Safety Class I must be so designed that in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646, and disregarding the exceptions provided for in marginal 3643(1),

- (a) water cannot penetrate into the containment vessel; and
- (b) the configuration of the contents and the geometry of the containment vessel cannot be significantly altered.

(7) The nuclear safety criteria for packages of Nuclear Safety Class I are as follows:

(a) In the case of an individual package:

1. the following circumstances shall be assumed to exist:

- (i) the package exhibits the maximum damage which, demonstrably, would occur if it were subjected to the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651, disregarding the exceptions provided for in marginal 3643(1);
- (ii) water can penetrate into all void spaces; however, if the design of the packaging incorporates special features intended to prevent water from penetrating, even as a result of human error, into certain of the void spaces, those spaces may be assumed to contain no water if such an assumption is specifically approved by the competent authority of the country in which the packaging was designed and by the competent authorities of all the countries in whose territory the package is to be carried;

2. the contents of the containment vessel shall not exceed 80% of the mass<sup>\*/</sup> of a similar system of fissile and non-fissile contents, having the same form and configuration, which would be critical in the

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<sup>\*/</sup> In the case of fuel elements, the mass is expressed in terms of the number of elements.

## Class IVb

2456  
(contd)

conditions of 1. above, taking into account its physical and chemical characteristics, including any change which might occur in those characteristics in the conditions of 1. above and in the conditions of moderation and reflection specified below:

(i) with the substance inside the containment vessel:

the most reactive configuration and moderation foreseeable in the conditions of 1;

full reflection by the water around the containment vessel or such greater reflection around the containment vessel as might be caused by the material of the packaging itself;

and, in addition:

(ii) if any part of the substance can escape from the containment vessel in the conditions of 1. above;

the most reactive configuration and moderation; and  
full reflection by the water around this substance.

(b) In addition, in the case of groups of packages:

1. any number of undamaged packages, in any arrangement whatever, intermingled with any number of other undamaged packages of Nuclear Safety Class I, themselves in any arrangement whatever, must remain sub-critical; for this purpose, the term "undamaged" means the condition in which the packages are designed to be handed over for carriage;
2. 250 such packages, when damaged, must remain sub-critical if they are stacked in any way whatever and a reflector equivalent to water is immediately adjacent to the stack on three mutually adjoining sides; for this purpose, the term "damaged" means the evaluated or demonstrated condition of each package resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646



## Class IVb

and 3648 to 3651, disregarding the exceptions provided for in marginal 3643(1). It shall further be assumed that homogeneous hydrogenous moderation occurs to such extent between the packages and such quantity of water compatible with the test results penetrates into the package that maximum reactivity ensues.

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(contd)

(8) Compliance with the nuclear safety criteria set out in (7) above shall be verified either by

- (a) applying the method of calculation shown in Appendix A.6, marginal 3621; or by
- (b) checking compliance with the data of the physical model shown in Appendix A.6, marginal 3622.

Special provisions relating to packages of Nuclear Safety Class II

(9) All packages of Nuclear Safety Class II must be so designed that in the conditions resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646, and disregarding the exceptions provided for in marginal 3643(1),

- (a) neither the volume, nor any spacing, on the basis of which the nuclear safety of a group of such packages has been calculated can be reduced by more than 5 per cent;
- (b) water cannot penetrate into the containment vessel; and
- (c) the configuration of the contents and the geometry of the containment vessel cannot be significantly altered.

(10) The nuclear safety criteria for packages of Nuclear Safety Class II are as follows:

- (a) In the case of an individual package the criteria applicable shall be the same as those set out in (7)(a).
- (b) In addition, a "permissible number" shall be calculated for each package design of Nuclear Safety Class II, such that:

## Class IVb

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(contd)

1. a group of undamaged packages equal to five times the "permissible number" will remain sub-critical if the packages are stacked in any arrangement, one directly on top of another, and a reflector equivalent to water is immediately adjacent to the stack on all sides; for this purpose, the term "undamaged" means the condition in which the packages are designed to be handed over for carriage;
2. a group of damaged packages equal to twice the "permissible number" will remain sub-critical if the packages are stacked in any arrangement and a reflector equivalent to water is immediately adjacent to the stack on all sides; for this purpose, the term "undamaged" means the evaluated or demonstrated condition of each package resulting from the tests prescribed in Appendix A.6, marginals 3642 to 3646 and 3648 to 3651, disregarding the exceptions provided for in marginal 3643 (1). It shall further be assumed that homogeneous hydrogenous moderation occurs to such extent between the packages and such quantity of water compatible with the test results penetrates into the package that maximum reactivity ensues.

Approval of designs of packages of Nuclear Safety Classes I, II and III

(11) The following provisions apply to the approval of designs of packages of Nuclear Safety Classes I, II and III:

- (a) Package designs prepared in a country which is a Party to ADR must be approved by the competent authority of that country; if the country in which the design was prepared is not a Party to ADR, carriage may take place on condition that:
  - (i) the country in question has certified that the design complies with the technical requirements of ADR and the certificate is validated by the competent authority of the first ADR country reached by the consignment;
  - (ii) if no certificate has been supplied, the package design is approved by the competent authority of the first ADR country reached by the consignment.

## Class IVb

- (b) The application for approval must include all the information necessary to satisfy the competent authority that the design complies with the provisions of this marginal. 2456 (contd)
- (c) The competent authority shall issue a certificate for each design approved or validated. This certificate shall include:
- |   |   |
|---|---|
| (i) for packages of Nuclear Safety Class I:     | a detailed description of the permitted contents;   |
| (ii) for packages of Nuclear Safety Class II:   | a detailed description of the permitted content or contents and the "permissible number" or "permissible numbers" in conformity with paragraph (10)(b); |
| (iii) for packages of Nuclear Safety Class III: | a detailed description of the individual consignment and particulars of any special precautions to be taken during carriage,                            |

and, in each case, all appropriate instructions for using the packaging.

- (d) When a package design prepared in a country which is a Party to ADR is approved, the competent authority shall assign to that design an identification mark consisting of:
- the distinguishing sign of the country<sup>\*/</sup> of the competent authority; and
  - the approval number (in uninterrupted numerical sequence).
- (e) The afore-mentioned identification mark must be accompanied by an indication enabling each packaging manufactured in conformity with the approved design to be individually identified; the competent authority shall grant approval only on condition that the designer furnishes the afore-mentioned indication and notifies the competent authority thereof.

<sup>\*/</sup> See footnote to marginal 2452 (7)(c)(ii).

## Class IVb

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(contd)
- (f) In addition, except in the case of packages of Nuclear Safety Class I satisfying the requirements of Appendix A.6, marginal 3622, and conforming to the permitted contents values specified in Tables I to X appertaining to those requirements, each package design must be approved by the competent authority of each country in which the package is to be carried; such approval may take the form of validation of the certificate issued by the competent authority referred to in (a) above. In the case of packages of Nuclear Safety Class III, every competent authority giving its approval must specify any other special precautions compliance with which during carriage it considers necessary.
- (g) The manufacturer, the sender or the user must be able to furnish to the competent authority a complete certification that the methods and materials used in making the packaging conform to the standards approved for the design; the competent authority may carry out inspections of the packaging even during its manufacture.

Approval of carriage and prior notification

(12) The following provisions apply to approval of the carriage of packages of Nuclear Safety Classes I and II containing substances of 4<sup>o</sup>, and of packages of Nuclear Safety Class III:

- (a) Consignments of packages of Nuclear Safety Classes I and II containing substances of 4<sup>o</sup> and whose design satisfies the requirements of marginal 2455(4):
1. the consignment must be approved by the competent authority of its country of origin. However, if that country is not a Party to ADR, the first ADR country reached by the consignment shall be deemed to be its country of origin;

## Class IVb

2. the application for approval must contain:  
either a detailed certification by the manufacturer, the sender or the user that the methods and materials used in making the packaging conform to the specifications of the approved design, or a document, issued by the competent authority of the country in which the packaging was manufactured, certifying that that authority has received such detailed certification from the manufacturer, the sender or the user; and  
all the information necessary to show that the consignment complies with the relevant requirements; in addition, any special loading, unloading or handling procedures must be specified where appropriate;
3. when approving a consignment, the competent authority shall issue a certificate:  
(i) specifying the measures which the sender must take before handing over the consignment for carriage; and  
(ii) attesting that no additional requirements to be complied with during carriage are necessary<sup>\*/</sup>;
4. arrangements must be made in advance with the carriers concerned so that they can take the necessary steps for carriage in good time;
5. the consignment must be notified in advance to the competent authority of each of the countries in which the package is to be carried. The notification must contain the information necessary to enable the competent authority to identify the consignment.

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(contd)

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<sup>\*/</sup> i.e. measures during carriage which, while not prescribed in the ordinary way by this marginal, are considered necessary to ensure the safety of the package during carriage; in particular any human intervention to measure temperature or pressure or to carry out periodic pressure reduction. These measures must also allow for the possibility of an unexpected delay.

## Class IVb

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(contd)

(b) The carriage of packages of Nuclear Safety Class III and the carriage of packages of Nuclear Safety Classes I and II containing substances of 4<sup>o</sup>, approval of the design of which packages is referred to in marginal 2455(6), are governed by the following provisions in addition to the provisions of (a) other than (a)3(ii):

1. carriage must be approved by every competent authority whose certificate of approval of the package design, or whose validation both as referred to in marginal 2456 (11)(c)(iii) or 2455 (7)(b), lays down special precautions or additional requirements to be complied with during carriage, except such authority as may have waived the right of approval of carriage at the time when the package design was approved;
2. the application for approval of carriage must specify the mode of carriage, the transport equipment, the intended route, and any special precautions or additional requirements under marginal 2456 (11)(c)(iii) or 2455 (7)(b) to be complied with during carriage;
3. the certificate of approval of carriage issued by a competent authority must state the special precautions or additional requirements, to be complied with during carriage, which it has prescribed under marginal 2456 (11)(c)(iii) or 2455 (7)(b).  
If the sending of other consignments together with packages of Nuclear Safety Class III is prohibited, that prohibition must be expressly stipulated in the certificate of approval. The approval by a competent authority may take the form of validation of the certificate issued by another competent authority.

(13) If a consignment passes through countries whose languages differ, any special precautions or additional requirements prescribed under (12)(b)3. above to be complied with during carriage shall be drawn up in an

## Class IVb

official language of the country of origin of the consignment  $\sqrt{\text{see}}$  2456  
(12)(a)1.7 and in an official language of each of the countries whose (contd)

(1) The substances of 5<sup>o</sup> are the following: 2457

- (a) uranium or thorium ores and physical or chemical concentrates of these ores;
- (b) non-irradiated natural or depleted uranium and non-irradiated natural thorium;
- (c) tritium, in the form of tritium oxides, in aqueous solution, on condition that the concentration does not exceed 5 mCi/ml;
- (d) substances in which the activity is uniformly distributed and the estimated concentration per gramme does not exceed:
  - (i) 0.1 microcurie in the case of radionuclides of Group I; or
  - (ii) 5 microcuries in the case of radionuclides of Group II; or
  - (iii) 300 microcuries in the case of radionuclides of Groups III and IV.

In the case of fissile substances, the limits specified in marginal 2456 (2)(a), (c) or (d) must be respected. If these limits are exceeded, the substances fall under marginal 2451, 3<sup>o</sup>, but without application of the provisions of marginal 2456 (1)(a);

- (e) articles which, while made of non-radioactive substances, are externally contaminated by a radioactive substance; on condition that:
  - (i) the radioactive substance is not in an easily dispersible form and the average surface contamination on 1 m<sup>2</sup> does not exceed:
    - 0.1 microcurie/cm<sup>2</sup> in the case of alpha emitters of Group I; or
    - 1 microcurie/cm<sup>2</sup> in the case of other radionuclides;
  - (ii) the articles are suitably wrapped or enclosed.

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(contd)

(2) Up to the levels of activity per package specified in marginal 2454 (1) (a), the substances of low specific activity referred to in paragraph (1)(a) and (b), if not in liquid or gaseous form, may be dispatched in industrial packagings which need only comply with the requirements of marginal 2452(2) and (4) and be strong enough to prevent any loss of the contents in normal carriage. In the case of substances in a special form, the limit specified in marginal 2454 (2)(a) shall apply.

Substances referred to in paragraph (1)(b) which are in the form of a massive solid shall be so packed as to prevent movement of any kind liable to cause abrasion of the substance; if they are in some other compact solid form they shall be placed in a metal vessel inert towards them, or in a sheathing of other resistant materials, so that the surfaces of the substances are not exposed.

(3) Substances of low specific activity carried as a complete load may be dispatched in industrial packagings strong enough to prevent any loss of the contents in normal carriage, but the packages need not comply with the requirements of marginals 2452 and 2453.

Substances referred to in paragraph (1)(b) which are in the form of a massive solid must be so packed as to prevent movement of any kind liable to cause abrasion of the substance; if they are in some other compact solid form they shall be placed in a metal vessel inert towards them, or in a sheathing of other resistant materials, so that the surfaces of the substances are not exposed.

2458

3. Mixed packing

A package containing radioactive substances must not contain in addition anything other than articles and instructions necessary for the use of those substances; however, the presence of such articles must not constitute an additional risk through the possibility of a reaction with the radioactive contents.



## Class IVb

4. Marking and danger labels on packages (see Appendix A.9)

2459

(1) With the exception of packages containing substances of 5<sup>o</sup> carried as a complete load, every package containing substances and articles of Class IVb shall bear, on two opposite sides,

labels conforming to model No. 6A in the case of packages of

Category I - WHITE;

labels conforming to model No. 6B in the case of packages of

Category II - YELLOW; and

labels conforming to model No. 6C in the case of packages of

Category III - YELLOW [see marginal 2453(1)].

(2) The labels shall be completed by the addition of the following particulars in clear and indelible characters:

- (a) alongside the word "contents", the name of the radionuclide or substance whose presence constitutes the principal danger in the event of damage to the package (for example: "strontium-90"; "irradiated uranium");
- (b) alongside the word "activity", the total activity of the contents in curies;

Note: The total activity may also be expressed in microcuries, millicuries or kilocuries on condition that the prefixes "micro", "milli" and "kilo" are written in full.

- (c) on labels of models Nos. 6B and 6C the transport index shall also be entered, in the largest possible figures, in the box provided for the purpose.

(3) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner on other packagings.

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2460

B. Particulars in the transport document

2461

(1) The description of the goods in the transport document must be: "Radioactive substances"; it must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" (e.g. IVb, 1<sup>o</sup>(a), ADR). This description must be followed by the words "The nature of the goods, and the packaging, are in conformity with the provisions of ADR".

(2) The transport document must also include the following particulars for each package:

- (a) the Group or Groups of the radionuclides contained in the radioactive substances dispatched;
- (b) the names of the radioactive substances, a description of their physical and chemical state and, in the case of a radioactive substance in a special form, an indication whether that substance is in the form indicated under (a) or in that indicated under (b) of marginal 2450, Note 4;
- (c) the activity in curies (or in microcuries, millicuries or kilocuries, on condition that the prefixes "micro", "milli" and "kilo" are written in full);
- (d) the Category of package (I-WHITE, II-YELLOW, III-YELLOW);
- (e) the transport index (for Categories II-YELLOW and III-YELLOW);
- (f) the type of packaging, (industrial, A or B);
- (g) for consignments of fissile substances:
  - (i) in the case of exemption provided for in marginal 2456(2)(a), (c) or (d): the quantity in grammes, concentration, U-235 enrichment, as appropriate;
  - (ii) in other cases, the Nuclear Safety Class to which the package belongs, in conformity with marginal 2456(5).

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(3) The following shall be annexed to the transport document if necessary and as appropriate:

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(contd)

- (a) 1. A copy of the certificate of approval of the packaging design, in the case of substances referred to in marginal 2450, Note 3;
  2. a copy of the certificate of approval or validation of a packaging design of Type B [see marginal 2452(7)(c)(i)]; or an excerpt from that certificate showing the identification mark of the approved model;
  3. a copy of the certificate of approval of the capsule design [see marginal 2454(3)];
  4. a copy of the certificate of approval of the package design for substances of 2<sup>o</sup> and 4<sup>o</sup> [see marginal 2455(5)], accompanied, where appropriate, by copies of the certificates of approval or validation issued by competent authorities other than the authority which issued the original certificate [see marginal 2455(7)(b)];
  5. a copy of the certificate of approval of the package design for fissile substances of 3<sup>o</sup> and 4<sup>o</sup> [see marginal 2456(11)(c)], accompanied, where appropriate, by copies of the certificates of approval or validation issued by competent authorities other than the authority which issued the original certificate [see marginal 2456(11)(f)].
- (b) 1. A copy of the certificate of approval of carriage of substances of 2<sup>o</sup> [see marginal 2455(8)(c)], accompanied, where appropriate, by copies of the approvals or validations of competent authorities other than the authority which issued the original certificate [see marginal 2455(9)(c)];

## Class IVb

2461  
(contd)

2. a copy of the certificate of approval of carriage of packages of Nuclear Safety Class I and of Nuclear Safety Class II containing substances of 4<sup>o</sup>, and of packages of Nuclear Safety Class III [see marginal 2456(12)]<sup>7</sup>, accompanied, in the case of packages of Nuclear Safety Class III, or of packages of Nuclear Safety Class I or Nuclear Safety Class II containing substances of 4<sup>o</sup> and the approval of whose design is referred to in marginal 2455(6), by copies of the approvals or validations of competent authorities other than the authority which issued the original certificate [see marginal 2456(12)(b)3]<sup>7</sup>;
3. in the case of packages of Nuclear Safety Class III the loading of which together with other consignments is prohibited [see marginal 2456(12)(b)3]<sup>7</sup>, an instruction to that effect.

2462-  
2468C. Empty packagings

2469

(1) Empty packagings which do not comply with the provisions of marginal 2451a 1. and 2.C are subject to the provisions applicable to packages containing substances of this Class.

(2) Empty tanks must be closed as though they were full.

2470-  
2499

## CLASS V. CORROSIVE SUBSTANCES

1. List of substances

Among the substances and articles covered by the heading of Class V, those which are listed in marginal 2501 or are covered by a collective heading of that marginal are subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR. 2500

A. Acid substances 2501

## (a) Inorganic acids

1° Sulphuric acid:

- (a) sulphuric acid containing more than 85% pure acid ( $H_2SO_4$ ), and oleum (fuming sulphuric acid);
- (b) sulphuric acid containing more than 75% but not more than 85% pure acid ( $H_2SO_4$ );
- (c) sulphuric acid containing not more than 75% pure acid ( $H_2SO_4$ );
- (d) waste sulphuric acid, completely denitrated:

Note: Incompletely denitrated waste sulphuric acid is not to be accepted for carriage.

(e) lead sludge containing sulphuric acid;

Note: Lead sludge containing less than 3% free acid is a substance of Class IVa (see marginal 2401, 73°).

(f) storage batteries filled with sulphuric acid.

For (a) to (d), see also marginal 2501a, under (a).

2° Nitric acid:

- (a) nitric acid containing more than 70% pure acid ( $HNO_3$ );
- (b) nitric acid containing more than 55% but not more than 70% pure acid ( $HNO_3$ );
- (c) nitric acid containing not more than 55% pure acid ( $HNO_3$ ).

For (a) to (c), see also marginal 2501a, under (a) and (b).

## Class V

- 2501 (contd) 3° Mixed nitrating acids (sulphuric and nitric acids)  
 (a) mixed nitrating acids containing more than 30% pure nitric acid ( $\text{HNO}_3$ );  
 (b) mixed nitrating acids containing not more than 30% pure nitric acid ( $\text{HNO}_3$ );  
Note: For waste mixed nitrating acids, see 1°(d).  
 For (a) and (b), see also marginal 2501a, under (a) and (b).
- 4° Perchloric acid in aqueous solutions containing not more than 50% pure acid ( $\text{HClO}_4$ ). See also marginal 2501a, under (a).  
Note: Aqueous solutions of perchloric acid containing more than 50% but not more than 72.5% pure acid ( $\text{HClO}_4$ ) are substances of Class III(c) (see marginal 2371, 3°). Solutions containing more than 72.5% pure acid are not to be accepted for carriage; the same applies to mixtures of perchloric acid with any liquid other than water.
- 5° Solutions of hydrochloric acid, solutions of hydrobromic acid, solutions of hydriodic acid, and mixtures of sulphuric acid and hydrochloric acid. See also marginal 2501a, under (a).  
Notes: 1. Mixtures of nitric acid with hydrochloric acid are not to be accepted for carriage.  
 2. Liquefied anhydrous hydrobromic acid and liquefied hydrochloric acid are substances of Class 1d (see marginal 2131, 5° and 10°).
- 6° Hydrofluoric acid (aqueous solutions):  
 (a) containing more than 60% but not more than 85% pure acid (HF);  
 (b) containing not more than 60% pure acid (HF).  
Notes: 1. Aqueous solutions containing more than 85% pure acid (HF) are not to be accepted for carriage.  
 2. Liquefied anhydrous hydrofluoric acid is a substance of Class 1d (see marginal 2131, 5°).  
 For (a) and (b), see also marginal 2501a, under (a).
- 7° Fluoboric acid [aqueous solutions containing not more than 78% pure acid ( $\text{HBF}_4$ )]. See also marginal 2501a, under (a).  
Note: Solutions of fluoboric acid containing more than 78% pure acid ( $\text{HBF}_4$ ) are not to be accepted for carriage.

## Class V

- 8° Fluosilicic acid [hydrofluosilicic acid ( $H_2SiF_6$ )] . See also marginal 2501a, under (a). 2501 (contd)
- 9° Stabilized sulphur trioxide. See also marginal 2501a, under (a) and (c).

Note: Unstabilized sulphur trioxide is not to be accepted for carriage.

- (b) Inorganic halides, acid salts and similar halogenated substances.
- 11° Liquid halides and similar halogenated substances (except compounds of fluorine) which, in contact with moist air or water, give off acid fumes, such as:

- (a) antimony pentachloride ( $SbCl_5$ ), chlorosulphonic acid [ $SO_2(OH)Cl$ ], disulphur dichloride (stabilized) ( $S_2Cl_2$ ), chromyl chloride (chromium oxychloride) ( $CrO_2Cl_2$ ), phosphoryl chloride (phosphorus oxychloride) ( $POCl_3$ ), phosphorus trichloride ( $PCl_3$ ), silicon tetrachloride ( $SiCl_4$ ), sulphuryl chloride ( $SO_2Cl_2$ ), thionyl chloride ( $SOCl_2$ ), titanium tetrachloride ( $TiCl_4$ ) and stannic chloride ( $SnCl_4$ );

Note: Unstabilized disulphur dichloride is not to be accepted for carriage.

- (b) phosphorus tribromide ( $PBr_3$ ), pyrosulphuryl chloride ( $S_2O_5Cl_2$ ) and thiophosphoryl chloride ( $PSCl_3$ ).

For (a) and (b), see also marginal 2501a, under (a).

- 12° Solid halides and similar halogenated substances (except compounds of fluorine) which, in contact with moist air or water, give off acid fumes, such as:

aluminium chloride (anhydrous) ( $AlCl_3$ ), antimony trichloride (technical) ( $SbCl_3$ ), phosphorus pentachloride ( $PCl_5$ ) and zinc chloride ( $ZnCl_2$ ).

See also marginal 2501a, under (a) and (d).

Note: Non-anhydrous aluminium chloride is not to be accepted for carriage.

## Class V

- 2501 (contd) 13° Bisulphates. See also marginal 2501a, under (a).  
*Note:* Bisulphates are not subject to the provisions of ADR if the sender certifies in the transport document that the products are free from free sulphuric acid and are dry.
- 14° Bromine. See also marginal 2501a, under (a).
- 15° The following compounds of fluorine:  
(a) difluorides;  
(b) ammonium fluoride, chromic fluoride, antimony pentafluoride;  
(c) boron trifluoride-acetic acid complex, boron trifluoride-propionic acid complex;  
(d) bromine trifluoride (BrF<sub>3</sub>), bromine pentafluoride (BrF<sub>5</sub>).  
For (a) to (d), see also marginal 2501a, under (a).
- (c) Organic substances:
- 21° The following acids:  
(a) chloroacetic acids:  
1. monochloroacetic and trichloroacetic acids (solid);  
2. dichloroacetic acid (liquid) and mixtures of chloroacetic acids;  
(b) formic acid containing not less than 70% pure acid;  
(c) glacial acetic acid and its aqueous solutions containing more than 80% pure acid;  
(d) propionic acid containing more than 80% pure acid;  
(e) acetic anhydride.  
For (a) to (e), see also marginal 2501a, under (a).
- 22° Liquid acid halides, such as:  
acetyl chloride and benzoyl chloride. See also marginal 2501a, under (a).
- 23° Alkyl and aryl chlorosilanes:  
(a) alkyl chlorosilanes and aryl chlorosilanes having a flash-point below 21°C;



## Class V

- (b) alkyl chlorosilanes and aryl chlorosilanes having a flash-point of 21°C or above; 2501 (contd)

Note: Substances of this item number which give off inflammable gases on contact with water are not to be accepted for carriage.

For (a) and (b), see also marginal 2501a, under (a).

B. Substances of basic character

- 31° (a) Sodium hydroxide and potassium hydroxide (caustic soda, caustic potash), in lumps, in flakes or in powdered form. See also marginal 2501a, under (a);
- (b) Sodium hydroxide filled in the molten state.
- 32° Sodium hydroxide and potassium hydroxide in solutions (soda lye, potash lye), also in mixtures (caustic lyes), alkaline solutions of phenol, cresols and xylenols, alkaline residues from oil refineries. See also marginal 2501a, under (a).
- 33° Storage batteries filled with alkaline solutions. See also marginal 2501a, under (a).
- 34° Hydrazine in aqueous solutions containing not more than 72% hydrazine ( $N_2H_4$ ). See also marginal 2501a, under (a).
- Note: Aqueous solutions containing more than 72% hydrazine ( $N_2H_4$ ) are not to be accepted for carriage.
- 35° Alkyl and aryl amines and polyamines, such as: 1,2-diaminoethane (ethylenediamine), hexamethylenediamine, triethylenetetramine. See also marginal 2501a, under (a).
- 36° Sodium sulphide containing not more than 70%  $Na_2S$ .
- Note: Sodium sulphide containing more than 70%  $Na_2S$  is not to be accepted for carriage.
- 37° Hypochlorite solutions:
- (a) hypochlorite solutions containing more than 50 g available chlorine per litre;
- (b) hypochlorite solutions containing not more than 50 g available chlorine per litre.
- For (a) and (b), see also marginal 2501a, under (a).

## Class V

2501  
(contd)C. Other corrosive substances41° Solutions of hydrogen peroxide:

- (a) aqueous solutions of hydrogen peroxide containing more than 40% but not more than 60% hydrogen peroxide;
- (b) aqueous solutions of hydrogen peroxide containing more than 6% but not more than 40% hydrogen peroxide.

For (a) and (b), see also marginal 2501a, under (a).

Note: Hydrogen peroxide and its aqueous solutions containing more than 60% hydrogen peroxide are substances of Class IIIc (see marginal 2371, 1°).

D. Empty receptacles and empty tanks51° Empty packagings, uncleaned, and empty tanks, uncleaned, except those which have contained substances of 13° and 36°.

2501a

Substances handed over for carriage in conformity with the following provisions are not subject to the provisions relating to this Class contained in this Annex or in Annex B:

- (a) substances of 1° (a) to (d), 2° (b) and (c), 3° (b), 4° to 9°, 11° to 15°, 21° to 23°, 31° (a), 32°, 34°, 35°, 37° and 41°, in quantities not exceeding 1 kg for each substance, on condition that they are packed in leak-proof receptacles incapable of being attacked by the contents and that these receptacles are packed with care in strong, leak-proof wooden packagings with leak-proof closures;
- (b) substances of 2° (a) and 3° (a), in quantities not exceeding 200 g for each substance, on condition that they are packed in leak-proof receptacles incapable of being attacked by the contents and that these receptacles are secured, not more than 10 per case, in wooden cases with inert absorbent cushioning materials;
- (c) sulphur trioxide (9°), whether or not mixed with a small quantity of phosphoric acid, on condition that it is packed in strong sheet-metal boxes weighing not more than 15 kg, hermetically closed and fitted with a handle;

## Class V

- (d) phosphorus pentachloride (12°) compressed into blocks weighing not more than 10 kg each, on condition that these blocks are packed in welded and air-tight sheet-metal boxes placed, either singly or in groups, in a crate, a case or a container; 2501a (contd)
- (e) metal-cased storage batteries filled with an alkaline solution (33°), on condition that they are so closed as to prevent leakage of the solution and are protected against short circuits.

2. ProvisionsA. Packages1. General conditions of packing

(1) Packagings shall be so closed and arranged as to prevent any loss of the contents. For the special provision relating to storage batteries [1° (f) and 33°], see marginals 2504 and 2516; for hypochlorite solutions of 37° and hydrogen peroxide of 41°, see marginals 2520 and 2521 respectively. 2502

(2) The materials of which the packagings and their closures are made must not be liable to attack by the contents, or cause the contents to decompose, or form harmful or dangerous compounds therewith.

(3) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular, where substances are in the liquid state or in solution, receptacles and their closures must, unless the section headed "Packing of a single substance or of articles of the same kind" provides otherwise, be able to withstand any pressure which, the presence of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose, a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage. Inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance or of articles of the same kind", inner packagings may be enclosed in outer packagings, either singly or in groups.

## Class V

2502  
(contd)

(4) Bottles and other glass receptacles must be free from faults liable to impair their strength; in particular, internal stresses must have been suitably relieved. The walls must be not less than 3 mm thick in the case of receptacles weighing, with their contents, more than 35 kg and not less than 2 mm in the case of other receptacles.

The tightness of the closure system must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any loosening of the closure system during carriage.

(5) When receptacles made of glass, porcelain, stoneware or similar materials, or of a suitable plastics material, are prescribed or allowed, they must, in the absence of any provision to the contrary, be provided with protective packagings. Receptacles made of glass, porcelain, stoneware or similar materials shall be carefully secured therein by cushioning materials. Cushioning materials shall be suited to the nature of the contents.

2503

2. Packing of a single substance or of articles of the same kind

- (1) Substances of 1<sup>o</sup> (a) to (e) and 2<sup>o</sup> to 5<sup>o</sup> shall be packed:
- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
  - (b) in hermetically closed cylindrical receptacles made of glass, porcelain, stoneware or similar material. These receptacles shall be secured by absorbent cushioning materials in a wooden case or other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or

## Class V

(c) in hermetically closed glass carboys, which shall be secured by absorbent cushioning materials in a wooden case or other outer packaging of sufficient strength, or firmly fixed in iron or wicker hampers. The carboys shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. 2503 (contd)

(2) Substances of 1° (a) to (e), 2° and 3° may also be packed in hermetically closed metal drums having a suitable lining in the case of substances of 1° (b), (c), (d) and (e) and a lining only if necessary in the case of substances of 2° and 3°. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg they shall be fitted with rolling hoops.

(3) Substances of 1° (a) to (e), 2° and 5° may also be packed in hermetically closed receptacles made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paper-board or of some other material of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg.

(4) Substances of 5° may also be packed in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres, with walls of sufficient thickness, which shall be not less than 4 mm in the case of receptacles of 50 litres or over; the openings shall be closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles need have no protective packaging if the competent authority of the country of departure so allows. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg.

(5) In the case of substances of 2° (a), 3° (a) and 4°, the absorbent cushioning materials must be incombustible; in the case of substances of 2° (b), they shall be fire-resistant.

Storage batteries filled with sulphuric acid [1° (f)] shall be secured in battery cases. The batteries shall be protected against short circuits and be secured by absorbent cushioning materials in a wooden packing case. Packing cases shall be fitted with means of handling. 2504

## Class V

2504  
(contd)

Nevertheless, if the storage batteries are made of a shock-resistant material and their upper part is so designed that the acid cannot splash out in dangerous quantities, the batteries need not be packed, but they must be protected against any short circuit, sliding, falling or damage, and be fitted with means of handling. No dangerous quantities of acid must appear on the outside of packages.

Similarly, storage batteries forming part of the equipment of vehicles need not have special packaging if the vehicles are loaded upright on their wheels and secured against falling.

2505

Substances of 6<sup>o</sup>, 7<sup>o</sup> and 8<sup>o</sup> shall be packed:

- (a) in hermetically closed metal receptacles, with a suitable lining if necessary, of a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 90% of their capacity. Such a package must not weigh more than 100 kg; or
- (b) in hermetically closed metal drums, with a suitable lining if necessary. The drums shall not be filled beyond 90% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (c) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles shall not be filled beyond 90% of their capacity. Such a package must not weigh more than 100 kg.

2506

(1) Sulphur trioxide (9<sup>o</sup>) shall be packed:

- (a) in soldered receptacles made of black sheet-iron or tin-plate, or in hermetically closed bottles made of black sheet-iron, tin-plate or copper; or
- (b) in flame-sealed glass receptacles, or in hermetically closed receptacles made of porcelain, stoneware or similar materials; or
- (c) in steel drums which have been pressure-tested at 1.5 kg/cm<sup>2</sup>.

## Class V

(2) The receptacles referred to in (a) and (b) above shall be secured by incombustible and absorbent cushioning materials in packagings made of wood, black sheet-iron or tin-plate. 2506 (contd)

Substances of 11<sup>o</sup> shall be packed: 2507

- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in hermetically closed metal drums, with a suitable lining if necessary. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (c) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically closed glass carboys, which shall be secured by absorbent cushioning material in a wooden case or in some other outer packaging of sufficient strength. The carboys shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg.

Substances of 12<sup>o</sup> shall be packed:

- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, which must not contain more than 5 kg of substance each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or

2508

## Class V

- 2508 (contd)
- (b) in hermetically closed metal receptacles, with a suitable lining if necessary, which must not contain more than 15 kg of substance each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
  - (c) in hermetically closed metal drums, with a suitable lining if necessary. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
  - (d) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. Such a package must not weigh more than 100 kg; or
  - (e) in hermetically closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg;
  - (f) zinc chloride may also be packed in hermetically closed bags, made of a suitable plastics material, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg.
- 2509
- Substances of 13<sup>o</sup> and 15<sup>o</sup> shall be packed:
- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, which must not contain more than 5 kg of substance each; however, glass receptacles are not accepted for fluorides of 15<sup>o</sup>. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
  - (b) in hermetically closed metal receptacles, with a lead lining if necessary, which must not contain more than 15 kg of substance each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or



## Class V

- (c) in hermetically closed metal drums, with a lead lining if necessary. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. Such a package must not weigh more than 100 kg; or
- (e) in hermetically closed bags, made of a suitable plastics material, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (f) in hermetically closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg; or
- (g) in stout paper bags of four plies, lined with a hermetically closed bag made of a suitable plastics material. Such a package must not weigh more than 55 kg.

2509  
(contd)

(1) Bromine ( $14^{\circ}$ ) shall be packed in suitable receptacles containing not more than 7.5 kg of substance per receptacle. 2510

(2) Bromine containing less than 0.005% water, or between 0.005% and 0.2% water provided that in the latter case measures are taken to prevent corrosion of the lining of the receptacles, may also be carried in receptacles satisfying the following conditions:

- (a) the receptacles shall be made of steel and be equipped with a leak-proof lining made of lead or of some other material affording equivalent protection, and with hermetic closures; receptacles made of monel metal or nickel, or equipped with a nickel lining, shall also be permitted;
- (b) their capacity must not exceed 1250 litres;
- (c) the receptacles shall not be filled beyond 92% of their capacity or beyond 2.86 kg per litre of capacity;

## Class V

- 2510 (contd) (d) the receptacles shall be welded and designed for a pressure of not less than 21 kg/cm<sup>2</sup>.

The materials and workmanship must in other respects meet the requirements of marginals 2141 (1) and (2) (b). The initial test of unlined steel receptacles shall be subject to the provisions of marginals 2145 (1) and 2146 (1), A and B.

- (e) the closing devices must project as little as possible from the receptacle and be fitted with a protective cap. The closing devices and the cap shall be fitted with gaskets made of a material not capable of being attacked by bromine. The closing devices must be in the upper part of the receptacles, so that they can in no case be in permanent contact with the liquid;
- (f) the lead lining must be leak-proof and be not less than 3 mm thick. If some other material is used, it must provide protection equivalent to that provided by lead;
- (g) the receptacles must be provided with fittings enabling them to stand stably upright, and with lifting attachments (rings, flanges, etc.) at the top, which must be tested at twice the working load.

(3) Receptacles in conformity with (2) above shall, before being put into service, be subjected to a tightness test at a pressure of 2 kg/cm<sup>2</sup>. The tightness test shall be repeated every two years and shall be accompanied by an internal inspection of the receptacle and a check of its tare. This test and this inspection shall be supervised by an expert approved by the competent authority.

(4) The receptacles must bear, in clearly legible and indelible characters:

- (a) the name or mark of the maker and the number of the receptacle;
- (b) the word "Bromine";
- (c) the tare of the receptacle and its maximum weight when filled;
- (d) the date (month and year) of the last test undergone;
- (e) the stamp of the expert who carried out the test and the inspections.

## Class V

(1) Substances of 21<sup>o</sup> (a) 1, shall be packed:

2511

- (a) in hermetically closed receptacles made of glass, porcelain, stone-ware or similar material, or of a suitable plastics material, which must not contain more than 5 kg of substance each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically closed metal receptacles, with a suitable lining if necessary, which must not contain more than 15 kg of substance each. These receptacles shall be secured with cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically closed metal drums, with a suitable lining if necessary. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. Such a package must not weigh more than 100 kg; or
- (e) in hermetically closed bags, made of a suitable plastics material, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (f) in hermetically closed wooden casks of sufficient strength, with a suitable lining. Such a package must not weigh more than 250 kg; or
- (g) in stout paper bags of four plies, lined with a hermetically closed bag made of a suitable plastics material. Such a package must not weigh more than 55 kg; or

## Class V

2511  
(contd)

- (h) in jute bags rendered moisture-proof by a lining made of a suitable material, coated with bitumen, or in jute bags lined with a hermetically closed bag made of a suitable plastics material. Such a package must not weigh more than 55 kg.

(2) Substances of 21<sup>o</sup> (a) 2., (b), (c), (d) and (e) shall be packed:

- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in hermetically closed glass carboys, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The carboys shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or
- (c) in hermetically closed metal receptacles, with a suitable lining if necessary, of a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically closed canisters made of a suitable metal, welded or hard-soldered, of a capacity not exceeding 60 litres and fitted with means of handling. The canisters shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or
- (e) in hermetically closed metal drums, with a suitable lining if necessary. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops; or

## Class V

- (f) in hermetically closed receptacles made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (g) in hermetically closed receptacles, made of a suitable plastics material of a capacity not exceeding 60 litres, with walls of sufficient thickness, which shall be not less than 4 mm in the case of receptacles of 50 litres or over; the openings shall be closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles need have no protective packagings if the competent authority of the country of departure so allows. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg.

2511  
(contd)Substances of 22<sup>o</sup> shall be packed:

2512

- (a) in hermetically closed receptacles made of glass, porcelain, stone-ware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in hermetically closed metal drums, with a suitable lining if necessary. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (c) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with

## Class V

2512  
(contd)

- complete sides, made of paperboard or of some other material of sufficient strength. Receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (d) in hermetically closed glass carboys, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The carboys shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg.

2513

- (1) Substances of 23<sup>o</sup> shall be packed:
- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, except those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in hermetically closed metal receptacles, with a suitable lining if necessary, of a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (c) in hermetically closed metal drums, with a suitable lining if necessary. Drums intended to hold substances of 23<sup>o</sup> (a) must satisfy the requirements of Appendix A.5. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops.
- (2) Substances of 23<sup>o</sup> (b) may also be packed:
- (a) in hermetically closed canisters made of a suitable metal, welded or hard-soldered, of a capacity not exceeding 60 litres and fitted with means of handling. The canisters shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or

## Class V

- (b) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres, with walls of sufficient thickness, which shall be not less than 4 mm in the case of receptacles of 50 litres or over; the openings shall be closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles need have no protective packaging if the competent authority of the country of departure so allows. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg. 2513  
(contd)
- (1) Substances of 31° (a) shall be packed: 2514
- (a) in hermetically closed receptacles made of glass, porcelain, stone-ware or similar material, or of a suitable plastics material, which must not contain more than 5 kg of substance each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
- (b) in hermetically closed metal receptacles, with a suitable lining if necessary, which must not contain more than 15 kg of substance each. These receptacles shall be secured by cushioning materials in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 100 kg; or
- (c) in hermetically closed metal drums, with a suitable lining if necessary. If the drums, with their contents, weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (d) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. Such a package must not weigh more than 100 kg; or

## Class V

- 2514 (contd)
- (e) in hermetically closed bags, made of a suitable plastics material, which shall be placed in a wooden case or in some other outer packaging of sufficient strength. Such a package must not weigh more than 75 kg; or
  - (f) in jute bags rendered moisture-proof by a lining made of a suitable material, coated with bitumen, or in jute bags lined with a hermetically closed bag made of a suitable plastics material. Such a package must not weigh more than 55 kg.

(2) Substances of 31<sup>o</sup> (a) in flakes or in powdered form may also be packed in stout paper bags of four plies, lined with a hermetically closed bag made of a suitable plastics material. Such a package must not weigh more than 55 kg.

(3) Sodium hydroxide of 31<sup>o</sup> (b) filled in the molten state shall be contained in steel drums with walls not less than 0.5 mm thick. The drums, with their contents, must not weigh more than 450 kg.

2515

Substances of 32<sup>o</sup> shall be packed:

- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or
- (b) in hermetically closed metal receptacles, with a suitable lining if necessary, of a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or



## Class V

- (c) in hermetically closed canisters made of a suitable metal, welded or hard-soldered, of a capacity not exceeding 60 litres, and fitted with means of handling. The canisters shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or
- (d) in hermetically closed metal drums, with a suitable lining if necessary. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (e) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (f) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres, and with walls of sufficient thickness, which shall be not less than 4 mm in the case of receptacles of 50 litres or over; the openings shall be closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles need have no protective packaging if the competent authority of the country of departure so allows. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (g) in hermetically closed cylindrical receptacles made of glass, porcelain, stoneware or similar material, of a capacity not exceeding 20 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or
- (h) in hermetically closed glass carboys, which shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength, or be firmly fixed in iron or wicker hampers. The carboys shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg.

2515  
(contd)

## Class V

- 2516 Storage batteries filled with alkaline solutions (33°) shall be made of metal and the upper part shall be so designed that the lye cannot splash out in dangerous quantities. The batteries shall be protected against short-circuits and be packed in a wooden packing case.
- 2517 (1) Hydrazine (34°) shall be packed:
- (a) in hermetically closed glass receptacles, of a capacity not exceeding 5 litres, which shall be secured by suitable cushioning materials in boxes placed in a wooden case; or
  - (b) in receptacles made of aluminium not less than 99.5% pure or of stainless steel or of lead-lined iron; or
  - (c) in receptacles, made of a suitable plastics material, fitted with a screw closure and having a capacity not exceeding 65 litres, placed singly in suitable protective packagings or secured in groups by suitable cushioning materials in suitable protective packagings; a package must not weigh more than 100 kg, or more than 50 kg if the protective packaging consists of a fibreboard case; or
  - (d) in drums, made of a suitable plastics material, of a capacity not exceeding 220 litres and with walls not less than 1.5 mm thick, placed singly in drums fitted with rolling hoops.
- (2) No receptacle shall be filled beyond 93% of its capacity. The receptacles under (b), (c) and (d) shall be pressure-tested at 1 kg/cm<sup>2</sup>.
- 2518 Substances of 35° shall be packed:
- (a) in hermetically closed receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, of a capacity not exceeding 5 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg. Packages weighing more than 30 kg, other than those forwarded as a complete load, shall be fitted with means of handling; or

## Class V

- (b) in hermetically closed metal receptacles, with a suitable lining if necessary, of a capacity not exceeding 15 litres. These receptacles shall be secured by absorbent cushioning materials in a wooden case or in some other outer packaging of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (c) in hermetically closed canisters made of a suitable metal, welded or hard-soldered, of a capacity not exceeding 60 litres, and fitted with means of handling. The canisters shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 75 kg; or
- (d) in hermetically closed metal drums, with a suitable lining if necessary. The drums shall not be filled beyond 95% of their capacity. If, with their contents, they weigh more than 275 kg, they shall be fitted with rolling hoops; or
- (e) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres. These receptacles shall be placed singly and tightly in a protective packaging with complete sides, made of paperboard or of some other material of sufficient strength. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg; or
- (f) in hermetically closed receptacles, made of a suitable plastics material, of a capacity not exceeding 60 litres, with walls of sufficient thickness, which shall be not less than 4 mm in the case of receptacles of 50 litres or over; the openings shall be closed by two plugs, one placed over the other, one of them being screw-threaded. These receptacles need have no protective packaging if the competent authority of the country of departure so allows. The receptacles shall not be filled beyond 95% of their capacity. Such a package must not weigh more than 100 kg.

2518  
(contd)(1) Sodium sulphide (36<sup>o</sup>) shall be packed:

2519

- (a) in leak-proof iron receptacles; or
- (b) in quantities not exceeding 5 kg, also in receptacles, made of glass or of a suitable plastics material, which shall be secured in strong wooden receptacles, glass receptacles being secured therein by cushioning materials.

## Class V

- 2519  
(contd)
- (2) Sodium sulphide in solid form may also be enclosed in other leak-proof receptacles. If carried as a complete load, it may also be packed:
- (a) in stout paper bags of five plies, so closed as to be leak-proof and lined with a bag made of a suitable plastics material; or
  - (b) in bags made of a suitable plastics material equal in strength to the paper bags.

Packages made up of bags must not weigh more than 55 kg.

- 2520
- (1) Hypochlorite solutions (37°) shall be packed:
- (a) in receptacles made of glass, porcelain, stoneware or similar material, or of a suitable plastics material, secured in protective packagings; fragile receptacles shall be secured therein by cushioning materials; or
  - (b) in metal drums, suitably lined.

(2) In the case of hypochlorite solutions of 37° (a), the receptacles or drums shall be so designed as to allow gases to escape, or shall be fitted with pressure-relief valves.

- 2521
- (1) Aqueous solutions of hydrogen peroxide containing more than 40% but not more than 60% hydrogen peroxide [41° (a)] shall be contained:
- (a) in receptacles, which must be able to stand stably upright, made of aluminium not less than 99.5% pure or of a special steel not liable to cause the hydrogen peroxide to decompose. The capacity of these receptacles must not exceed 200 litres; or
  - (b) in receptacles, made of glass, porcelain, stoneware or a suitable plastics material, of a capacity not exceeding 20 litres. Each receptacle shall be secured by absorbent, incombustible and inert cushioning materials in a sheet-steel packaging with complete sides, lined with suitable materials. This packaging shall be placed in a wooden packing case with a sloping protective cover.

For closure and degree of filling, see under (3).

## Class V

(2) Aqueous solutions of hydrogen peroxide containing more than 6% but not more than 40% hydrogen peroxide [41° (b)] shall be contained in receptacles made of glass, porcelain, stoneware, aluminium not less than 99.5% pure, special steel not liable to cause the hydrogen peroxide to decompose, or a suitable plastics material.

2521  
(contd)

Receptacles of a capacity not exceeding 3 litres shall be secured by cushioning materials in wooden cases; if the receptacles contain aqueous solutions of hydrogen peroxide containing more than 35% hydrogen peroxide, the cushioning materials must be suitably fire-proofed. A package must not weigh more than 35 kg.

If the receptacles have a capacity of more than 3 litres they must satisfy the following conditions:

- (a) receptacles made of aluminium or of special steel must be able to stand stably upright. A package must not weigh more than 250 kg;
- (b) receptacles made of glass, porcelain, stoneware or a suitable plastics material shall be placed in suitable strong protective packagings which will keep them securely upright; the packagings shall be fitted with means of handling. Inner receptacles other than those made of a plastics material shall be secured in outer packagings by cushioning materials. Where receptacles contain aqueous solutions of hydrogen peroxide containing more than 35% but not more than 40% hydrogen peroxide, the cushioning materials shall be suitably fire-proofed. A package of this kind must not weigh more than 90 kg; however, it may weigh up to 110 kg if the protective packagings are, in addition, packed in a case or crate;
- (c) aqueous solutions of hydrogen peroxide containing more than 6% but not more than 40% hydrogen peroxide may also be contained, without protective packagings, in receptacles made of a suitable plastics material, provided that the thickness of the walls (including areas recessed for labelling) is not at any point less than 4 mm, the walls are protected by strong ribs, and the ends are reinforced. The receptacles shall be fitted with means of handling. The capacity must not exceed 60 litres.

## Class V

2521  
(contd)

For closure and degree of filling, see under (3).

(3) Receptacles of a capacity not exceeding 3 litres may have a hermetic closure. In such cases the receptacles shall be filled with a weight of solution which, expressed in grammes, is equal to not more than two-thirds of the figure expressing the capacity of the receptacle in cm<sup>3</sup>.

Receptacles of a capacity exceeding 3 litres shall be fitted with a special closure preventing excess internal pressure, leakage of the liquid, and the entry of foreign matter into the receptacle. Where receptacles are packed separately, the outer packaging shall be fitted with a cover which, while protecting the closure, makes it possible to verify that the closure is directed upwards. These receptacles may not be filled beyond 95% of their capacity.

2522

3. Mixed packing

(1) Substances grouped under the same item number may be included in the same package. The inner packagings shall conform to what is prescribed for each substance, and the outer packaging shall be that laid down for the substances of the item number in question.

(2) If smaller quantities are not prescribed in the section entitled "Packing of a single substance or of articles of the same kind" and no special conditions are laid down below, substances of this Class, in quantities not exceeding 6 kg in the case of solids or 3 litres in the case of liquids for all of the substances listed under the same item number or the same letter, may be enclosed in the same package either with substances of another item number or of another letter of the same Class, or with substances or articles belonging to other Classes (if mixed packing is likewise allowed in the case of such substances or articles), or with other goods, subject to the following special conditions.

The inner packagings must satisfy the general and special conditions of packing. In addition, the general provisions of marginals 2001 (5) and 2002 (6) and (7) must be observed.

Mixed packing of an acid substance with a basic substance in the same package is not allowed if both substances are contained in fragile receptacles.

A package must not weigh more than 150 kg, or more than 75 kg if it contains fragile receptacles.

## Class V

Special conditions2522  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
1°(a)	Oleum	3 litres	12 litres	Must not be packed together with chlorates, permanganates, solutions of hydrogen peroxide, perchlorates, peroxides or hydrazine. The limitation of 18 litres applies to sulphuric, nitric and hydrochloric acids, and mixed nitrating acids, for all of these substances. If the package contains an acid subject to a limitation of 12 litres, this limitation must be applied.
1°(a), (b), (c)	Sulphuric acid other than oleum	3 litres	18 litres	
2°(a)	Nitric acid containing more than 70% pure acid	3 litres	12 litres	Must not be packed together with formic acid, triethanolamine, aniline, xylidine, toluidine, chlorates, permanganates, inflammable liquids with a flash-point below 21°C, solutions of hydrogen peroxide, perchlorates, peroxides, hydrazine, glycerine, glycols. Only inert filling materials must be used.
2°(b) and	Nitric acid containing not more than 70% pure acid	3 litres	18 litres	
3°	Mixed nitrating acids	3 litres	18 litres	

## Class V

2522  
(contd)

Item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
4°	Perchloric acid	Mixed packing not allowed		
5°	Hydrochloric acid	5 litres	18 litres	Must not be packed together with chlorates, permanganates, perchlorates, peroxides (other than solutions of hydrogen peroxide).
6°	Solutions of hydrofluoric acid	1 litre	10 litres	
11°(a)	Disulphur dichloride	500 g	500 g	
11°(a)	Antimony pentachloride Chlorosulphonic acid Sulphuryl chloride Thionylchloride Titanium tetrachloride Stannic chloride	2.5 kg	5 kg	Must not be packed together with substances of 36° of Class V or with substances of Class IIIc; must be protected against penetration of moisture
12°	Antimony trichloride			
14°	Bromine - in fragile receptacles - in other receptacles	500 g 1 kg	500 g 3 kg	
15°(a)	Difluorides	5 kg	15 kg	Must not be packed together with substances of Classes Ie, II and IIIc, or with nitric acid or mixed nitrating acids.



## Class V

2522  
(contd)

Item No.	Description of substance	Maximum quantity per receptacle	Maximum quantity per package	Special provisions
21°(b)	Formic acid	5 litres	15 litres	Must not be packed together with chlorates, permanganates, solutions of hydrogen peroxide, nitric acid, mixed nitrating acids.
21°(c)	Acetic acid	5 litres	15 litres	Must not be packed together with chlorates or permanganates.
34°	Hydrazine	5.5 kg	5.5 kg	Must not be packed together with sulphuric acid, chlorosulphonic acid, nitric acid, mixed nitrating acids, chlorates, permanganates, sulphur, solutions of hydrogen peroxide, perchlorates and peroxides. Must be kept separate from caustic alkaline substances and strong oxidizing agents.
36°	Sodium sulphide containing not more than 70% Na <sub>2</sub> S	2.5 kg	15 kg	Must not be packed together with acid substances.
41°(a)	Solutions of hydrogen peroxide containing more than 35% hydrogen peroxide	Mixed packing not allowed		

## Class V

2522  
(contd)

item No.	Description of substance	Maximum quantity		Special provisions
		per receptacle	per package	
41 <sup>o</sup> (b)	Solutions of hydrogen peroxide containing more than 15% but not more than 35% hydrogen peroxide			Must not be packed together with sulphuric acid, chlorosulphonic acid, formic acid, nitric acid, mixed nitrating acids, triethanolamine, aniline, xylydine, toluidine, permanganates, inflammable liquids with a flash-point below 21°C, metallic peroxides, hydrazine.
	- in fragile receptacles	1 litre	3 litres	
	- in other receptacles	3 litres	12 litres	
	Solutions of hydrogen peroxide containing more than 6% but not more than 15% hydrogen peroxide	3 litres	12 litres	Only inorganic filling materials must be used.

## Class V

4. Marking and danger labels on packages 2523  
(see Appendix A.9)

Cases containing storage batteries  $\sqrt{1^{\circ}(f)}$  and  $33^{\circ}7$  shall be legibly and indelibly marked: "Storage batteries". This inscription shall be in an official language of the country of departure and also, if that language is not English or French, or German, in English, French or German, unless otherwise provided in agreements, if any, concluded between the countries concerned in the transport operation.

(1) Every package containing substances of  $1^{\circ}$  to  $7^{\circ}$ ,  $9^{\circ}$ ,  $11^{\circ}$ ,  $12^{\circ}$ ,  $14^{\circ}$ ,  $15^{\circ}$ ,  $22^{\circ}$ ,  $31^{\circ}$  to  $35^{\circ}$  and  $41^{\circ}(a)$  shall bear a label conforming to model No.5. 2524

(2) Packages containing fragile receptacles not visible from the outside shall bear labels conforming to model No.9. If the fragile receptacles contain liquids, the packages shall, in addition, except in the case of sealed ampoules, bear labels conforming to model No.8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.

(3) Every case containing storage batteries  $\sqrt{1^{\circ}(f)}$  and  $33^{\circ}7$  and packages weighing not more than 75 kg containing substances of  $1^{\circ}$  to  $7^{\circ}$ ,  $9^{\circ}$ ,  $11^{\circ}$ ,  $21^{\circ}$ ,  $31^{\circ}$  to  $35^{\circ}$  and  $37^{\circ}$  which, under the provisions of Annex B, may be carried in closed or sheeted vehicles, shall, in addition, bear on two opposite sides labels conforming to model No.8.

(4) In the case of consignments carried as a complete load, label No.5, as prescribed under (1), need not be affixed to the packages if the vehicle bears the marking prescribed in Annex B, marginal 10 500.

## Class V

2525

B. Particulars in the transport document

2526

(1) The description of the goods in the transport document must conform to one of the names underlined in marginal 2501. Where the name of the substance is not indicated in the case of 11<sup>o</sup>, 12<sup>o</sup>, 13<sup>o</sup>, 15<sup>o</sup>, 22<sup>o</sup> and 35<sup>o</sup>, the trade name must be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. V, 1<sup>o</sup> (a) ADR].

(2) In the case of bromine containing 0.005% to 0.2% water, carried in receptacles in conformity with marginal 2510 (2), the following must be certified in the transport document: "Steps have been taken to prevent corrosion of the lining of the receptacles".

2527-

2534

C. Empty packagings

2535

(1) Receptacles of 51<sup>o</sup> and tanks must be closed in the same manner and leak-proof in the same degree as though they were full.

(2) The description of the goods in the transport document must be: "Empty receptacle, V, 51<sup>o</sup>, ADR (or RID)". This description must be underlined in red.

(3) Uncleaned receptacles and uncleaned tanks which have contained hydrofluoric acid (6<sup>o</sup>) or bromine (14<sup>o</sup>) shall bear a label conforming to model No.5 (Appendix A.9). They must have no traces of acid or bromine on the outside.

2536-

2599

CLASS VI. REPUGNANT SUBSTANCES AND SUBSTANCES  
LIABLE TO CAUSE INFECTION1. List of substances

Among the substances and articles covered by the heading of Class VI, 2600 only those listed in marginal 2601 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR.

- 1° (a) Fresh tendons, clippings of fresh skins not limed or salted, 2601  
trimmings from fresh tendons or from clippings of fresh skins;  
Note: Clippings of wet fresh skins, limed or salted, are not subject to the provisions of ADR.
- (b) fresh horns, claws or hoofs not cleansed of bone and soft adhering parts, fresh bones not cleansed of flesh or other soft adhering parts;
- (c) undressed pig's bristles and hair.
- 2° Fresh skins, unsalted or salted, from which offensive quantities of blood or brine drip  
Note: Properly salted skins containing only a small quantity of moisture are not subject to the provisions of ADR.
- 3° Cleaned or dried bones, cleaned or dried horns, claws or hoofs.  
Note: Dry bones divested of fat, not giving off any putrid odour, are not subject to the provisions of ADR.
- 4° Fresh calf rennets, cleansed of all traces of edible matter.  
Note: Dried calf rennets not giving off an offensive odour are not subject to the provisions of ADR.
- 5° Compressed residues arising from the manufacture of skin glue (calcareous residues, residues from the liming of skin clippings, or residues used as fertilizers).
- 6° Non-compressed residues arising from the manufacture of skin glue
- 7° Non-infected urine protected against decomposition.

## Class VI

- 2601 8° Anatomical pieces, entrails and glands.  
(contd) (a) non-infected  
(b) infected
- 9° Manure.
- 10° Excrement.
- 11° Other animal substances, repugnant or liable to cause infection, not already specifically mentioned in 1° to 10°.
- 12° Empty packagings and empty bags which have contained substances of 1° to 8°, 10° and 11°, and sheets which have been used to cover substances of Class VI.
- Note: If uncleaned, these packagings, bags and sheets are not to be accepted for carriage.

2. ProvisionsA. Packages1. General conditions of packing

- 2602 (1) Packagings shall be so closed and leak proof as to prevent any loss of the contents. However, see Annex B, marginal 61 104 (2) (a), for the special provision concerning metal receptacles containing substances of 1°, 8° and 11°.
- (2) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. In particular where substances are in the liquid state or are liable to ferment, receptacles and their closures must, unless the section headed "Packing of a single substance" provides otherwise, be able to withstand any pressure which, the presence of air also being taken into account, may arise inside the receptacles in normal carriage. For this purpose a free space must be left, account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage.
- (3) No trace of the contents must adhere to the outside of packages.

## Class VI

2. Packing of a single substance

Substances of 1<sup>o</sup> shall be packed:

2603

- (a) if forwarded otherwise than as a complete load:
1. in metal receptacles fitted with a safety closure capable of yielding to internal pressure, or in casks, small vats or cases; or
  2. in the case of substances of 1<sup>o</sup> (c) in the dry state, also in bags, on condition that the bad odour can be removed by disinfection. In the case of substances not in the dry state, packing in bags is allowed only from 1 November to 15 April;

(b) if forwarded as a complete load:

1. in the packagings specified in (a) 1. above; or
2. on condition that the bad odour can be removed by disinfection, in bags impregnated with suitable disinfectants.

Substances of 2<sup>o</sup> shall be packed:

2604

(a) if forwarded otherwise than as a complete load:

1. in casks, small vats or cases; or
2. during the months from November to February inclusive, in bags impregnated with suitable disinfectants, on condition that the bad odour can be removed by disinfection;

(b) if forwarded as a complete load:

1. in the packagings specified in (a) 1. above; or
2. on condition that the bad odour can be removed by disinfection, in bags impregnated with suitable disinfectants.

Substances of 3<sup>o</sup> shall be packed in casks, small vats, cases, metal receptacles or bags.

2605

Substances of 4<sup>o</sup> shall be packed:

2606

(a) if forwarded otherwise than as a complete load:

in casks, small vats, cases, metal receptacles or bags;

(b) if forwarded as a complete load: in any suitable packagings.

## Class VI

- 2607 Substances of 5<sup>o</sup> and 6<sup>o</sup> shall be packed in casks, small vats, cases or metal receptacles.
- 2608 Substances of 7<sup>o</sup> shall be packed in hermetically closed receptacles made of galvanized sheet-steel.
- 2609 (1) Substances of 8<sup>o</sup> shall be packed in metal receptacles fitted with a safety closure capable of yielding to internal pressure, in casks or small vats; substances of 8<sup>o</sup> (a) may also be packed in cases.
- (2) Substances of 8<sup>o</sup> may also be packed as follows:
- (a) substances of 8<sup>o</sup> (a), in receptacles made of glass, porcelain, stoneware, metal or a suitable plastics material. These receptacles shall be placed, either singly or in groups, in a strong wooden case, with absorbent cushioning materials if the receptacles are fragile. If the substances to be carried are immersed in a preserving fluid, the absorbent materials shall be sufficient in quantity to absorb all the fluid. The preserving fluid must not be inflammable. Packages weighing more than 30 kg shall be fitted with means of handling;
- (b) substances of 8<sup>o</sup> (b), in suitable receptacles placed with cushioning materials in a strong wooden case having a metal lining rendered leak-proof e.g. by soldering. Packages weighing more than 30 kg shall be fitted with means of handling.
- 2610 Substances of 9<sup>o</sup> shall be forwarded only in bulk.
- 2611 Substances of 10<sup>o</sup> shall be packed in receptacles made of sheet-metal.
- 2612 Substances of 11<sup>o</sup> shall be packed in metal receptacles fitted with a safety closure capable of yielding to internal pressure, or in casks, small vats or cases.
- 2613 3. Mixed packing
- Substances listed under an item number of marginal 2601 may be included in the same package only with substances listed under the same item number, and then only on condition that the packagings prescribed in sections A.1 and 2 above are used.



## Class VI

4. Marking and danger labels on packages (see Appendix A.9)

Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No.9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.

2614

B. Particulars in the transport document

2615

2616

The description of the goods in the transport document must conform to one of the names underlined in marginal 2601. Where the name of the substance is not indicated, the trade name must be used. The description of the goods must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [ e.g. VI, 1<sup>o</sup> (a), ADR ]

2617-  
2622C. Empty packagings

(1) Articles of 12<sup>o</sup> shall be cleaned and treated with suitable disinfectants

2623

(2) The description in the transport document must be:

"Empty packaging (or empty bag, or sheet), VI, 12<sup>o</sup>, ADR (or RID)".

This description must be underlined in red.

2624-  
2699



## CLASS VII. ORGANIC PEROXIDES

1. List of substances

Among the substances and articles covered by the heading of Class VII, only those listed in marginal 2701 are to be accepted for carriage, and then only subject to the provisions of this Annex and of Annex B. These substances and articles to be accepted for carriage under certain conditions are to be considered as substances and articles of ADR. 2700

Note: Organic peroxides which may explode on contact with a flame or which are more sensitive to shock and to friction than dinitrobenzene are not to be accepted for carriage unless they are specifically listed in Class Ia (see marginal 2021, 10° and Appendix A.1, marginal 3112; also marginal 2701, Group E, below).

Group A

2701

1° Ditertiary butyl peroxide2° Tertiary butyl hydroperoxide with not less than 20% ditertiary butyl peroxide and not less than 20% phlegmatizer.

Note: Tertiary butyl hydroperoxide with not less than 20% ditertiary butyl peroxide but without phlegmatizer is listed under 31°.

3° Tertiary butyl peracetate with not less than 30% phlegmatizer.4° Tertiary butyl perbenzoate.5° Tertiary butyl permaleate with not less than 50% phlegmatizer.6° Ditertiary butyl diperphthalate with not less than 50% phlegmatizer.7° 2, 2-bis (tertiary butyl peroxy) butane with not less than 50% phlegmatizer.8° Benzoyl peroxide:

(a) with not less than 10% water;

(b) with not less than 30% phlegmatizer.

Notes: 1. Benzoyl peroxide in the dry state or with less than 10% water or less than 30% phlegmatizer is a substance of Class Ia [see marginal 2021, 10° (a)].

2. Benzoyl peroxide containing not less than 70% dry and inert solids is not subject to the provisions of ADR.

## Class VII

2701  
(contd)

9° Cyclohexanone peroxides [1-hydroxy-1'-hydroperoxydicyclohexyl peroxide and bis (1-hydroxycyclohexyl) peroxide and mixtures of these two compounds]:

- (a) with not less than 5% water;
- (b) with not less than 30% phlegmatizer.

Notes: 1. Cyclohexanone peroxides and their mixtures in the dry state or with less than 5% water or less than 30% phlegmatizer are substances of Class Ia [see marginal 2021, 10° (b)].

2. Cyclohexanone peroxides and their mixtures containing not less than 70% dry and inert solids are not subject to the provisions of ADR.

10°  $\alpha, \alpha$ -Dimethylbenzyl hydroperoxide (cumyl hydroperoxide) with a peroxide content not exceeding 95%.

11° Dilauroyl peroxide.

12° 1,2,3,4-Tetrahydro-1-naphthyl hydroperoxide.

13° 2,4-Dichlorobenzoyl peroxide:

- (a) with not less than 10% water;
- (b) with not less than 30% phlegmatizer.

14° p-Menthanyl hydroperoxide with a peroxide content not exceeding 95% (remainder: alcohols and ketones).

15° 2,6,6-Trimethyl ncrpinanyle hydroperoxide (pinanyl hydroperoxide; pinane hydroperoxide) with a peroxide content not exceeding 95% (remainder: alcohols and ketones).

16° Di-( $\alpha, \alpha$ -dimethylbenzyl) peroxide with a peroxide content not exceeding 95%.

Note: Di-( $\alpha, \alpha$ -dimethylbenzyl) peroxide containing 60% or more dry and inert solids is not subject to the provisions of ADR.

17° Parachlorobenzoyl peroxide:

- (a) with not less than 10% water;
- (b) with not less than 30% phlegmatizer.

## Class VII

Notes: 1. Parachlorobenzoyl peroxide in the dry state or with less than 10% water or less than 30% phlegmatizer is a substance of Class Ia [see marginal 2021, 10°(c)].

2701  
(contd)

2. Parachlorobenzoyl peroxide containing 70% or more dry and inert solids is not subject to the provisions of ADR.

- 18° Di-isopropylbenzene hydroperoxide (isopropylcumyl hydroperoxide) with 45% of a mixture of alcohol and ketone.
- 19° 4-Methylpentan-2-one peroxide (isobutylmethylketone peroxide) with not less than 40% phlegmatizer.
- 20° Tertiary butyl (2,2-dimethylbenzyl) peroxide with not more than 95% peroxide.
- 21° Diacetyl peroxide with not less than 75% phlegmatizer.
- 22° Acetyl benzoyl peroxide with not less than 60% phlegmatizer.

Note: re 1° to 22°. Substances which are inert to organic peroxides and have a flash-point not lower than 100°C and a boiling-point not lower than 150°C are deemed to be phlegmatizing substances. Substances of Group A may also be diluted with solvents which are inert to these substances.

Group B

30° Butanone peroxide (ethyl methyl ketone peroxide):

- (a) with not less than 50% phlegmatizer;
- (b) in solutions containing not more than 12% of this peroxide in solvents which are inert to it.

31° Tertiary butyl hydroperoxide:

- (a) with not less than 20% tertiary butyl peroxide, without phlegmatizer;
- (b) in solutions containing not more than 12% of this hydroperoxide in solvents which are inert to it.

Note: re 30° and 31°. Substances which are inert to organic peroxides and have a flash-point not lower than 100°C and a boiling-point not lower than 150°C are deemed to be phlegmatizing substances.

Group C

35° Peracetic acid containing not more than 40% peracetic acid and not less than 45% acetic acid and not less than 10% water.

## Class VII

2701  
(contd)

Notes: re Groups A, B and C. Mixtures of products listed in Groups A, B and C are to be accepted for carriage subject to the conditions laid down for Group C if they contain peracetic acid, and in other cases subject to the conditions laid down for Group B.

Group D

40° Samples of phlegmatized organic peroxides not listed in Groups A, B or C, or of their solutions, are to be accepted in quantities not exceeding 1 kg per package on condition that their stability in storage is at least equal to that of the substances listed in Groups A and B.

Group E

Notes: Group E comprises organic peroxides which decompose easily at normal temperatures and must therefore be carried only under conditions of adequate refrigeration. Although of an explosive nature as defined by the Note on Class VII, a few organic peroxides are included in Group E because they can be safely carried in a refrigerated state and in order to avoid any confusion regarding their handling.

45° Diocetyl peroxide (dicaprylyl peroxide) of technical purity.

46° Acetyl cyclohexane sulphonyl peroxide:

- (a) containing not less than 30% water;
- (b) in solution with not less than 80% solvent.

47° Diisopropyl peroxydicarbonate:

- (a) of technical purity;
- (b) in solution with not less than 50% phlegmatizer or solvent.

48° Dipropionyl peroxide in solution with not less than 75% solvent.

49° Tertiary butyl perpivalate:

- (a) of technical purity;
- (b) in solution with not less than 25% phlegmatizer or solvent.

50° Bis-(3,5,5-trimethylhexanoyl) peroxide in solution with not less than 20% phlegmatizer.

51° Dipelargonyl peroxide of technical purity.

## Class VII

52° Tertiary butyl per-2-ethylhexanoate of technical purity.

2701  
(contd)

Notes: 1. Substances which are inert to organic peroxides and have a flash-point not lower than 100°C and a boiling point not lower than 150°C are deemed to be phlegmatizing substances.

2. The solvents referred to are substances which are inert to organic peroxides and which also satisfy one of the following conditions:

- (a) they are not inflammable and have a boiling point of not less than 85°C; or
- (b) they are not inflammable and have a boiling point of less than 85°C but not less than 60°C, in which case hermetically closed containers must be used; or
- (c) they have a flash-point of not less than 21°C and a boiling point of not less than 85°C; or
- (d) they have a flash-point of less than 21°C but not less than 5°C and a boiling point of not less than 60°C, in which case hermetically closed containers must be used.

Group F

55° Empty packagings, uncleaned, and empty tanks, uncleaned, which have contained substances of Class VII.

2. ProvisionsA. Packages1. General conditions of packing

(1) The materials of which the packagings and their closures are made must not be liable to attack by the contents or form harmful or dangerous compounds therewith. 2702

(2) Packagings, including their closures, must be sufficiently rigid and strong in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage. Inner packagings shall be firmly secured in outer packagings. Unless otherwise specified in the section entitled "Packing of a single substance", inner packagings may be enclosed in outer packagings, either singly or in groups.

## Class VII

2702  
(contd)

(3) Cushioning materials must not be readily inflammable; in addition they shall be suited to the nature of the contents and must not cause the peroxides to decompose.

2. Packing of a single substance

a. Packing of substances of Group A

2703

Receptacles shall be so closed and leak-proof as to prevent any loss of the contents.

2704

(1) Substances of 1° to 7°, 8°(b), 9°(b), 10° to 12°, 13°(b), 14° to 16°, 17°(b) and 18° to 22° and their solutions must be packed:

- (a) in hot-dipped tinned receptacles or in receptacles made of aluminium not less than 99.5% pure; or
- (b) in receptacles, made of a suitable plastics material, which shall be placed in protective packagings; or
- (c) not more than 2 litres per bottle, in tightly-closing glass bottles which shall be secured by cushioning materials in a protective packaging so as to be protected against breakage.

(2) Substances of 1° to 3°, 5° to 7°, 8°(b), 9°(b), 10° to 12°, 13°(b), 16°, 18° and 20° may also be packed in hot-dipped galvanized receptacles.

(3) Substances of 8°(a), 9°(a), 13°(a) and 17°(a) shall be contained, not more than 5 kg per packaging, in water-tight packagings placed in a wooden case.

(4) Pasty and solid peroxides may also be packed in bags, made of a suitable plastics material, placed in suitable protective packagings. The thickness of the packing material shall be sufficient to prevent any loss of the contents from the bags in normal carriage. Solid peroxides may be packed, not more than 1 kg per receptacle, in paraffin-waxed fibre-board receptacles placed in a wooden case; however, in the case of cyclohexanone peroxides of 9°(a) the contents of a receptacle shall be limited to 500 g.



## Class VII

(5) Substances of 10° and of 14° to 18° may also be packed in receptacles made of sheet-steel. 2704 (contd)

(6) With the exception of bags made of a suitable plastics material, receptacles containing liquid or pasty organic peroxides must not be filled beyond 93% of their capacity.

(7) A package must not weigh more than 50 kg. Packages weighing more than 15 kg shall be fitted with means of handling.

b. Packing of substances of Group B 2705

(1) Receptacles filled with substances of 30°(a) and 31°(a) shall be fitted with a venting device allowing compensation between the internal pressure and the atmospheric pressure and in all circumstances - even in the event of expansion of the liquid through heating - preventing the liquid from splashing out and impurities from entering the receptacle. For substances of 30°(b) and 31°(b), only receptacles so closed and leak-proof as to prevent any loss of the contents shall be accepted.

(2) Packages shall be fitted with a base which keeps them securely upright without danger of falling.

(1) Substances of 30°(a) and 31°(a) shall be packed: 2706

- (a) in hot-dipped tinned or hot-dipped galvanized receptacles or in receptacles made of aluminium not less than 99.5% pure; or
- (b) in receptacles, made of a suitable plastics material, placed in protective packagings. The strength of these receptacles shall be sufficient to prevent any loss of the contents in normal carriage; or
- (c) not more than 2 litres per bottle, in glass bottles, which shall be secured by cushioning materials in protective packagings so as to be protected against breakage.

(2) Receptacles containing liquid or pasty organic peroxides must not be filled beyond 90% of their capacity.

(3) A package must not weigh more than 40 kg. Packages weighing more than 15 kg shall be fitted with means of handling.

## Class VII

2706  
(contd)

(4) Substances of 30<sup>o</sup>(b) and 31<sup>o</sup>(b) may be forwarded only in quantities not exceeding 5 kg in receptacles as specified in (1) but not equipped with a venting device (in glass bottles, only in quantities not exceeding 1.5 litre). The receptacles must not be filled beyond 75% of their capacity.

c. Packing of substances of Group C

2707

(1) Substances of 35<sup>o</sup> and mixtures containing peracetic acid shall be packed, not more than 25 kg per receptacle, in thick-walled glass receptacles, or in receptacles made of a suitable plastic material, fitted with a special closure made of a suitable plastic material, capable of being sealed, in communication with the atmosphere through an opening situated above the level of the liquid, and in all circumstances - even in the event of expansion of the liquid through heating - preventing the liquid from splashing out and impurities from entering the receptacle.

(2) Glass receptacles shall be firmly secured, by clean mica powder or glass wool used as cushioning materials, in protective packagings made of sheet-steel or of aluminium, capable of being closed, and fitted with means of handling and with a base which keeps them securely upright without risk of falling; the receptacles shall be secured even if the walls of the protective packagings are not complete. Receptacles made of a suitable plastic material must be placed in close-fitting protective packagings made of sheet-steel and capable of being closed.

d. Packing of substances of Group D

2708

Substances of Group D shall be packed, in quantities not exceeding 1 kg per package, in hot-dipped tinned receptacles, or in receptacles made of aluminium not less than 99.5% pure, or in bottles made of a suitable plastic material injection-moulded or blown and having a sufficient wall thickness, or in glass bottles placed in protective packagings made of sheet-steel, aluminium or wood. The glass bottles shall be firmly secured in the protective packagings by clean mica powder or glass wool used as

## Class VII

cushioning materials. Solid compounds may also be packed in bags, made of a suitable plastics material of sufficient thickness, likewise placed in protective packagings made of sheet-steel, aluminium, or wood. If the peroxides give off gases at a temperature lower than 40°C, the receptacles must satisfy the conditions of marginal 2705. 2708 (contd)

e. Packing of substances of Group E

(1) Packages containing substances of Group E shall be fitted with a venting device allowing compensation between the internal pressure and the atmospheric pressure and in all circumstances - even in the event of expansion of the liquid through heating - preventing the liquid from splashing out and impurities from entering the receptacle. 2709

(2) Receptacles containing liquid organic peroxides must not be filled beyond 95% of their capacity.

(1) Substances of 45° and 51° shall be packed, not more than 50 kg per receptacle or bag, in receptacles or bags, made of a suitable plastics material, which shall be placed in suitable protective packagings in quantities not exceeding 50 kg per packaging. 2710

(2) Substances of 46°(a) shall be packed, not more than 5 kg per bag, in bags made of a suitable plastics material, which shall be placed, not more than 20 kg per packaging and either singly or in groups, in suitable protective packagings.

(3) Substances of 47°(a) shall be packed:

- (a) not more than 1 kg per receptacle, in receptacles made of a suitable plastics material;
- (b) not more than 3 kg per bowl, in bowls made of aluminium not less than 99.5% pure, with plastics lids.

The protective packaging must not contain more than 10 kg of the substance.

## Class VII

2710  
(contd)

(4) Substances of 46°(b), 47°(b), 48°, 49°(b), 50° and 52° shall be packed, not more than 25 kg per receptacle, in receptacles made of a suitable plastics material, which shall be placed, not more than 50 kg per packaging (but not more than 25 kg per packaging in the case of substances of 52°), in protective packagings.

(5) Substances of 49°(a) shall be packed, not more than 10 kg per receptacle, in receptacles made of a suitable plastics material, which shall be placed, not more than 40 kg per packaging, in protective packagings.

(6) Packages weighing more than 35 kg which contain substances of Group E shall be fitted with means of handling.

f. Packing of substances in small quantities

2711

Substances of 1° to 22°, 30° and 31°, forwarded in small quantities, may also be packed as follows:

(a) liquids

not more than 1 kg per package, in bottles, made of aluminium, a suitable plastics material, or glass, with stoppers made of a suitable plastics material or with yoke or screw closures having, in either case, an elastic gasket. The bottles shall be secured, by clean mica powder or glass wool used as cushioning materials, in fibreboard or wooden boxes. The filling material must be sufficient in quantity to absorb the whole of the liquid. The bottles must not be filled beyond 75% of their capacity;

(b) pasty or powdered substances

not more than 1 kg per package, in aluminium boxes or in fibreboard or wooden boxes (the two latter being lined with aluminium or with a suitable plastics material) with a strong closure. A free space of 10% shall be left in the packagings.

3. Mixed packing

2712

Substances of Class VII may not be included in the same package either with other substances or articles of ADR or with other goods. Substances of Group C must not be included in the same package with substances of Groups A, B or E.

## Class VII

4. Marking and danger labels on packages (see Appendix A.9)

2713

(1) Every package containing substances of Class VII shall bear a label conforming to model No. 2.

Packages containing substances of 46<sup>o</sup>(a), 47<sup>o</sup>(a) and 49<sup>o</sup>(a) shall also bear a label conforming to model No. 1.

(2) Packages containing fragile receptacles not visible from the outside shall bear a label conforming to model No. 9. If the fragile receptacles contain liquids, the packages shall in addition, except in the case of sealed ampoules, bear labels conforming to model No. 8; packages containing substances of 30<sup>o</sup>, 31<sup>o</sup>, 35<sup>o</sup>, 40<sup>o</sup> and 45<sup>o</sup> to 52<sup>o</sup> shall also bear labels conforming to model No. 8; these labels shall be affixed high up on two opposite sides of cases or in an equivalent manner when other packagings are used.

2714

B. Particulars in the transport document

The description of the goods in the transport document must conform to one of the names underlined in marginal 2701; it must be underlined in red and followed by particulars of the Class, the item number (together with the letter, if any), and the initials "ADR" or "RID" [e.g. VII, 8<sup>o</sup>(a), ADR]

2716/  
2719C. Empty packagings

(1) Receptacles and tanks of 55<sup>o</sup> must be closed in the same manner and leak-proof in the same degree as though they were full.

2720

(2) The description in the transport document must be: "Empty receptacle, VII, 55<sup>o</sup> ADR (or RID)". This description must be underlined in red.

2721-  
3099



Part III

## APPENDICES

## APPENDIX A.1

A. Stability and safety conditions relating to explosive substances, inflammable solids and organic peroxides

The conditions of stability set out below are the standard minima defining the stability required of substances to be accepted for carriage. These substances may be handed over for carriage only if they fully conform to the following requirements. 3100

Re marginal 2021, 1°, marginal 2101, 4° and marginal 2331, 7°(a): Nitrocellulose heated for half an hour at 132°C must not give off visible yellowish-brown nitrous fumes. The ignition temperature must be above 180°C. Pyroxylin thread must satisfy the same conditions of stability as nitrocellulose. See marginals 3150, 3151(a) and 3153. 3101

Re marginal 2021, 3°, 4° and 5°, and marginal 2331, 7°(b) and (c): 3102

1. Nitrocellulose powders not containing nitroglycerine; plasticized nitrocellulose:  
3 g of powder or of plasticized nitrocellulose, heated for one hour at 132°C, must not give off visible yellowish-brown nitrous fumes. The ignition temperature must be above 170°C.
2. Nitrocellulose powders containing nitroglycerine:  
1 g of powder heated for one hour at 110°C must not give off visible yellowish-brown nitrous fumes. The ignition temperature must be above 160°C.

With regard to 1. and 2., see marginals 3150, 3151(b) and 3153.

## Appendix A.1

3103

Re marginal 2021, 6°, 7°, 8° (a) and (b) and 9° (a), (b) and (c):

1. Trinitrotoluene (tolite), mixtures termed liquid trinitrotoluene and trinitroanisolite (6°), hexyl (hexanitrodiphenylamine) and picric acid [7° (a)], pentolites (mixtures of pentaerythritol tetranitrate and trinitrotoluene) and hexolites (mixtures of trimethylene-trinitramine and trinitrotoluene) [7° (b)], phlegmatized penthrite and phlegmatized hexogen [7° (c)], trinitroresorcinol [8° (a)], tetryl (trinitrophenylmethylnitramine) [8° (b)], penthrite (pentaerythritol tetranitrate) and hexogen (trimethylene-trinitramine) [9° (a)], pentolites (mixtures of penthrite and trinitrotoluene) and hexolites (mixtures of hexogen and trinitrotoluene) [9° (b)] and mixtures of penthrite or hexogen with wax, paraffin wax or substances similar to wax or paraffin wax [9° (c)], heated for 3 hours at a temperature of 90°C, must not give off visible yellowish-brown nitrous fumes. See marginals 3150 and 3152(a).
2. Organic nitro-compounds mentioned under 8° other than trinitroresorcinol and tetryl (trinitrophenylmethylnitramine), heated for 48 hours at a temperature of 75°C, must not give off visible yellowish-brown nitrous fumes. See marginals 3150 and 3152(b).
3. Organic nitro-compounds mentioned under 8° must not be more sensitive to ignition, shock or friction than:
  - trinitroresorcinol, if they are soluble in water;
  - tetryl (trinitrophenylmethylnitramine), if they are insoluble in water.
 See marginals 3150, 3152, 3154, 3155 and 3156.

3104

Re marginal 2021, 11° (a) and (b):

1. Black powder [11° (a)] must not be more sensitive to flame-ignition, impact or friction than the finest sporting powder having the following composition: 75% potassium nitrate, 10% sulphur and 15% black alder charcoal. See marginals 3150, 3154, 3155 and 3156.



## Appendix A.1

2. Slow mining powders similar to black powder  $\sqrt{11^{\circ}(b)}$  must not be more sensitive to flame-ignition, impact or friction than the standard explosive having the following composition: 75% potassium nitrate, 10% sulphur and 15% lignite. See marginals 3150, 3154, 3155 and 3156. 3104 (contd)
- Re marginal 2021, 12<sup>o</sup>: Nitrate explosives in powder form  $\sqrt{12^{\circ}(a)}$ , and explosives not containing inorganic nitrates, in powder form  $\sqrt{12^{\circ}(b)}$ ; must be capable of being stored for 48 hours at 75°C without giving off visible yellowish-brown nitrous fumes. Before and after storing they must not be more sensitive to flame-ignition, impact or friction than the standard explosive having the following composition: 80% ammonium nitrate, 12% trinitrotoluene, 6% nitroglycerine and 2% wood flour. See marginals 3150, 3152(b), 3154(a) and (b), 3155 and 3156. 3105
- A sample of the standard explosive referred to above is held at the disposal of the Contracting States by Laboratoire des substances explosives, Sevran (Seine-et-Oise), France.
- Re marginal 2021, 13<sup>o</sup>: Chlorate and perchlorate explosives must not contain any ammonium salt. They must not be more sensitive to flame-ignition, impact or friction than a chlorate explosive having the following composition: 80% potassium chlorate, 10% dinitrotoluene, 5% trinitrotoluene, 4% castor oil and 1% wood flour. See marginals 3150, 3154, 3155 and 3156. 3106
- Re marginal 2021, 14<sup>o</sup>(a) and (b): Explosives of 14<sup>o</sup>(a) and (b) must not be more sensitive to flame-ignition, impact or friction than blasting gelatine containing 93% nitroglycerine or guhr dynamite containing not more than 75% nitroglycerine. They must satisfy the exudation test of marginal 3158. See marginals 3150, 3154(b), 3155 and 3156. 3107
- Re marginal 2021, 14<sup>o</sup>(c): Explosives of 14<sup>o</sup>(c) must be capable of being stored for 48 hours at 75°C without giving off visible yellowish-brown nitrous fumes. Before and after storing they must not be more

## Appendix A.1

- 3107 (contd) sensitive to flame ignition, impact or friction than the standard explosive having the following composition: 37.7% nitroglycol or nitroglycerine or a mixture of the two, 1.8% guncotton, 4% trinitrotoluene, 52.5% ammonium nitrate and 4% wood flour. See marginals 3150, 3152(b), 3154(a), (b), (c) and (d), 3155 and 3156.
- 3108 Re marginal 2061, 1<sup>o</sup>(b): The explosive substance must not be more sensitive to flame-ignition, impact or friction than tetryl. See marginals 3150, 3154, 3155 and 3156.
- 3109 Re marginal 2061, 1<sup>o</sup>(c): The explosive substance must not be more sensitive to flame-ignition, impact or friction than penthrite. See marginals 3150, 3154, 3155 and 3156.
- 3110 Re marginal 2061, 5<sup>o</sup>(d): The transmission charge must not be more sensitive to flame-ignition, impact or friction than tetryl. See marginals 3150, 3154, 3155 and 3156.
- 3111 Re marginal 2100 (2)(d): The explosive charge, after having been stored for four weeks at 50°C, must show no signs of deterioration due to insufficient stability. See marginals 3150 and 3157.
- 3112 Re marginal 2701, 1<sup>o</sup> to 50<sup>o</sup>: The substances shall be subjected to the test described in marginals 3154, 3155 and 3156.
- 3113-  
3149

B. Rules for tests

- 3150 (1) The test procedures set out below are to be applied when differences of opinion arise as to the acceptability of substances for carriage by road.
- (2) If other methods or test procedures are used to verify the conditions of stability prescribed above in this Appendix, those methods must lead to the same findings as could be reached by the methods specified below.

## Appendix A.1

(3) In carrying out the stability tests by heating described below, the temperature of the oven containing the sample under test must not deviate by more than 2°C from the prescribed temperature; the prescribed duration of a 30-minute or 60-minute test must be observed to within two minutes, that of a 48-hour test to within one hour, and that of a 4-week test to within 24 hours.

3150  
(contd)

The oven must be such that the required temperature is restored not more than five minutes after insertion of the sample.

(4) Before undergoing the tests prescribed in marginals 3151, 3152, 3153, 3154, 3155 and 3156, the samples must be dried for not less than 15 hours at the ambient temperature in a vacuum desiccator containing fused and granulated calcium chloride, the sample substance being spread in a thin layer; for this purpose, substances which are neither in powder form nor fibrous shall be ground, or grated, or cut into small pieces. The pressure in the desiccator must be brought below 50 mm of mercury.

(5)(a) Before being dried as prescribed in paragraph (4) above, substances of marginal 2021, 1° (except those containing paraffin wax or a similar substance), 2°, 9°(a) and (b), and those of marginal 2331, 7°(b), shall undergo preliminary drying in a well-ventilated drying oven, with its temperature set at 70°C, until the loss of weight per quarter-hour is less than 0.3% of the original weight.

(b) For substances of marginal 2021, 1° (when they contain paraffin wax or a similar substance), 7°(c) and 9°(c), the preliminary drying must be carried out as prescribed in sub-paragraph (a) above, except that the temperature of the oven shall be set at between 40° and 45°C.

(6) Nitrocellulose of marginal 2331, 7°(a) shall first undergo preliminary drying as prescribed in paragraph (5)(a) above; drying shall then be completed by keeping the nitrocellulose for at least 15 hours over concentrated sulphuric acid in a desiccator.

## Appendix A.1

Test of chemical stability under heatRe marginals 3101 and 3102

3151

(a) Test of substances listed in marginal 3101.

(1) In each of two glass test tubes having the following dimensions:

length..... 350 mm  
internal diameter..... 16 mm  
thickness of wall..... 1.5 mm

is placed 1 g of substance dried over calcium chloride (if necessary the drying must be carried out after reducing the substance to pieces weighing not more than 0.05 g each). Both test tubes, completely covered with loose-fitting closures, are then so placed in an oven that at least four fifths of their length is visible, and are kept at a constant temperature of 132°C for 30 minutes. It is observed whether nitrous gases in the form of yellowish-brown fumes clearly visible against a white background are given off during this time.

(2) In the absence of such fumes the substance is deemed to be stable.

(b) Test of powders listed in marginal 3102.

(1) Nitrocellulose powders not containing nitroglycerine, whether gelatinized or not, and plasticized nitrocellulose: 3 g of powder are placed in glass test tubes, similar to those referred to in (a), which are then placed in an oven kept at a constant temperature of 132°C.

(2) Nitrocellulose powders containing nitroglycerine: 1 g of powder is placed in glass test tubes, similar to those referred to in (a), which are then placed in an oven kept at a constant temperature of 110°C.

(3) The test tubes containing the powders referred to in (1) and (2) are kept in the oven for one hour. During this time no nitrous gases must be visible. Observation and appraisal as in (a).

## Appendix A.1

Re marginals 3103 and 3105

(a) Test of substances listed in marginal 3103, 1.

3152

(1) Two samples of explosive each weighing 10 g are placed in cylindrical weighing bottles having an internal diameter of 3 cm and a height of 5 cm to the underside of the cover; the bottles are then firmly closed with their covers and heated for three hours at a constant temperature of 90°C in an oven in which they are clearly visible.

(2) During this time no nitrous gases must be visible.  
Observation and appraisal as under marginal 3151(a).

(b) Test of substances listed in marginals 3103, 2. and 3105.

(1) Two samples of explosive each weighing 10 g are placed in cylindrical weighing bottles having an internal diameter of 3 cm and a height of 5 cm to the underside of the cover; the bottles are then firmly closed with their covers and heated for 48 hours at a constant temperature of 75°C in an oven in which they are clearly visible.

(2) During this time no nitrous gases must be visible.  
Observation and appraisal as under marginal 3151(a).

Ignition temperature (see marginals 3101 and 3102)

(1) The ignition temperature is determined by heating 0.2 g of substance enclosed in a glass test tube immersed in a Wood's alloy bath. The test tube is placed in the bath when the latter has reached 100°C. The temperature of the bath is then progressively increased by 5°C per minute.

3153

(2) The test tubes must have the following dimensions:

length .....	125 mm
internal diameter .....	15 mm
thickness of wall .....	0.5 mm

and must be immersed to a depth of 20 mm.

## Appendix A.1

3153  
(contd)

(3) The test must be repeated three times, the temperature at which ignition of the substance occurs, i.e., slow or rapid combustion, deflagration or detonation, being noted each time.

(4) The lowest temperature recorded in the three tests is the ignition temperature.

3154

Test of sensitivity to red heat and to flame-ignition

(see marginals 3103 and 3110).

(a) Test in red-hot hemispherical iron crucible (see marginals 3103 to 3106 and 3108 to 3110).

(1) Quantities of the explosive to be examined increasing from 0.5 g to 10 g are thrown into a red-hot hemispherical iron crucible 1 mm thick and 120 mm in diameter.

The results of the test are to be classified as follows:

1. ignition with slow combustion (explosives with an ammonium nitrate base);
2. ignition with rapid combustion (chlorate explosives);
3. ignition with violent combustion and deflagration (black powder);
4. detonation (fulminate of mercury).

(2) The effect on the sequence of events of the amount of explosive used should be taken into account.

(3) The explosive to be examined must not show any fundamental difference from the standard explosive.

(4) The iron crucibles must be carefully cleaned before each test and replaced at frequent intervals.

(b) Test of ease of ignition (see marginals 3103 to 3110).

(1) The explosive to be examined is placed in a small heap on an iron plate in quantities increasing - in the light of the results of the test under (a)- from 0.5 g to a maximum of 100 g.

## Appendix A.1

(2) A burning match is applied to the apex of the small heap and note is taken whether the explosive ignites and burns slowly, deflagrates, or detonates, and whether, once ignition has occurred, combustion continues even after the match has been removed. If no ignition takes place a similar test is made by bringing the explosive into contact with a gas flame and noting the same points.

3154  
(contd)

(3) The results of the test are compared with those obtained with the standard explosive.

(c) Combustion test in conditions of enclosure in a sheet-steel box (see marginal 3107)

(1) The combustion test is carried out in a cubical box, made of sheet steel with edges 8 cm long and a wall thickness of 1 mm. The box is made of annealed mild steel sheet and closed in as tight a manner as possible by folding the edge of the lid over (fig. 1).

(2) In the case of explosives sensitive to friction, the top surface should be covered with a sheet of paper to prevent particles of explosive from finding their way between the edges and remaining trapped there when the edge of the lid is being bent over. The box is completely filled with the explosive so that the latter has as nearly as possible the same density as when in cartridges. The box is placed in the fire with care; it shall first be wrapped in, for example, several layers of packing paper to avoid immediate ignition of the explosive.

A pile of wood 0.8 m high is prepared for the fire by first placing on the ground a thin layer of wood-wool and then on top of it, lying flat, three billets about 0.5 m long and 0.25 m in diameter. Across these are laid three more billets of similar size. On top of all are placed three layers of small sticks cut about 0.2 m long, with wood-wool between the layers. On each side, three or four pieces of wood about 0.5 m long are leant against the pile to prevent it from collapsing while it burns. The pile is set alight with a lighted fuse of wood-wool.

## Appendix A.1

3154  
(contd)

(3) Observations are made to see whether the explosive flares or explodes; how long it burns and what phenomena accompany combustion; and what changes the box has undergone.

(4) The test is carried out four times. A photograph is taken of the steel boxes after they have been used.

(d) Test by heating in a confined space in a steel tube with a calibrated orifice plate (steel tube test) (see marginals 3103 to 3110 and 3112)

(1) The tests in (a) to (c) may be supplemented by the following test.

(2) Description of the steel tube (fig. 2):

The tube is made by pressing from sheet steel suitable for deep drawing<sup>1/</sup>. The dimensions are: inner diameter 24 mm; wall thickness 0.5 mm; length 75 mm. The open end is fitted with an outer flange. The tube is closed with a pressure-resistant central-orifice plate fixed tightly on the flange by an externally-threaded collar slipped over the tube and by a box nut screwed on to this collar. The plate is made from heat-resisting chrome steel<sup>2/</sup> 6 mm thick. To allow the escape of gases of decomposition, plates are used having cylindrical central orifices (a) with the following diameters: 1.0-1.5-2.0-2.5-3-4-5-6-8-10-12-14-16-18-20mm; a diameter of 24 mm is added when the tube is used without orifice plate and closing device. The threaded collar and nut are made of manganese-chrome steel non-scaling up to 800° C<sup>3/</sup>. With orifice plates of from 1 to 8 mm diameter, nuts with a perforation (b) 10 mm in diameter must

<sup>1/</sup> e.g. Material Specification No. 1.0336.505 g, in accordance with DIN 1623 Sheet 1.

<sup>2/</sup> e.g. Material Specification No. 1.4873, in accordance with Sheet "Stahl-Eisen-Werkstoff" 490-52.

<sup>3/</sup> e.g. Material Specification No. 1.3817, in accordance with Sheet "Stahl-Eisen-Werkstoff" 490-52.



## Appendix A.1

be used; if the diameter of the orifice is above 8 mm, that of the nut perforation must be 20 mm. Each tube is used for one test only. On the other hand, the orifice plates, threaded collars and nuts may be used again provided they are undamaged. As a check the orifice must be measured after each test.

3154  
(contd)

## (3) Heating and protective device (fig. 3):

Heating is provided by town gas with a net calorific value of 4,000 kcal/Nm<sup>3</sup>, from 4 burners producing about 2.4 kcal/sec. for a consumption of 0.6 l/sec.

As destruction of the tube is possible, heating is undertaken in a splinter-proof welded box, made of steel 10 mm thick, open on one side and at the top. The tube is suspended between two rods 4 mm in diameter inserted through holes drilled in opposite walls of the box, and is then heated by four Teclu burners (external tube diameter 19 mm), the lowest heating the bottom of the tube, those at the right and left the walls, and that at the rear the closure. The burner tubes are inserted and secured in holes 20 mm in diameter drilled in the walls of the splinter-proof box. The burners are lit simultaneously by a pilot jet and regulated to a plentiful supply of air so that the tips of the blue inner cones of the flames are almost touching the tube.

The whole installation is contained in a test stand separated from the observation area by a strong wall in which sight holes protected by armoured glass and slatted steel plates are arranged. The splinter-proof box is placed with its open side towards the observation area, care being taken that the flames are not affected by draughts. Equipment for extracting gases of decomposition and smoke from the explosion is installed in the test room.

If town gas is not available, propane can be used for heating. In such a case the propane is taken from an industrial cylinder fitted with a pressure regulator (500 mm water gauge), through a meter (bellows-type meter with a capacity of 2 litres at 500 mm water gauge), and distributed by a manifold to the four burners, whose jets have a diameter

## Appendix A.1

3154  
(contd)

of 0.8 mm. Each burner consumes not more than about 1.7 litre of propane a minute. The gas cylinders and the meter are placed outside the test stand.

## (4) Test procedure:

The tube is filled with the explosive substance to within 15 mm of the top, i.e. to a height of 60 mm. If the substance is in powdered form it is compressed by cautiously and gently tapping the tube and then pressing lightly with a small wooden rod. If the substance is gelatinous it is put into the tube with the aid of a spatula; after each addition the substance is lightly pressed down with a small wooden rod to eliminate occlusions of air. When the quantity of substance inserted has been weighed, the threaded collar is slipped on to the tube, the required orifice plate is put in place, and the nut is tightened by hand. It is essential to make sure that none of the substance is trapped between the flange and the plate, or in the threads. The tube is then put in a rigidly mounted vice with shielding against inadvertent explosion, and the nut is fully tightened with a spanner. The tube, now ready for the test, is suspended between the two rods in the splinter-proof box; the pilot jet is lighted and when the test stand has been closed, the gas supply to the four burners is turned on. At the same time a stop-watch is started to measure the time  $t_1$  elapsing between the lighting of the burners and the ignition of the substance, as shown by the escape of a flame from the orifice in the plate, and the time  $t_2$  between lighting and explosion. On completion of the test the gas supply is shut off and the exhaust system in the test stand is started up; no one must enter the stand until a sufficient period of time has elapsed.

To make sure that the heating device is working satisfactorily, the tests must be preceded by a "dummy run".

## (5) Interpretation of results:

The relative degree of sensitivity of a substance to heating in the steel tube is expressed by the limiting diameter, this being the orifice with the largest diameter in millimetres with which, in three tests, at

## Appendix A.1

least one tube explodes, that is to say breaks up into at least three pieces. The thermal sensitivity increases with increasing limiting diameter and with decreasing times  $t_1$  and  $t_2$ .

3154  
(contd)

Organic peroxides (except those wetted or diluted with volatile substances e.g. water) for which the limiting diameter is not less than 2.0 mm should be considered as explosive substances of Class Ia (see also note to marginal 2700).

(e) Heating test in a pressure vessel with an orifice plate and bursting disc (pressure vessel test) (see marginal 3112)

(1) For organic peroxides, the tests shown under (a), (b) and (d) may be supplemented by the following test:

(2) Description of the pressure vessel (figs. 4 to 6):

Figures 4 to 6 and the appropriate captions give the details of the apparatus used and the dimensions and materials of the constituent parts.

It should be noted that the use of 24 plates is provided for, the diameters of the orifices being: 1.0-1.2-1.5-2.0-2.5-3.0-3.5-4.0-4.5-5.0-5.5-6.0-7.0-8.0-9.0-10.0-11.0-12.0-14.0-16.0-18.0-20.0-22.0 and 24.0 mm. These plates have a thickness of 2.0 mm  $\pm$  0.2 mm.

The bursting disc is cut by a punch from a sheet of brass 0.05 mm thick withstanding a bursting pressure of 5.4  $\pm$  0.5 kg/cm<sup>2</sup> at normal temperature. Unannealed rolled brass containing 67% copper is suitable.

(3) Heating device:

The pressure vessel is heated by technical-grade butane taken from a cylinder fitted with a pressure regulator. The heat output must be about 2,700 kcal/h. With a net calorific value of 27,000 kcal/m<sup>3</sup> (at 1 atm and 20°C), the rate of gas supply must be about 100 l/h. A Teclu butane burner is used. The amount of gas used is measured by a rotameter or other meter and regulated by the burner valve.

## Appendix A.1

3154  
(contd)

Instead of butane, town gas or propane may be used with a suitable burner, provided that the heat output of the gas is likewise about 2,700 kcal/h (for example, in the case of town gas with a net calorific value of 4,050 kcal/m<sup>3</sup> it would be necessary to supply about 670 l/h).

The gas cylinder and the rotameter or other meter must be situated outside the test area.

## (4) Test procedure:

For a normal test, 10 grammes of the substance are placed in the vessel. In the case of a substance the sensitivity of which is unknown a start is made with smaller quantities: 1 gramme to begin with, then (if possible) 5 grammes, and finally 10 grammes. The bottom of the vessel must be evenly covered with the substance. The bursting disc, central orifice plate and retaining ring are then put in place. The wing nuts are tightened by hand and the box nut with a spanner. The bursting disc is covered with enough water to keep it at a low temperature.

The pressure vessel is placed on a tripod (with an inside ring diameter of 67 mm) which is inside a protective cylinder. The ring at the bottom of the vessel rests on the tripod.

The burner is lit, the flow of gas set at the required rate, and the flow of air so adjusted that the colour of the flame is blue and the inner cone of the flame light blue. The tripod must be of such a height that the inner cone almost touches the bottom of the vessel. Then the burner is placed under the vessel through a hole in the protective cylinder.

The test area must be very well ventilated and admission to it prohibited during the test. The vessel is observed from outside either by mirrors or through a sight hole in the wall, fitted with armoured glass.

The time  $t_1$  between the beginning of heating and the beginning of a reaction (flame, production of smoke, hissing) and the time  $t_2$  until the end of the reaction (detonation, end of hissing and production of smoke, or extinction of the flame) are measured. The vessel is then cooled with water and cleaned.

## Appendix A.1

## (5) Interpretation of results:

3154  
(contd)

The relative degree of sensitivity of a substance to heating in the pressure vessel is expressed by the limiting diameter, this being the largest orifice diameter in millimetres with which the bursting disc is broken at least once in three tests while having remained intact during three tests with the next larger diameter.

The thermal sensitivity increases with increasing limiting diameter and with decreasing times  $t_1$  and  $t_2$ .

Organic peroxides (except those wetted or diluted with volatile substances, e.g. water) for which the limiting diameter is not less than 9 mm should be considered as explosive substances of Class Ia (see also note to marginal 2700).

Test of sensitivity to impact (see marginals 3103 to 3110 and 3112)

3155

## (a) Fall-hammer test I (figs. 7 and 8) against a standard (control) explosive

(1) The explosive, after drying as described in marginal 3150, is put into the following form.

- (a) Compact explosives are rasped fine enough to pass without residue through a sieve of 1 mm mesh; only the residue remaining on a sieve of 0.5 mm mesh is kept for the following test;
- (b) Explosives in powdered form are passed through a sieve of 1 mm mesh; all that passes through this sieve is kept for the impact test;
- (c) Plastic and gelatinous explosives are formed into small, roughly spherical pills weighing between 25 and 35 mg.

(2) The apparatus for carrying out the test consists of a weight which, sliding between two bars, is capable of being set to fall from a prearranged height and of being readily released for the fall. The weight does not fall directly onto the explosive, but falls onto a striker D resting on an anvil E, both in very hard steel and sliding easily in the guide ring F (fig. 7). The sample of explosive is placed

## Appendix A.1

3155  
(contd)

between the striker and the anvil. The striker, anvil and guide ring are in a protective cylinder C made of hardened steel and placed on a steel block B embedded in a cement block A (fig. 8). The dimensions of the various parts are given in the figures.

(3) The tests are carried out in turn on the explosive to be tested and on the standard (control) explosive as follows:

- (a) The explosive, in the form of a spherical pill (if it is plastic) or measured with a measuring spoon of 0.05 cm<sup>3</sup> capacity (if it is in the form of a powder or of raspings), is arranged with care between the striker and the anvil, whose contact surfaces must not be moist. The ambient temperature must not exceed 30°C nor be less than 15°C. Each sample of the explosive must be subjected to one impact only. After each test the striker, the anvil and the guide ring must be carefully cleaned, any residue of explosive being removed.
- (b) The tests must begin at heights of fall likely to cause complete explosion of the explosives under test. The height of fall is reduced gradually until the resulting explosion is incomplete or no explosion results. At this height four impact tests are carried out, and if at least one produces a definite explosion, four further fall tests from a slightly lower height are carried out, and so on.
- (c) The lowest height of fall causing a definite explosion in a series of at least four tests at that height is taken as the limit of sensitivity.
- (d) The impact test is normally carried out with a drop weight of 2 kg; however, if the sensitivity to impact with this weight requires a height of fall greater than 60 to 70 cm, the impact test must be carried out with a weight of 5 kg.

## Appendix A.1

- (b) Fall-hammer test II (figs. 9 to 13) with numerical expression of impact sensitivity (impact energy in kgm)

3155  
(contd)

(1) The test described in (a) may be replaced by the following test.

(2) Description of the apparatus:

The essential parts of the apparatus are the impact device [see under (4)], the cast steel block with base, the anvil, the column, the guides and the hammer with release device (fig. 9). A steel anvil (100 mm in diameter, 70 mm high) is screwed on the steel block (230 x 250 x 200 mm) cast integral with the base (450 x 450 x 60 mm). Bolted to the back of the steel block is the support into which the column formed from a seamless-drawn steel tube (90 mm outside diameter, 75 mm inside diameter) is fixed. The two guides are fixed to the column by means of three cross-members and are fitted with a toothed rack to limit the rebound of the hammer and with a movable graduated scale for setting the height of fall. The hammer holding and releasing device is adjustable between the guides and is clamped to them by the operation of a lever-nut on two jaws. The apparatus is so fixed on a concrete block (600 x 600 x 600 mm) by means of four anchoring screws sealed in the concrete that the base is in contact with the concrete over its whole area and the guides are exactly vertical. A wooden splinter-proof box which has a lead lining 2 mm thick and opens easily surrounds the apparatus up to the level of the bottom cross-member. An exhauster enables the explosion gases and dust from the substance to be removed.

(3) Description of the fall-hammers:

Each hammer is provided with two positioning grooves holding it between the guides as it drops and with a suspension spigot, a removable cylindrical striking head and a rebound catch which are screwed on to the hammer (fig. 10). The striking head is of hardened steel (HRC 60 to 63); its minimum diameter is 25 mm; it has a shoulder preventing it from being forced into the hammer by the impact.

## Appendix A.1

3155  
(contd)

There are three hammers of different weights. The 1-kg hammer is used for highly sensitive substances, the 5-kg hammer for substances of medium sensitivity and the 10-kg hammer for substances of low sensitivity. The 5-kg and 10-kg hammers are of massive and compact steel<sup>\*/</sup>. The 1-kg hammer must have a heavy steel centre carrying the striking head and forming with it the main mass of the hammer.

The 1-kg hammer is used for drop heights of 10 to 50 cm (impact energy 0.1 to 0.5 kgm), the 5-kg hammer for drop heights of 15 to 60 cm (impact energy 0.75 to 3 kgm), and the 10-kg hammer for drop heights of 35 to 50 cm (impact energy 3.5 to 5 kgm).

## (4) Description of the impact device:

The sample to be examined is enclosed in an impact device (fig. 11) consisting of two solid steel cylinders coaxially placed one above the other in a cylindrical guide ring likewise made of steel. The cylinders are steel rollers for anti-friction bearings and are 10 mm in diameter (type with a mean deviation of  $-4$  microns for a tolerance of  $-2$  microns, i.e. a diameter of  $10_{-0.005}^{-0.003}$  mm), 10 mm high, with polished surfaces and rounded edges (radius of curvature 0.5 mm) and an HRC hardness between 58 and 65. The guide ring has an outer diameter of 16 mm, a lapped bore of  $10_{+0.010}^{+0.005}$  mm and a height of 13 mm. A cylindrical plug gauge may be used to check that the bore diameter is within the prescribed tolerances. The cylinders and the guide ring shall be degreased with acetone before use.

The impact device is placed on an intermediate anvil 26 mm in diameter and 26 mm high and centred by a locating ring provided with a ring of vent-holes to permit the escape of the gases (figs. 11 and 12). Each striking surface of the cylinders shall be used only once. If an explosion occurs, the guide ring shall not be used again.

## (5) Preparation of the samples:

The explosive substances are tested in the dry state. Substances of marginal 2021, 11° to 14° and 16°, are tested as delivered provided that their water content agrees with the value indicated by the

<sup>\*/</sup> At least St 37-1, in accordance with DIN 17000.



## Appendix A.1

manufacturer. If the water content is higher, the mixtures must be dried before the test until their moisture content is that indicated.

3155  
(contd)

In addition, in the case of solid substances other than those in paste-like form the following points should be observed:

- (a) substances in powdered form are sieved (sieve mesh 0.5 mm); everything that passes through the sieve is used for the test;
- (b) substances which have been compressed, cast or otherwise consolidated are broken into small pieces and sieved; the siftings from 0.5 mm to 1.0 mm in diameter are used for the test.

(6) Test procedure:

In the case of substances in powdered form, a sample is taken with a cylindrical measure of 40 mm<sup>3</sup> capacity (3.7 mm diameter x 3.7 mm). For substances in paste-like form, a cylindrical tube of the same capacity is used, which is plunged into the mass. After levelling off the excess extending beyond the measure, the sample is taken out by means of a wooden rod. For explosive liquids a fine-drawn pipette of 40 mm<sup>3</sup> capacity is used.

The sample is placed on the open impact device, which is already in the locating ring on the intermediate anvil, and in the case of substances in powdered or paste-like form the upper steel cylinder is lightly and carefully pressed with the forefinger until it touches the sample without flattening it. In the case of liquid substances the upper steel cylinder is pressed down with the aid of the depth scale of a vernier gauge until it is 1 mm from the lower cylinder, and held in this position by a rubber ring previously slipped on to it (fig. 13).

The device is placed centrally on the anvil, the protective wooden box is closed, the hammer suspended at the required height is released, and the exhaustor is then started up. The test is performed six times at each height of fall.

## Appendix A.1

3155  
(contd)

## (7) Interpretation of results:

In interpreting the results of the test of sensitivity to impact a distinction is made between "no reaction", "decomposition" (without flame or detonation; recognizable by colour-change or odour) and "explosion" [with weak to strong detonation\*]. The degree of sensitivity to impact of a substance is measured by determining the weight of the hammer in kg and the lowest height of drop in cm with which an explosion occurs in at least one out of six tests, and the resultant impact energy in kgm. The sensitivity of the substance to impact is greater the lower the impact energy in kgm.

3156 Test of sensitivity to friction (see marginals 3103 to 3110 and 3112)

## (a) Friction test in a porcelain mortar

(1) The explosive is dried over calcium chloride. A sample of the explosive is compressed and ground in an unglazed porcelain mortar by means of a pestle, also unglazed. The mortar and pestle must have a temperature about 10 degrees higher than the ambient temperature (15° to 30°C).

(2) The results of the test are compared with those obtained with the standard (control) explosive, and are classified as follows:

1. no effect;
2. faint occasional crackling;
3. frequent crackling or very pronounced occasional crackling.

(3) Explosives which, under test, give the result set out in 1. are to be considered as practically insensitive to friction; if they give the result set out in 2. they are to be considered as moderately sensitive to friction; if they give the result set out in 3. they are to be considered as very sensitive to friction.

\* For some substances there is "ignition without detonation". This reaction is, however, regarded as an explosion (and designated by the terms in inverted commas) because it involves the entire sample and an explosion can also occur under identical conditions.

## Appendix A.1

(b) Test with the friction apparatus (figs. 14 and 15)

3156  
(contd)

(1) The test described in (a) may be replaced by the following test.

(2) Description of the apparatus:

The friction apparatus is made up of a cast-steel base on which the friction device proper, comprising a fixed porcelain peg and a movable porcelain plate (fig. 14), is mounted. The porcelain plate is held in a carriage which runs in two guides. On operation of a push-button switch the carriage is moved by an electric motor through a connecting-rod, an eccentric disc and suitable gearing in such a way that the porcelain plate moves back and forth once only beneath the porcelain peg, the distance of travel being 10 mm. The peg-holder pivots on an axis so that the porcelain peg can be changed; it is extended by a loading arm with six notches for hanging a weight. Balance in the "zero" position (without weights) is achieved by adjusting a counter-weight. When the peg-holder is lowered on to the porcelain plate the longitudinal axis of the porcelain peg is perpendicular to the upper surface of the plate. One of the weights is hung by means of a ring and hook in the appropriate notch; the load on the peg can be varied from 0.5 to 36 kg.

(3) Description of the porcelain plate and peg:

The flat porcelain plates are made of pure technical white porcelain and have the following dimensions: 25 mm x 25 mm x 5 mm. Before being fired, their two rubbing surfaces are thoroughly roughened by being rubbed with a sponge. The sponge-marks are clearly visible.

The cylindrical porcelain pegs are also made of technical white porcelain; they are 15 mm long and 10 mm in diameter and their roughened ends are rounded, with a radius of curvature of 10 mm.

Samples of porcelain pegs and plates of the quality described above are deposited with the Bundesanstalt für Materialprüfung, Berlin-Dahlem, which can supply the addresses of manufacturers.

## Appendix A.1

3156  
(contd)

As the natural undamaged roughness of the plates and pegs is an essential condition for the reaction of the explosive substance, each part of the surface must be used only once. In consequence, the two end surfaces of each peg are sufficient for two tests, and the two friction surfaces of a plate will each serve for about three to six tests.

## (4) Preparation of samples:

The explosive substances are tested in the dry state. Substances of marginal 2021, 11° to 14° and 16°, are tested as delivered, provided that their water content agrees with the value indicated by the manufacturer. If the water content is higher, the mixtures must be dried before the test until their moisture content is that indicated.

In addition, for solid substances, except those in paste-like form, the following points should be observed:

- (a) substances in powdered form are sieved (sieve mesh 0.5 mm); everything that passes through the sieve is used for the test;
- (b) substances which have been compressed, cast or otherwise consolidated are broken into small pieces and sieved; everything that passes through a sieve mesh of 0.5 mm is used for the test.

## (5) Test procedure:

A porcelain plate is fixed on the carriage of the friction apparatus so that the grooves of the sponge-marks on it run transversely to the direction of movement. The quantity to be tested, about 10 mm<sup>3</sup>, is taken from substances in powdered form by means of a cylindrical measure (2.3 mm diameter x 2.4 mm); in the case of substances in paste-like form, the sample is measured by a cylindrical tube which is plunged into the mass. After levelling off the excess extending beyond the measure, the sample is taken out by means of a wooden rod and placed on the porcelain plate. The firmly-clamped porcelain peg is set on the heaped-up quantity as shown in fig. 15; the loading arm is loaded

## Appendix A.1

with the required weight and the push-button switch is operated. Care must be taken that the peg rests on the sample and that there is enough of the substance in front of it to come under the peg as the plate moves.

3156  
(contd)

## (6) Interpretation of results:

In interpreting the results of the test a distinction is made between "no reaction", "decomposition" (change of colour, smell), "ignition", "crackling" and "explosion".

The relative degree of sensitivity of a substance to friction in the friction apparatus as described is indicated (without taking the coefficient of friction into account) by the smallest load on the peg, in kg, with which ignition, crackling or an explosion occurs in at least one out of six tests. In this connexion, even ignition and crackling are deemed to be dangerous reactions. The sensitivity of an explosive substance to friction is greater the lower the ascertained load on the peg (loading weight in relation to length of loading peg).

Explosive liquids and substances in paste-like form are not in general sensitive to friction under the conditions of this test, since because of the lubricating effect the slight frictional heat produced is insufficient to induce ignition. With such substances the absence of any reaction is no indication that the substance is not dangerous.

The stability of the products referred to in marginal 3111 is to be checked by ordinary laboratory methods.

3157

Test of dynamite for exudation (see marginal 3107)

3158

(1) The apparatus for testing dynamite for exudation (figs. 16 to 18) consists of a hollow bronze cylinder. This cylinder, which is closed at one end by a plate of the same metal, has an internal diameter of 15.7 mm and a depth of 40 mm. It is pierced by 20 holes 0.5 mm in diameter (4 sets of 5 holes) on the circumference. A bronze piston, cylindrical over 48 mm of its total length of 52 mm, can slide in the vertical cylinder; this piston, whose diameter is 15.6 mm, is loaded with a weight of 2,220 g so as to produce a pressure of 1.2 kg/cm<sup>2</sup>.

## Appendix A.1

3158  
(contd)

(2) A small plug of dynamite weighing 5 to 8 g, 30 mm long and 15 mm in diameter, is wrapped in very fine gauze and placed in the cylinder; the piston and its loading weight are then placed on it so that the dynamite is subjected to a pressure of 1.2 kg/cm<sup>2</sup>.

The time taken for the appearance of the first signs of oily droplets (nitroglycerine) at the outer orifices of the cylinder holes is noted.

(3) The dynamite is considered satisfactory if the time elapsing before the appearance of the liquid exudations is more than 5 minutes, the test having been carried out at a temperature of 15° to 25°C.

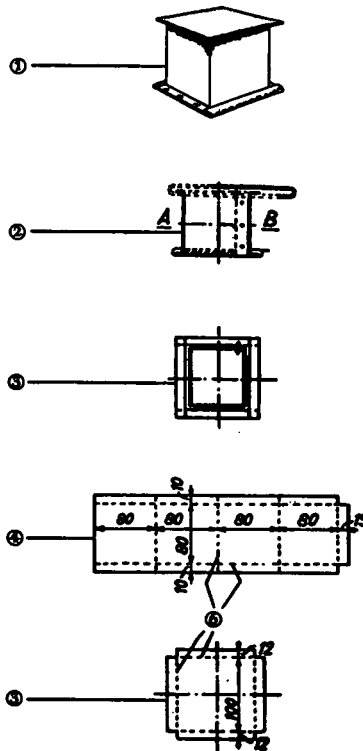
3159-  
3199

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## Appendix A.1

## Combustion test

Re marginal 3154(o)

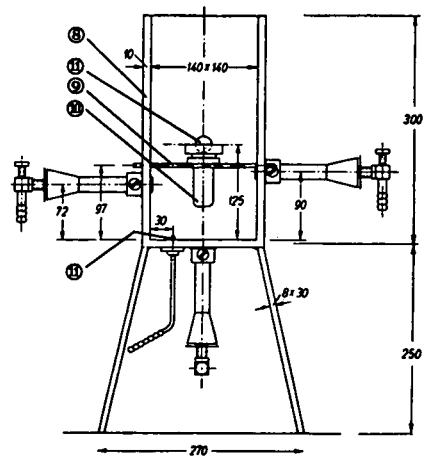
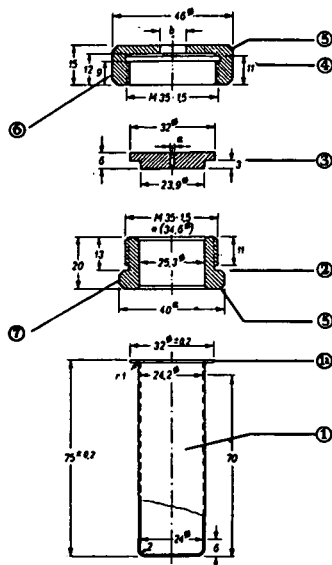
Fig. 1: Steel box

thickness of wall 1 mm  
 dimensions in mm

- (1) general view
- (2) vertical section
- (3) section A-B
- (4) fabrication of wall
- (5) fabrication of base and cover
- (6) edges to be folded in

## Appendix A.1

Test by heating in a steel tube  
with a calibrated orifice plate  
 Re marginal 3154(d)

Fig. 2: Steel tube and accessoriesFig. 3: Heating and protective device

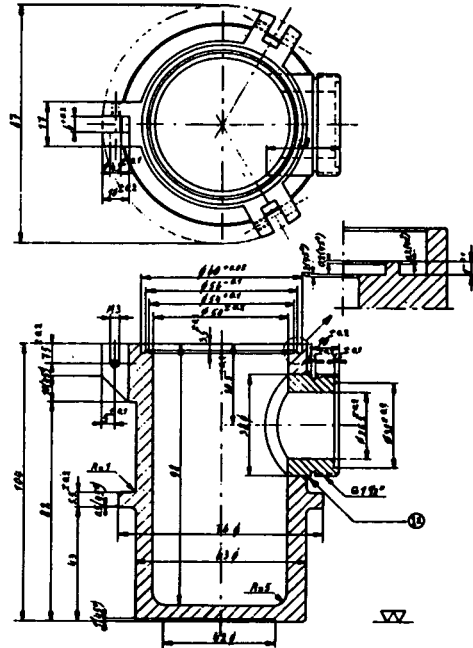
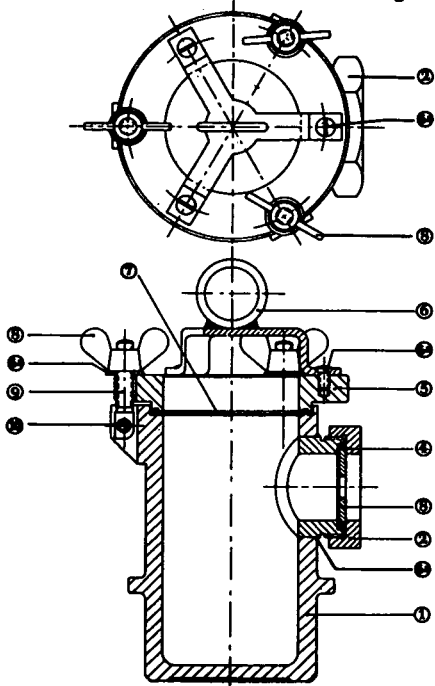
dimensions in mm; for construction materials  
 see marginal 3154 (d) (2) and (3)

- (1) tube
- (1a) outer flange
- (2) threaded collar; low-friction thread
- (3) orifice plate  $a = 1.0 \dots 20.0$  diameter
- (4) nut  $b = 10$  or  $20$  diameter
- (5) chamfered surface
- (6) 2 flats for spanner size 41
- (7) 2 flats for spanner size 36
- (8) splinter-proof box
- (9) 2 supporting rods for the tube
- (10) assembled tube
- (11) position of rear burner; the other burners are visible
- (12) pilot jet



## Appendix A.1

Heating test in a pressure vessel  
with an orifice plate and bursting disc  
Re marginal 3154(c)



**Fig. 4:** Assembled pressure vessel;  
vertical section and plan

**Fig. 5:** Pressure vessel  
dimensions in mm

- (1) pressure vessel (stainless steel)
- (1a) welded joint
- (2) box nut (fully-killed weldable steel)
- (3) central-orifice plate (stainless steel)
- (4) inert retaining ring, 0.5 thick
- (5) pressure ring (stainless steel)
- (6) brass handle
- (6a) brass screw (material M4 x 8 DIN 88)
- (7) bursting disc [for material see marginal 3154(e)(2)]
- (8) wing nuts (brass M6 DIN 315)
- (8a) washer (brass 6 DIN 125)
- (9) eye-bolt (stainless steel)
- (10) pivot for wing nuts (stainless steel)

**Note:** Stainless steel having the following average composition is considered suitable: Cr 18%, Ni 9%, Mn  $\leq$  2%, Si  $\leq$  1%, C  $\leq$  0.12%.

## Appendix A.1

Heating test in a pressure vessel with  
an orificic plate and bursting disc  
Re marginal 3154(e)

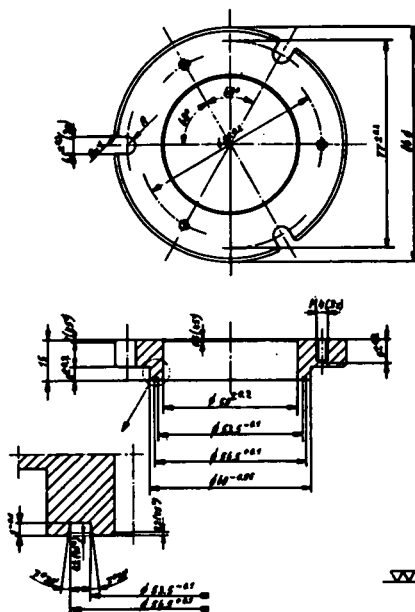


Fig. 6: Pressure ring of the vessel; details in  
vertical section and plan view  
dimensions in mm

## Appendix A.1

Fall-hammer test I  
 Re marginal 3155(a)

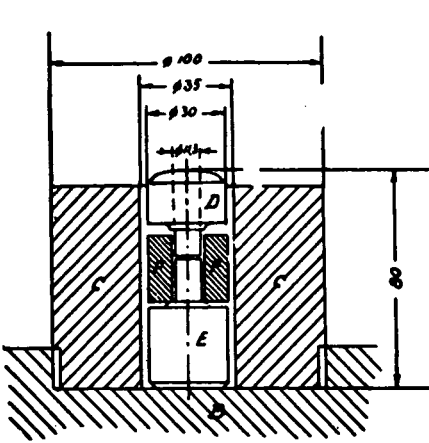


Fig. 7: Impact device, vertical section  
 dimensions in mm

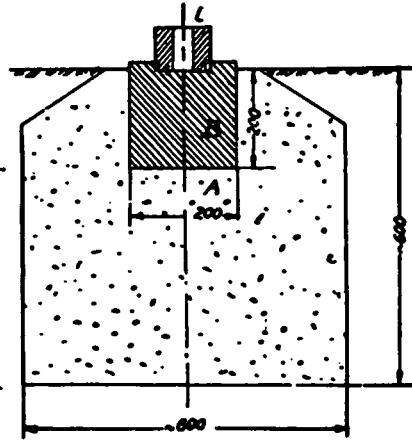


Fig. 8: Base for impact device, vertical section  
 dimensions in mm

- A. cement concrete block
- B. steel block
- C. protective cylinder
- D. striker
- E. anvil
- F. guide ring

## Appendix A.1

Fall-hammer test II  
 Re marginal 3155(b)

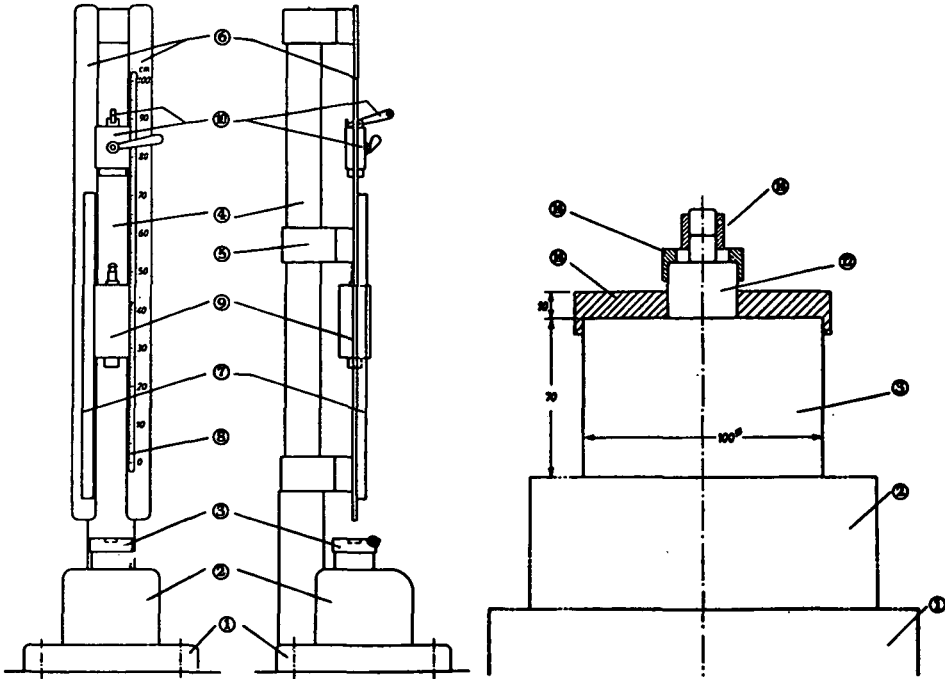


Fig. 9: Fall-hammer II,  
front and side, general view  
 dimensions in mm

Fig. 10: Fall-hammer II,  
lower part  
 dimensions in mm

- (1) base, 450 x 450 x 60
- (2) steel block, 230 x 250 x 200
- (3) anvil, 100 diameter x 70
- (4) column
- (5) middle cross-member
- (6) 2 guides
- (7) toothed rack
- (8) graduated scale
- (9) fall-hammer (drop weight)
- (10) holding and releasing device
- (11) locating plate
- (12) intermediate anvil (interchangeable),  
26 diameter x 26
- (13) locking ring with orifices
- (14) impact device

## Appendix A.1

Fall-hammer test II

Re marginal 3115 (b)

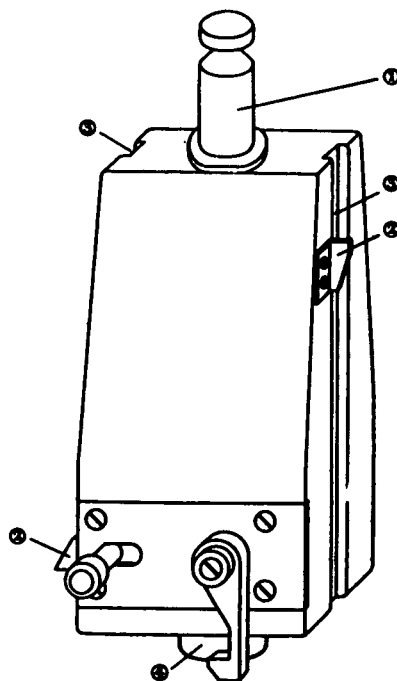


Fig. 11: Hammer (drop weight) of 5 kg

- (1) suspension spigot
- (2) height marker
- (3) positioning groove
- (4) cylindrical striking head
- (5) rebound catch

## Appendix A.1

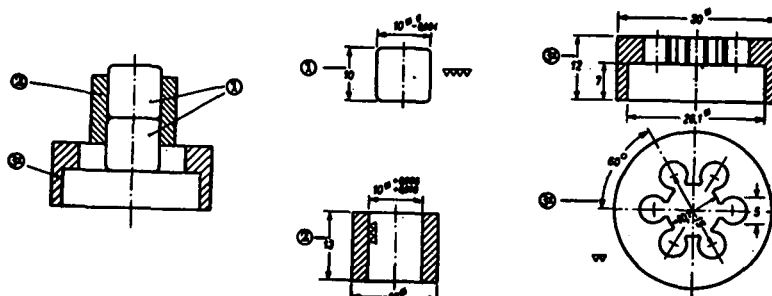
Fall-hammer test II  
Re marginal 3155(b)

Fig. 12: Impact device for substances in powdered or paste-like form  
dimensions in mm

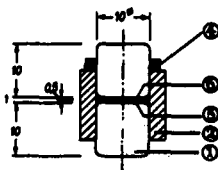


Fig. 13: Impact device for liquid substances

dimensions in mm

- (1) steel cylinders<sup>\*/</sup>
- (2) guide ring for steel cylinders<sup>\*/</sup>
- (3) locating ring with orifices
  - (a) vertical section
  - (b) plan
- (4) rubber ring
- (5) liquid substance (40 mm<sup>3</sup>)
- (6) space free from liquid

<sup>\*/</sup> Steel can have the following composition:

Cr  $\pm$  1.55%, C  $\pm$  1%, Si max 0.25%,  
Mn  $\pm$  0.35%; HRC 58...65 (heat-treated steel)

## Appendix A.1

Test with friction apparatus  
 Re marginal 3156(b)

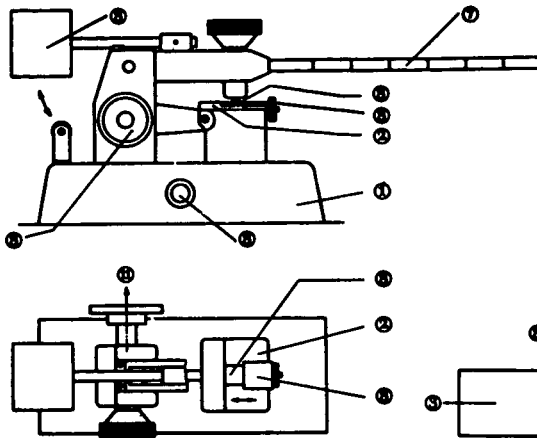


Fig. 14: Friction apparatus; elevation and plan view

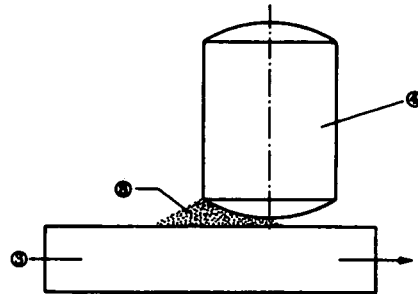


Fig. 15: Starting position of peg on sample

- (1) steel base
- (2) movable carriage
- (3) porcelain plate, 25 x 25 x 5 mm, held on the carriage
- (4) fixed porcelain peg, 10 diameter x 15 mm
- (5) sample under test, approximately 10 mm<sup>3</sup>
- (6) peg-holder
- (7) loading arm
- (8) counterweight
- (9) switch
- (10) wheel for setting carriage at starting position
- (11) direction to electric drive motor

## Appendix A.1

Test of dynamite for exudation

Re marginal 3158

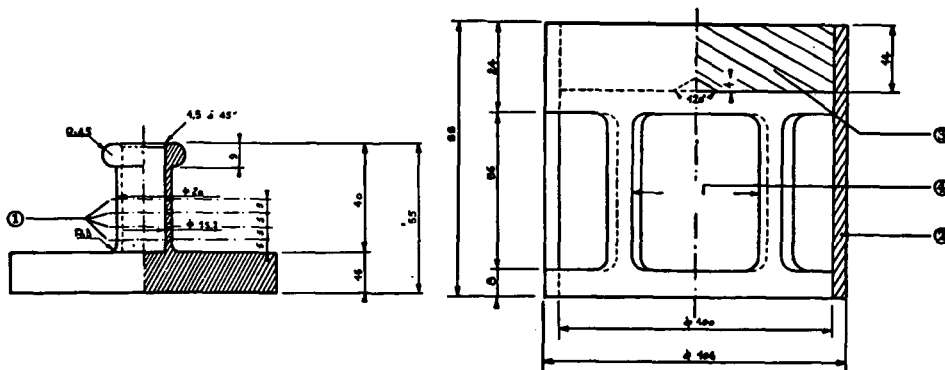


Fig. 17: Bell-shaped weight of 2220 g, capable of being suspended on the bronze piston

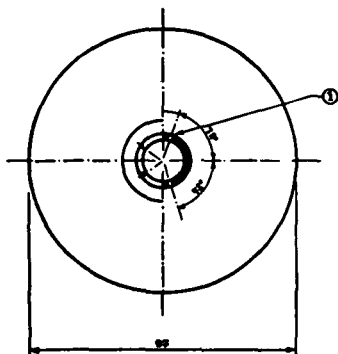


Fig. 16: Hollow bronze cylinder, closed at one end; plan and vertical section  
dimensions in mm

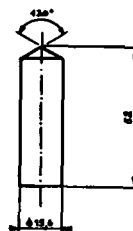


Fig. 18: Cylindrical bronze piston  
dimensions in mm

- (1) 4 sets of 5 holes of 0.5 diameter
- (2) copper
- (3) lead plate with central tapered recess on underside
- (4) 4 openings, about 46 x 56, evenly spaced round periphery



## APPENDIX A.2

A. Recommendations relating to the nature of aluminium-alloy receptacles for certain gases of Class IdI. Quality of the Material

(1) The materials of aluminium alloy receptacles which are to be accepted for the gases referred to in marginal 21 33 (2) (b), should satisfy the following requirements: 3200

Materials for receptacles subjected to a test pressure

	up to 30 kg/cm <sup>2</sup>	up to 60 kg/cm <sup>2</sup>	up to 375 kg/cm <sup>2</sup>
Brinell hardness HB in kg/mm <sup>2</sup> . . . . .	55 to 65	75 to 95	105 to 140
Tensile strength $\beta_z$ in kg/mm <sup>2</sup> . . . . .	22 to 26	26 to 30	38 to 55
Yield stress $\sigma_p$ in kg/mm <sup>2</sup> (permanent set $\lambda = 0.2\%$ ) . . . . .	10 to 14	17 to 21	23 to 41
Permanent elongation at fracture (l = 5 d), % . . . . .	30 to 22	22 to 19	16 to 12
Bending coefficient k (bend test on circumferential test pieces)			
external surface in tension ) . . . . .	40 to 30	30 to 25	24 to 13
internal surface in tension ) . . . . .			
Impact strength $\chi$ in kgm/cm <sup>2</sup> . . . . .	4	3	3 to 2.5

Intermediate values must be read from the diagrams in marginal 3203.

NOTES: 1. The characteristics above are based on previous experience with the following materials used for receptacles:

test pressure up to 30 kg/cm<sup>2</sup>: alloys of aluminium and magnesium;

test pressure up to 60 kg/cm<sup>2</sup>: alloys of aluminium, silicon and magnesium;

test pressure up to 375 kg/cm<sup>2</sup>: alloys of aluminium, copper and magnesium.

2. The permanent elongation at fracture (l = 5d) is measured on a test-piece of circular cross-section in which the gauge length l is equal to five times the diameter d; if test-pieces of rectangular section are used, the gauge length must be calculated by the formula  $l = 5.65 \sqrt{F_0}$ , where  $F_0$  indicates the initial cross-sectional area of the test-piece.

3. The bending coefficient k is defined as follows:  $k = 50 \frac{s}{r}$ , where s = wall thickness in cm and r = mean radius of curvature in cm. To calculate the effective value of k with the external and internal surfaces in tension, account must be taken of the bending coefficient  $k_0$  for the initial condition (mean radius  $r_0$ ).

3200  
(contd)

If, in the case of the appearance of a crack in the external (internal) surface under tension, the mean radius of curvature at the place affected is  $r_1$  ( $r_2$ ) cm, the bending coefficient  $k_1$  ( $k_2$ ) is used to calculate the effective bending coefficients as follows:

coefficient  $k_{\text{exterior}} = k_1 - k_0$  and coefficient  $k_{\text{interior}} = k_2 + k_0$ .

4. The impact strength data relate to tests carried out in accordance with standard No. 10925, of November 1950, of the Société suisse des constructeurs de machines (VSM).

(2) The following tolerances are allowed as regards the value of the material indicated in (1): permanent elongation at fracture minus 10% of the figures given in the table above; bending coefficient minus 20%; impact strength minus 30%.

(3) The wall thickness of aluminium alloy receptacles at the thinnest point must be the following:

if the diameter of the receptacle is less than 50 mm: not less than 1.5 mm;

if the diameter of the receptacle is from 50 to 150 mm: not less than 2.0 mm;

if the diameter of the receptacle is more than 150 mm: not less than 3.0 mm.

(4) The ends of the receptacles shall have a semi-circular, elliptical or "basket-handle" profile; they must afford the same degree of safety as the body of the receptacle.

3201

#### II. Additional official test for aluminium alloys containing copper

(1) In addition to the tests required by marginals 2145, 2146 and 2147, it is further necessary to test for the possibility of intercrystalline corrosion of the inside wall of the receptacle if made of an aluminium alloy containing copper.

(2) When the inner side of a test-piece of 1,000 mm<sup>2</sup> (33.3 x 30 mm) of the material containing copper is treated with an aqueous solution containing 3% NaCl and 0.5% HCl at the ambient temperature for 72 hours, the loss of weight must not exceed 50 mg/1,000 mm<sup>2</sup>.

#### III. Protection of the inner surface

3202

The inner surface of aluminium-alloy receptacles must be provided with suitable protection against corrosion if the competent testing stations consider it necessary.

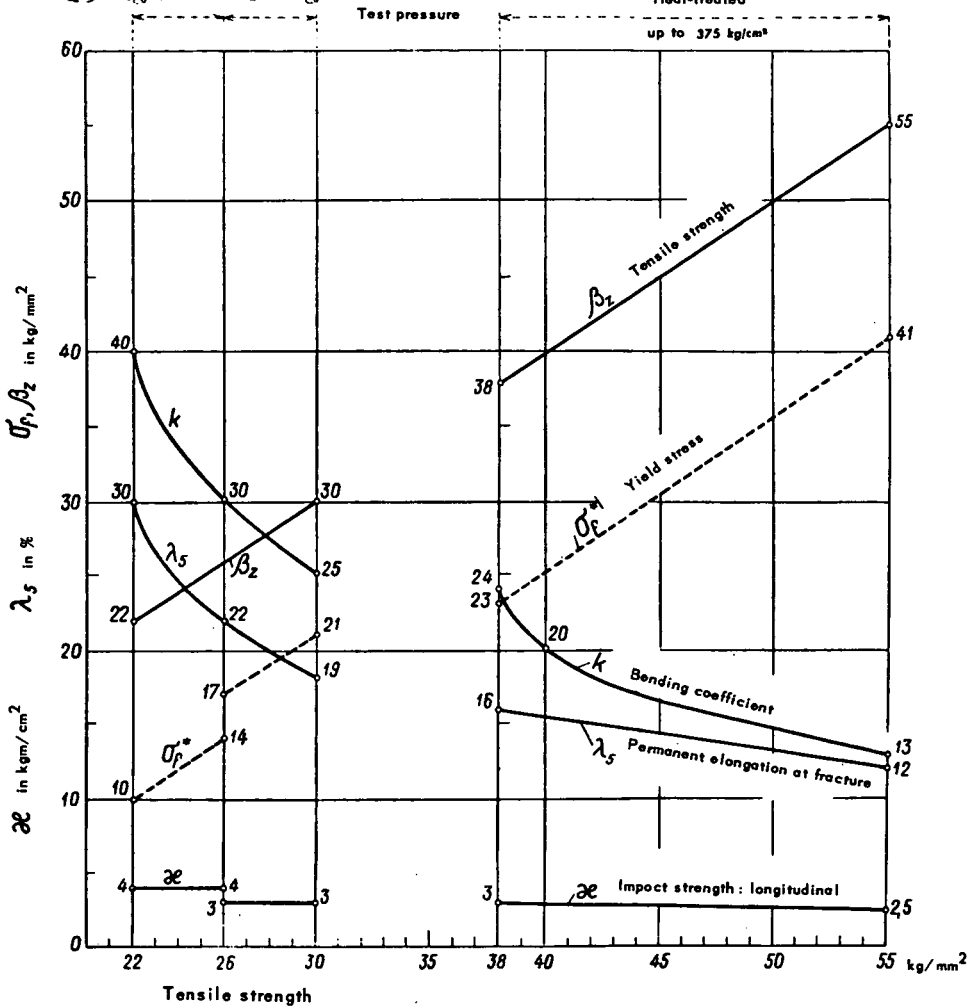
Appendix A. 2

ALUMINIUM ALLOY RECEPTACLES

3203

Not heat-treated, or heat-treated,  
according to the composition

≤ 30 kg/cm<sup>2</sup>      ≤ 60 kg/cm<sup>2</sup>



- Tolerances :
- Permanent elongation at fracture - 10%
  - Bending coefficient - 20%
  - Impact strength - 30%

\* The yield stress σ<sub>P</sub>\* must be at least equal to 4/3 of the circumferential stress σ<sub>c</sub> of the test pressure

$$\text{Circumferential stress } \sigma_c = \frac{P_i \cdot r_i}{100s} \text{ kg/mm}^2$$

- P<sub>i</sub> = test pressure in kg/cm<sup>2</sup>
- r<sub>i</sub> = internal radius in cm
- s = wall thickness in cm

## Appendix A.2

3204-  
3290B. (reserved)C. Provisions relating to tests on aerosol dispensers  
and non-refillable containers for gases  
under pressure of Class Id, 16° and 17°3291 1. Pressure and bursting tests on receptacle model

Hydraulic pressure tests shall be carried out on at least five empty receptacles of each model:

- (a) until the prescribed test pressure is reached, by which time no leakage or visible permanent deformation must occur;
- (b) until leakage or bursting occurs, the dishing of the bottom, if the latter is concave, first reversing and the receptacle not leaking or bursting until a pressure 1.2 times the test pressure has been reached.

2. Tightness (leakage) tests on all receptacles

3292

(1) For the test on aerosol dispensers (16°) and non-refillable containers of gas under pressure (17°) in a hot-water bath, the temperature of the bath and the duration of the test shall be such that the internal pressure of each receptacle reaches at least 90% of the internal pressure that would be reached at 55°C.

However, if the contents are sensitive to heat or if the receptacles are made of a plastics material which softens at this test temperature, the temperature of the bath shall be from 20° to 30°C; one dispenser out of every 2,000 must, in addition, be tested at the temperature prescribed in the foregoing paragraph.

(2) No leakage or permanent deformation of receptacles must occur. The provision concerning permanent deformation is not applicable to receptacles made of a plastics material which softens.

3293-  
3299

## APPENDIX A.3

Tests relating to inflammable liquids of Classes IIIa and IVa

(1) The flash-point is determined by means of one of the following types of apparatus: 3300

- (a) for use at temperatures not exceeding 50°C: Abel, Abel-Pensky, Luchoire-Finances, Tag;
- (b) for use at temperatures above 50°C: Pensky-Martens, Luchoire-Finances;
- (c) failing these, any other closed-cup apparatus capable of giving results within 2°C of those which an apparatus listed above would give at the same place.

(2) To determine the flash-point of paints, gums and similar viscous products containing solvents, only apparatus and test methods suitable for determining the flash-point of viscous liquids may be used, such as method A of IP standard 170/59 or more recent IP standards, German standards DIN 53 213 and TGL 14 301, leaflet 2.

The test procedure shall be:

3301

- (a) for the Abel apparatus, that of IP<sup>\*/</sup> standard 33/44; this standard may also be used for the Abel-Pensky apparatus;
- (b) for the Pensky-Martens apparatus, that of IP<sup>\*/</sup> standard 34/47, or that of A.S.T.M.<sup>\*\*</sup> standard D.93/46;
- (c) for the Tag apparatus, that of A.S.T.M.<sup>\*\*</sup> standard D.53/46;
- (d) for the Luchoire apparatus, that of the Instruction annexed to the ministerial order (arrêté ministériel) (France) of 26 October 1925 issued by the Ministère du Commerce et de l'Industrie and published in the Journal Officiel of 29 October 1925

If any other apparatus is used, the following precautions must be taken:

<sup>\*/</sup> The Institute of Petroleum, 61, New Cavendish Street, London, W.1.

<sup>\*\*</sup> American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, (Pa.).

## Appendix A.3

- 3301  
(contd.)
1. The test must be performed in a place free from draughts.
  2. The rate of temperature increase of the liquid being tested must never exceed 5°C per minute.
  3. The pilot-flame must be 5 mm ( $\pm$  0.5 mm) long.
  4. the pilot-flame must be applied to the opening of the receptacle after each rise of 1°C in the temperature of the liquid.

3302

In the event of a dispute as to the classification of an inflammable liquid, the number proposed by the sender shall be accepted if a check-test of the flash-point, carried out on the liquid in question, yields a result not differing by more than 2° from the limits (21°, 55° and 100°C respectively) stated in marginal 2301. If a check-test yields a result differing by more than 2°C from these limits, a second check-test must be carried out, and the highest figure obtained shall be adopted.

3303

The peroxide content of a liquid shall be determined as follows:

A quantity  $p$  (about 5 g, weighed to the nearest cg) of the liquid to be titrated is placed in an Erlenmeyer flask; 20 cm<sup>3</sup> of acetic anhydride and about 1 g of powdered solid potassium iodide are added; the flask is shaken and, after ten minutes, heated for 3 minutes to about 60°C; it is then allowed to cool for 5 minutes, after which 25 cm<sup>3</sup> of water are added. After being left standing for half an hour, the iodine liberated is titrated with a decinormal solution of sodium thiosulphate, no indicator being added. Complete decolorization indicates the end of the reaction. If  $n$  is the number of cm<sup>3</sup> of thiosulphate solution required, the percentage of peroxide (calculated as H<sub>2</sub>O<sub>2</sub>) present in the sample is obtained by the formula

$$\frac{17 n}{100 p} .$$

## APPENDIX A.4

Reserved

3400-  
3499

## APPENDIX A.5

Provisions relating to tests on steel drums for the carriage of  
inflammable liquids of Class IIIaI. Pressure test

Three drums of each type of construction and from each manufacturer 3500 shall be subjected by immersion in water to a pressure test at a gauge pressure of not less than 0.75 kg/cm<sup>2</sup>. The test pressure must remain constant and the drum leak-proof throughout a test period of ten minutes.

II. Drop test

The drums shall be filled to 95% of their capacity with water at 20°C and tested by being dropped either on to a non-resilient horizontal steel plate anchored to the floor or on to a horizontal concrete slab. The height of free drop shall be 110 cm. Each receptacle must satisfy the following three tests: 3501

- (a) a drop on an edge of one end of the drum, the longitudinal axis of the drum being inclined and the point of impact being vertically below the centre of gravity. If one of the ends is fitted with a bung, that end shall be tested first. In this case the point of impact shall be immediately beside the bung;
- (b) a drop as in (a) on that point of the edge of the other end of the drum which is opposite the point of impact referred to in (a);
- (c) a drop flat on the side of the drum, the line of impact lying in the same plane as the point of impact referred to in (a).

After these tests, all the drums must be leak-proof. They are still considered to be leak-proof if the interval between the detachment of two successive drops of liquid exceeds five minutes. If one of the three drums tested is not leak-proof, six further drums of the same type of construction shall be tested and must pass all the tests prescribed in I and II.

The tests under I and II shall be carried out by an approved body.

## Appendix A.5

III. Marking

3502

Drums of tested types of construction shall be durably marked with the impressed or printed sign of the State<sup>\*/</sup> in which the test was carried out, with the mark "ADR, IIIa" or "RID, IIIa", and with a registration number assigned by the body which carried out the tests.

IV. Test report

3503

A test report must be drawn up, which shall include:

1. particulars identifying the manufacturer of the drum,
2. a description (e.g. material used, thickness of walls and ends, joints, seams) and a drawing;
3. the result of the tests;
4. the mark of the drum.

A copy of the test report shall be sent to a body designated by the competent authority of the State in which the test is carried out.

3504-  
3599

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<sup>\*/</sup> The signs referred to are the national distinguishing signs for motor vehicles in international traffic.



## APPENDIX A.6

Tables: Method of applying the criteria of Nuclear Safety Class I;  
Methods of testing packagings intended for substances of Class IVbPart ATablesClassification of radionuclides for the purposes of carriage

3600

Re Introductory Note 2 to Class IVb

Notes: 1. The asterisk denotes that the radionuclide has been classified in a group in conformity with the table in marginal 3601.

2. For radionuclides not included in this list, see marginal 3601.

Symbol	Radionuclide	Group
Ac	Actinium-227	I
	Actinium-228	I
Ag	Silver-105	IV
	Silver-110m	III
	Silver-111	IV
Am	Americium-241	I
	Americium-243	I
Ar	Argon-37	VI
	Argon-37 (uncompressed) <sup>1/</sup>	VI
	Argon-41	II
	Argon-41 (uncompressed) <sup>1/</sup>	V
As	Arsenic-73	IV
	Arsenic-74	IV
	Arsenic-76	IV
	Arsenic-77	IV
<sup>1/</sup> <u>Uncompressed</u> means: whose absolute pressure referred to a temperature of 0°C does not exceed one atmosphere (i.e. the mean pressure of the atmosphere at a latitude of 45° and at mean sea level).		

Symbol	Radionuclide	Group
At	Astatine-211	III
Au	Gold-193*	III
	Gold-194*	III
	Gold-195*	III
	Gold-196	IV
	Gold-198	IV
	Gold-199	IV
Ba	Barium-131	IV
	Barium-140	III
Be	Beryllium-7	IV
Bi	Bismuth-206	IV
	Bismuth-207	III
	Bismuth-210 (Ra.E)	II
	Bismuth-212	III
Bk	Berkelium-249	I
Br	Bromine-82	IV
C	Carbon-14	IV
Ca	Calcium-45	IV
	Calcium-47	IV

## Appendix A.6

3600  
(contd)

Symbol	Radionuclide	Group
Cd	Cadmium-109	III
	Cadmium-115m	III
	Cadmium-115	IV
Ce	Cerium-141	IV
	Cerium-143	IV
	Cerium-144	III
Cf	Californium-249	I
	Californium-250	I
	Californium-252	I
Cl	Chlorine-36	III
	Chlorine-38	IV
Cm	Curium-242	I
	Curium-243	I
	Curium-244	I
	Curium-245	I
	Curium-246	I
Co	Cobalt-56*	III
	Cobalt-57	IV
	Cobalt-58m	IV
	Cobalt-58	IV
	Cobalt-60	III
Cr	Chromium-51	IV
Cs	Caesium-131	III
	Caesium-134m	IV
	Caesium-134	III
	Caesium-135	IV
	Caesium-136	IV
	Caesium-137	IV
Cu	Copper-64	IV
Dy	Dysprosium-154*	III
	Dysprosium-165	IV
	Dysprosium-166	IV

Symbol	Radionuclide	Group
Er	Erbium-169	IV
	Erbium-171	IV
Eu	Europium-150*	III
	Europium-152 (A) (9.2 hrs.)	IV
	Europium-152 (B) (12.7 yrs.)	III
	Europium-154	II
	Europium-155	IV
F	Fluorine-18	IV
Fe	Iron-55	IV
	Iron-59	IV
Ga	Gallium-67*	III
	Gallium-72	IV
Gd	Gadolinium-153	IV
	Gadolinium-159	IV
Ge	Germanium-71	IV
H	Hydrogen-3 see Tritium (T)	
Hf	Hafnium-181	IV
Hg	Mercury-197m	IV
	Mercury-197	IV
	Mercury-203	IV
Ho	Holmium-166	IV
I	Iodine-124*	III
	Iodine-125*	III
	Iodine-126	III
	Iodine-129	III
	Iodine-131	III
	Iodine-132	IV
	Iodine-133	III
	Iodine-134	IV
Iodine-135	IV	

## Appendix A.6

3600  
(contd)

Symbol	Radionuclide	Group
In	Indium-113m	IV
	Indium-114m	III
	Indium-115m	IV
Ir	Iridium-190	IV
	Iridium-192	III
	Iridium-194	IV
K	Potassium-42	IV
	Potassium-43*	III
Kr	Krypton-85m	III
	Krypton-85m (uncompressed) 1/	V
	Krypton-85	III
	Krypton-85 (uncompressed) 1/	VI
	Krypton-87	II
	Krypton-87 (uncompressed) 1/	V
La	Lanthanum-140	IV
Lu	Lutecium-172*	III
	Lutecium-177	IV
M.f.p.	Mixed fission products	II
Mg	Magnesium-28*	III
Mn	Manganese-52	IV
	Manganese-54	IV
	Manganese-56	IV
1/ <u>Uncompressed</u> means: whose absolute pressure referred to a temperature of 0°C does not exceed one atmosphere (i.e. the mean pressure of the atmosphere at a latitude of 45° and at mean sea level).		

Symbol	Radionuclide	Group
Mo	Molybdenum-99	IV
Na	Sodium-22	III
	Sodium-24	IV
Nb	Niobium-93m	IV
	Niobium-95	IV
	Niobium-97	IV
Nd	Neodymium-147	IV
	Neodymium-149	IV
Ni	Nickel-56*	III
	Nickel-59	IV
	Nickel-63	IV
	Nickel-65	IV
Np	Neptunium-237	I
	Neptunium-239	I
Os	Osmium-185	IV
	Osmium-191m	IV
	Osmium-191	IV
	Osmium-193	IV
P	Phosphorus-32	IV
Pa	Protactinium-230	I
	Protactinium-231	I
	Protactinium-233	II
Pb	Lead-203	IV
	Lead-210	II
	Lead-212	II
Pd	Palladium-103	IV
	Palladium-109	IV
Pm	Promethium-147	IV
	Promethium-149	IV
Po	Polonium-210	I

## Appendix A.6

3600  
(contd)

Symbol	Radionuclide	Group
Pr	Praseodymium-142	IV
	Praseodymium-143	IV
Pt	Platinum-191	IV
	Platinum-193m	IV
	Platinum-197m	IV
	Platinum-197	IV
Pu	Plutonium-238	I
	Plutonium-239	I
	Plutonium-240	I
	Plutonium-241	I
	Plutonium-242	I
Ra	Radium-223	II
	Radium-224	II
	Radium-226	I
	Radium-228	I
Rb	Rubidium-86	IV
	Rubidium-87	IV
	Rubidium (natural)	IV
Re	Rhenium-183	IV
	Rhenium-186	IV
	Rhenium-187	IV
	Rhenium-188	IV
	Rhenium (natural)	IV
Rh	Rhodium-103m	IV
	Rhodium-105	IV
Rn	Radon-220	IV
	Radon-222	II
Ru	Ruthenium-97	IV
	Ruthenium-103	IV
	Ruthenium-105	IV
	Ruthenium-106	III

Symbol	Radionuclide	Group
S	Sulphur-35	IV
Sb	Antimony-122	IV
	Antimony-124	III
	Antimony-125	III
Sc	Scandium-46	III
	Scandium-47	IV
	Scandium-48	IV
Se	Selenium-75	IV
Si	Silicon-31	IV
Sm	Samarium-145*	III
	Samarium-147	III
	Samarium-151	IV
	Samarium-153	IV
Sn	Tin-113	IV
	Tin-117m*	III
	Tin-121*	III
	Tin-125	IV
Sr	Strontium-85m	IV
	Strontium-85	IV
	Strontium-89	III
	Strontium-90	II
	Strontium-91	III
	Strontium-92	IV
T	Tritium (in a form other than those below)	IV
	Tritium (in the form of T <sub>2</sub> or HT)	VII
	Tritium (tritium-activated luminous paint or tritium gas adsorbed on a solid carrier)	VIII

## Appendix A.6

3600  
(contd)

Symbol	Radionuclide	Group
Ta	Tantalum-182	III
Tb	Terbium-160	III
Tc	Technetium-96m	IV
	Technetium-96	IV
	Technetium-97m	IV
	Technetium-97	IV
	Technetium-99m	IV
Te	Tellurium-125m	IV
	Tellurium-127m	IV
	Tellurium-127	IV
	Tellurium-129m	III
	Tellurium-129	IV
	Tellurium-131m	III
Th	Thorium-227	II
	Thorium-228	I
	Thorium-230	I
	Thorium-231	I
	Thorium-232	III
	Thorium-234	II
	Thorium (natural)	III
Tl	Thallium-200	IV
	Thallium-201	IV
	Thallium-202	IV
	Thallium-204	III
Tm	Thulium-168*	III
	Thulium-170	III
	Thulium-171	IV
U	Uranium-230	II
	Uranium-232	I
	Uranium-233	II
	Uranium-234	II
	Uranium-235	III
	Uranium-236	II
	Uranium-238	III
Uranium (natural)	III	

Symbol	Radionuclide	Group
V	Vanadium-48	IV
	Vanadium-49*	III
W	Tungsten-181	IV
	Tungsten-185	IV
	Tungsten-187	IV
Xe	Xenon-125	III
	Xenon-125* (uncompressed) $\frac{1}{2}$	III
	Xenon-131m	III
	Xenon-131m (uncompressed) $\frac{1}{2}$	V
	Xenon-133	III
	Xenon-133 (uncompressed) $\frac{1}{2}$	VI
	Xenon-135	II
Xenon-135 (uncompressed) $\frac{1}{2}$	V	
Y	Yttrium-88*	III
	Yttrium-90	IV
	Yttrium-91m	III
	Yttrium-91	III
	Yttrium-92	IV
	Yttrium-93	IV
Yb	Yttrium-175	IV
Zn	Zinc-65	IV
	Zinc-69m	IV
	Zinc-69	IV
Zr	Zirconium-93	IV
	Zirconium-95	III
	Zirconium-97	IV
<p><math>\frac{1}{2}</math>/Uncompressed means: whose absolute pressure referred to a temperature of 0°C does not exceed one atmosphere (i.e. the mean pressure of the atmosphere at a latitude of 45° and at mean sea level).</p>		

## Appendix A.6

3601

Formula for the classification for  
carriage of radionuclides not listed  
in marginal 3600

Re Introductory Note 3 to Class IVb

Radionuclide	Physical half-life		
	0 to 1000 days	More than 1000 days to 10 <sup>6</sup> years	More than 10 <sup>6</sup> years
Atomic number 1 to 81	Group III	Group II	Group III
Atomic number 82 and over	Group I	Group I	Group III

3602

Mass-activity ratios for natural thorium  
and uranium for purposes of carriage

Re Introductory Note 5 to Class IVb

Radioactive substance	Curies per gramme	Grammes per curie
Natural thorium	$1.11 \times 10^{-7}$	$9 \times 10^6$
Uranium (according to percentage by weight [below] of U-235)		
0.45	$5.0 \times 10^{-7}$	$2.0 \times 10^6$
0.72 (natural)	$7.06 \times 10^{-7}$	$1.42 \times 10^6$
1.0	$7.6 \times 10^{-7}$	$1.3 \times 10^6$
1.5	$1.0 \times 10^{-6}$	$1.0 \times 10^5$
5.0	$2.7 \times 10^{-6}$	$3.7 \times 10^5$
10.0	$4.8 \times 10^{-5}$	$2.1 \times 10^5$
20.0	$1.0 \times 10^{-5}$	$1.0 \times 10^5$
35.0	$2.0 \times 10^{-5}$	$5.0 \times 10^4$
50.0	$2.5 \times 10^{-5}$	$4.0 \times 10^4$
90.0	$5.8 \times 10^{-5}$	$1.7 \times 10^4$
93.0	$7.0 \times 10^{-5}$	$1.4 \times 10^4$
95.0	$9.1 \times 10^{-5}$	$1.1 \times 10^4$

## Appendix A.6

Neutron flux to be regarded for purposes of carriage  
as equivalent to a dose rate of 1 mR/h

3603

Re marginal 2453 (2), Note

Neutron energy	Flux density (neutrons/cm <sup>2</sup> /sec)
Thermal	268
5 keV	228
20 keV	112
100 keV	32
500 keV	12
1 MeV	7.2
5 MeV	7.2
10 MeV	6.8

Note: The flux values for energies intermediate between those listed above are to be obtained by linear interpolation.

Permissible maximum levels of radioactive contamination

3604

Re marginal 2451a 1.(b), marginal 2452(4)(i) and marginal  
42 280 (Annex B)

Emitter	Maximum permissible level
Beta or gamma emitters	$10^{-4}$ $\mu$ Ci/cm <sup>2</sup>
Alpha emitters	$10^{-5}$ $\mu$ Ci/cm <sup>2</sup>

Note: The above levels constitute the mean permissible levels for any area of 300 cm<sup>2</sup> of the surface considered.

3605-  
3620

## Appendix A.6

Part BMethod of applying the criteria of Nuclear  
Safety Class I

Re marginal 2456(7)

3621 Method of calculation

- (a) Every package must comply with the criteria set out in marginal 2456(7);
- (b) every package, whether damaged or not, must be so designed that the fissile substances it contains are protected against thermal neutrons;
- (c) if a parallel beam of neutrons having the energy spectrum specified in the table below strikes an undamaged package at any angle of incidence, the multiplication factor of the epithermal neutrons at the surface, i.e. the ratio of the number of epithermal neutrons emitted by the package to the number of epithermal neutrons penetrating into the package, must be less than one, and the spectrum of the neutrons emitted by the package - which is assumed to be one of an infinite array of such packages - must not be harder than that of the incident neutrons;
- (d) conformity with the standards set out in marginal 2456(7)(b)2. must be demonstrated.



## Appendix A.6

3621  
(contd)Neutron energy spectrum<sup>\*/</sup> to be used

Neutron energy E	Percentage of neutrons with energy less than E
11 MeV	100
2.4 MeV	80.2
1.1 MeV	59
0.55 MeV	46
0.26 MeV	37.3
0.13 MeV	31.9
43 keV	26.3
10 keV	21
1.6 keV	15.6
0.26 keV	11.1
42 eV	7.2
5.5 eV	3.6
0.4 eV	0

<sup>\*/</sup> This spectrum corresponds to the epithermal portion of the spectrum, in a state of equilibrium, emitted by a package having a wooden shield 5 cm thick, in a critical array of such packages.

Physical model

3622

## (1) Description of packagings

- (a) The packaging is so made that the fissile substance is surrounded by a layer of material capable of absorbing all thermal neutrons incident on it<sup>\*/</sup> and that this neutron-absorbing layer is itself surrounded by a thickness of not less than 10.2 cm of wood having a hydrogen content of not less than 6.5 per cent by weight, the smallest external dimension of this wooden casing being not less than 30.5 cm.

<sup>\*/</sup> This layer may be a casing of cadmium not less than 0.38 mm thick, equivalent to 0.325 g Cd per cm<sup>2</sup>.

## Appendix A.6

3622  
(contd)

- (b) The packaging is so made that in the conditions resulting from the tests prescribed in marginals 3642 to 3646 and 3648 to 3651 of this Appendix the fissile content will remain surrounded by the neutron-absorbing layer, this neutron absorber will remain surrounded by wood, and the wood will not be affected to such an extent as to reduce the thickness remaining to be less than 9.2 cm or the smallest external dimension of the remaining to less than 28.5 cm.

(2) Permissible content

This content must not exceed the permissible masses of fissile substance, indicated in Tables I to X below, consistent with  
the nature of the substance;  
the maximum moderation; and  
the greatest diameter (or volume)

which would result from subjecting the packaging to conditions corresponding to the tests referred to under (1)(b) above.

Note: A detailed calculation for a given packaging, carried out by the method described in marginal 3621, may yield less restrictive values.

## Appendix A.6

TABLE I  
Aqueous solutions of plutonium nitrate  
 Permissible mass of plutonium nitrate per package according to packaging wood density

I.1 Limited by maximum internal diameter of inner receptacle														
Inner receptacle diameter not exceeding (cm)	Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )													
	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.2	1.25
	kg Pu (NO <sub>3</sub> ) <sub>4</sub> per package													
10.16	No limit													
No limit	0.044	0.108	0.171	0.232	0.291	0.348	0.40	0.46	0.51	0.55	0.59	0.63	0.66	0.69
I.2 Limited by maximum internal volume of inner receptacle														
Inner receptacle volume not exceeding (litres)	Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )													
	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.2	1.25
	kg Pu (NO <sub>3</sub> ) <sub>4</sub> per package													
2	0.310	0.61	1.06	1.64	2.37	3.24	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
3	0.096	0.271	0.50	0.77	1.42	1.55	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
4	0.044	0.155	0.193	0.271	1.42	1.42	1.42	1.42	1.42	1.82	2.44	3.17	4.04	5.03
5	0.044	0.108	0.173	0.240	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
7	0.044	0.108	0.171	0.232	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
No limit	0.044	0.108	0.171	0.232	0.291	0.348	0.40	0.46	0.51	0.55	0.59	0.63	0.66	0.69

3622  
 (contd)

## Appendix A.6

3622  
(contd.)

TABLE II  
Aqueous solutions of  $\text{U}^{235}$  fluoride or  $\text{U}^{235}$  nitrate

Permissible mass of uranium per package according to packaging wood density

II.1 Limited by maximum internal diameter of inner receptacle												
Inner receptacle diameter not exceeding (cm)	Wood density not exceeding $1.25 \text{ g/cm}^3$ and not less than $(\text{g/cm}^3)$		0.6		0.65		0.7		0.75		0.8	
	0.85		0.9		0.95		1.0		1.05		1.1	
		1.15		1.2		1.25						
kg uranium per package												
10.16												
No limit												
No limit												
0.084												
0.120												
0.157												
0.193												
0.231												
0.267												
0.301												
0.335												
0.370												
0.400												
0.429												
0.456												
0.478												
0.498												
II.2 Limited by maximum internal volume of inner receptacle												
Inner receptacle volume not exceeding (litres)	Wood density not exceeding $1.25 \text{ g/cm}^3$ and not less than $(\text{g/cm}^3)$		0.6		0.65		0.7		0.75		0.8	
	0.85		0.9		0.95		1.0		1.05		1.1	
		1.15		1.2		1.25						
kg uranium per package												
2												
3												
4												
5												
7												
No limit												
0.084												
0.120												
0.157												
0.193												
0.231												
0.267												
0.301												
0.335												
0.370												
0.400												
0.429												
0.456												
0.478												
0.498												

\*/ Uranium containing no  $\text{U}^{233}$  and not more than 93.5 per cent by weight  $\text{U}^{235}$

## Appendix A.6

TABLE III

Non-hydrogenous uranium\*/ compounds or mixtures whose uranium-235 concentration does not exceed 4.8 g/cm<sup>3</sup>\*\*/

(Including unmoderated uranium metal of uranium-235 enrichment not exceeding 25 per cent by weight)  
Permissible mass of uranium per package according to packaging wood density

III.1 Limited by maximum internal diameter of inner receptacle				
Inner receptacle diameter not exceeding (cm)	Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than 0.6 g/cm <sup>3</sup>			
kg uranium per package				
1.16	No limit			
No limit	0.69			
III.2 Limited by maximum internal volume of inner receptacle				
Inner receptacle volume not exceeding (litres)	Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )			
3	0.65	0.7	0.75	0.8
4	7.0	10.5	12.2	14.5
5	4.8	7.8	7.8	7.8
7	3.63	3.63	3.63	3.63
No limit	1.41	1.41	1.41	1.41
	0.69	0.69	0.69	0.69
kg uranium per package				
3	14.5	14.5	14.5	14.5
4	7.8	7.8	7.8	7.8
5	3.63	3.63	3.63	3.63
7	1.41	1.41	1.41	1.41
No limit	0.69	0.69	0.69	0.69

\*/ Uranium containing no U<sup>233</sup> and not more than 93.5 per cent by weight U<sup>235</sup>

\*\*/ Mixtures containing beryllium or deuterium are excluded, and the mass of carbon must not exceed five times the permissible mass of uranium



Appendix A.6

TABLE V  
Unmoderated uranium <sup>\*/</sup> metal  
Permissible mass of uranium per package according to packaging wood density

V.1 Limited by maximum internal diameter of inner receptacle																	
Inner receptacle diameter not exceeding (cm)	kg uranium per package					Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )											
	6	7	8	9.2	10	← No limit	No limit	→	10	11	12	14	15	16	17	17	19
No limit**/	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
No limit**/	6	7	8	9.2	10	11	12	14	15	16	17	17	17	17	17	19	19
V.2 Limited by maximum internal volume of inner receptacle																	
Inner receptacle volume not exceeding (litres)	kg uranium per package					Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )											
	2	4	5	7	7	← No limit	No limit	→	10	11	12	14	15	16	17	17	19
No limit**/	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
No limit**/	6	7	8	9.2	10	11	12	14	15	16	17	17	17	17	17	19	19

<sup>\*/</sup> Uranium containing no U<sup>233</sup> and not more than 93.5 per cent by weight U<sup>235</sup>.  
<sup>\*\*/</sup> These larger masses are permissible where the fissile material is in the form of massive metal pieces weighing not less than 2 kg each and free from re-entrant surfaces.

## Appendix A.6

3622  
(contd)

TABLE VI  
 \*/Uranium compounds or mixtures whose uranium concentration does not exceed  $\frac{26.44}{H/U+1.41} \text{ g/cm}^3$   
 Permissible mass of uranium per package according to packaging wood density

VI.1 Limited by maximum internal diameter of inner receptacle														
Inner receptacle diameter not exceeding (cm)	Wood density not exceeding $1.25 \text{ g/cm}^3$ and not less than $(\text{g/cm}^3)$													
0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.2	1.25	
kg uranium per package														
6	← No limit →													
6.5	2.80	6.0	← No limit →											
7	2.80	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	No limit
7.5	2.80	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	No limit
10	0.330	0.87	1.10	1.80	2.50	3.50	4.6	7.1	7.7	9.6	11.6	13.8	16.1	18.3
No limit	0.084	0.120	0.157	0.193	0.231	0.267	0.301	0.335	0.370	0.400	0.429	0.456	0.478	0.498
VI.2 Limited by maximum internal volume of inner receptacle														
Inner receptacle volume not exceeding (litres)	Wood density not exceeding $1.25 \text{ g/cm}^3$ and not less than $(\text{g/cm}^3)$													
0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.2	1.25	
kg. uranium per package														
2	0.152	0.380	0.66	1.01	1.47	2.00	2.66	3.50	4.64	6.04	7.62	9.39	11.3	13.3
3	0.084	0.223	0.416	0.65	0.93	1.25	1.58	1.96	2.34	2.74	3.16	3.57	3.99	4.42
4	0.084	0.120	0.157	0.193	0.231	0.274	0.356	0.498	0.73	1.05	1.47	2.02	2.70	3.55
5	0.084	0.120	0.157	0.193	0.231	0.267	0.301	0.495	0.57	0.66	0.74	0.84	0.92	1.02
7	0.084	0.120	0.157	0.193	0.231	0.267	0.301	0.347	0.406	0.467	0.53	0.60	0.66	0.73
No limit	0.084	0.120	0.157	0.193	0.231	0.267	0.301	0.335	0.370	0.400	0.429	0.456	0.478	0.498

\*/Uranium containing no  $U^{233}$  and not more than 93.5 per cent by weight  $U^{235}$



TABLE VII  
Non-hydrogenous plutonium compounds or mixtures  
whose plutonium-239 concentration does not exceed  $10 \text{ g/cm}^3$ \*/

Permissible mass of plutonium per package according to packaging wood density

VII.1 Limited by maximum internal diameter of inner receptacle					
Inner receptacle diameter not exceeding (cm)	Wood density not exceeding $1.25 \text{ g/cm}^3$ and not less than $(\text{g/cm}^3)$				
	0.6	0.7	0.75	0.8	0.95
	1.1	1.15	1.1	1.15	1.25
kg plutonium per package					
6	3.60	4.2	← No limit →		
7	3.60	4.2	4.7	5.3	← No limit →
7.5	3.60	4.2	4.7	5.3	5.9
10	3.60	4.2	4.7	5.3	7.1
No limit	0.405	0.405	0.405	0.405	0.405
					8.1
					8.3
					8.6
					8.9
					0.405
					0.405
					0.405
VII.2 Limited by maximum internal volume of inner receptacle					
Inner receptacle volume not exceeding (litres)	Wood density not exceeding $1.25 \text{ g/cm}^3$ and not less than $(\text{g/cm}^3)$				
	0.6	0.65	0.7	0.75	0.8
kg plutonium per package					
3	3.60	4.2	4.7	5.3	5.9
4	3.60	3.84	3.84	3.84	3.84
5	2.44	2.44	2.44	2.44	2.44
7	1.20	1.20	1.20	1.20	1.20
No limit	0.405	0.405	0.405	0.405	0.405

\*/ Mixtures containing beryllium and deuterium are excluded, and the mass of carbon must not exceed 1/10 of the permissible mass of plutonium.

3622  
(contd)

## Appendix A.6

TABLE VIII

Unmoderated plutonium metal  
Permissible mass of plutonium per package  
according to packaging wood density

VIII.1 Limited by maximum internal diameter of inner receptacle	
Inner receptacle diameter not exceeding (cm)	Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )
	0.6      0.65      0.7      0.75      0.8      0.85
kg plutonium per package	
4	←      No limit      →
10	3.20      3.60      3.90      4.2      4.4      4.5
No limit*	0.405      0.405      0.405      0.405      0.405      0.405
No limit*	3.20      3.60      3.90      4.2      4.4      4.5
VIII.2 Limited by maximum internal volume of inner receptacle	
Inner receptacle volume not exceeding (litres)	Wood density not exceeding 1.25 g/cm <sup>3</sup> and not less than (g/cm <sup>3</sup> )
	0.6      0.65      0.7      0.75      0.8      0.85
kg plutonium per package	
3	3.20      3.60      3.90      4.2      4.4      4.5
4	3.20      3.60      3.84      3.84      3.84      3.84
5	2.44      2.44      2.44      2.44      2.44      2.44
7	1.20      1.20      1.20      1.20      1.20      1.20
No limit*	0.405      0.405      0.405      0.405      0.405      0.405
No limit*	3.20      3.60      3.90      4.2      4.4      4.5

\* These larger masses are permissible where the fissile material is in the form of massive metal pieces weighing not less than 2 kg each and free from re-entrant surfaces.



3622  
(contd)

## Appendix A.6

TABLE X  
Aqueous solutions of uranium-233 nitrate or uranium-233 fluoride  
 Permissible mass of uranium per package according to packaging wood density

X.1. Limited by maximum internal diameter of inner receptacle														
Inner receptacle diameter not exceeding (cm)	kg uranium per package													
	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.2	1.25
9	No limit													
9.5	0.035	0.067	No limit											
10	0.035	0.067	0.100	No limit										
No limit	0.035	0.067	0.100	0.134	0.169	0.200	0.231	0.261	0.289	0.316	0.340	0.361	0.371	0.391
X.2. Limited by maximum internal volume of inner receptacle														
Inner receptacle volume not exceeding (litres)	kg uranium per package													
	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.1	1.15	1.2	1.25
2	0.152	0.309	0.475	0.71	0.99	1.33	1.71	2.11	2.54	2.99	3.44	3.94	4.41	4.8
3	0.085	0.133	0.180	0.228	0.285	0.332	0.389	0.446	0.50	0.56	0.60	0.67	0.73	0.78
4	0.085	0.109	0.133	0.175	0.213	0.266	0.304	0.356	0.408	0.460	0.51	0.57	0.63	0.69
5	0.035	0.076	0.114	0.152	0.190	0.223	0.256	0.292	0.323	0.356	0.389	0.422	0.451	0.484
7	0.035	0.073	0.109	0.142	0.175	0.204	0.235	0.263	0.289	0.318	0.342	0.368	0.394	0.420
No limit	0.035	0.067	0.100	0.134	0.169	0.200	0.231	0.261	0.289	0.316	0.340	0.361	0.377	0.391

3623-  
3640

## Appendix A.6

Part CTest methodsI. PackagingGeneral

(1) The tests must be carried out on samples or prototypes of packaging of the design in question. However, proof that the packaging design satisfies the required conditions may also be furnished by calculations or by any other pertinent method. 364

## (2) Number of samples or prototypes to be tested

In the interest of both economy and safety, the number of packaging samples or prototypes to be tested will depend on the number of packagings of the type concerned which are to be produced and used, on the frequency of their use, and on the unit cost of very costly packagings. For samples and prototypes of a packaging design which are required to be tested, a programme of the tests must be drawn up showing the tests actually to be performed, their sequence, and the number of samples or prototypes required. The results of the tests may necessitate an increase in that number to meet the requirements of the methods with regard to maximum damage.

## (3) Preparation of a packaging sample or prototype for tests.

- (a) Before being tested, every packaging must be examined for the purpose of identifying and noting defects or damage, and more particularly:
1. non-conformity with specifications or drawings;
  2. defects of construction;
  3. corrosion or other deterioration;
  4. distortion of components.
- (b) The packaging must be freed from any dirt and moisture.
- (c) The packaging must be an exact replica of the one which is to be used for carriage; it must, in particular, include all attachments, casings, frames and other external accessories. The contents of the sample package must simulate as closely as possible the radioactive substance to be carried. The effects of spontaneous heating through radioactive

## Appendix A.6

3641  
(contd.)

disintegration may be assessed separately, but must be taken into account in evaluating the results of both the free-fall test and the thermal test. The contents may include a suitable radioactive substance. The weight of the sample package tested must be the same as that of a real package (packaging plus contents).

- (d) The containment vessel must be clearly identifiable.
- (e) The external parts of the packaging must be clearly identified so that any point on them can be easily and unambiguously referred to.

## (4) Verification of soundness of containment vessel and shield

After the sample package has been subjected to any one of the tests prescribed in marginals 3642 to 3651, it must still be shown that containment and shielding have been preserved to the extent required for the type of packaging considered. One means of doing so consists in verifying containment and shielding by the methods described in marginal 3652.

Methods prescribed for the tests referred to in marginals 2452(3)(i), (5)(a) and (6)(a); 2455(1)(b), (3), (4)(a) and (d), (6)(b) and (c); 2456(6), (7)(a)1 and (b)2; (9), (10)(a) and (b)2; and 3622(1)(b)

3642

The sample package must be subjected to each of the tests referred to below from which it is not expressly exempted. A sample must be subjected successively to at least two of the tests from which the package design is not expressly exempted.

Water-spray test followed by free fall

3643

(1) Exemptions

Packagings whose outer casing is made entirely of metal, wood, ceramic or a plastics material, or of any combination of these materials, are exempted from this test.

(2) Method

- (a) (i) The sample package, standing on its base on a level surface, is sprayed with water from four directions successively, as described in (d) below, for 30 minutes in each direction, the changes of direction being effected as quickly as possible; or

## Appendix A.6

- (ii) the sample package, standing on its base on a level surface, is sprayed from the four directions simultaneously, as described in (d) below, for not less than 30 minutes;
- (b) the undried sample package is subjected to the free-fall test from a height of 1.20 m specified in marginal 3644, immediately after spraying if the method described in (a)(i) above has been used, or after an interval of 1 h 30 min to 2 h 30 min if the method described in (a)(ii) above has been used;
- (c) the water must be sprayed at a pressure of  $2 \pm 0.3 \text{ kg/cm}^2$  in conformity with the following provisions:
- (i) the jet of water must be in the shape of a solid cone with a vertex angle of  $35^\circ$  measured at the nozzle outlet;
  - (ii) the delivery of each jet must be  $230 \pm 23$  litres per hour;
  - (iii) more than 50% of the drops of water must be 3 to 5 mm in diameter;
- (d) the jet must be directed downwards on to the sample package from a distance of 2.40 m (measured from the nozzle to a corner or edge of the package) at an angle of  $45^\circ$  to the horizontal, the axis of the jet being in a vertical plane defined as follows:
- (i) in the case of rectangular sample packages, the plane of the diagonal connecting the corner aimed at with the opposite corner;
  - (ii) cylindrical sample packages must stand on one of their plane faces and the jet must be directed from four directions successively, each at right angles to the next preceding and/or following.

3643  
(contd)

The water must be able to drain away continuously; in other words, the package must not stand in a pool of water.

Free-fall test

## (1) Exemptions

Cylinders to hold compressed gases at a pressure exceeding  $7 \text{ kg/cm}^2$  are exempted from this test.

3644

## (2) Method

- (a) The sample package is dropped on to the target in such a way as to sustain the greatest possible damage with respect to the safety factors to be verified;

## Appendix A.6

3644  
(contd)

- (b) the height of fall, measured from the lowest point of the sample package to the surface of the target, must be 1.20 m;
- (c) in addition, in the case of rectangular sample packagings made of paperboard or wood and weighing not more than 50 kg, a separate sample must be subjected to a free-fall test from a height of 30 cm on to each of its corners;
- (d) in addition, in the case of cylindrical sample packages made of paperboard and weighing not more than 100 kg, a separate sample must be subjected to a free-fall test from a height of 30 cm on to each quarter of each of the circular rims;
- (o) in the case of packages of Nuclear Safety Class II, the sample package to be tested as prescribed in (b) must, before the test, be subjected to a free-fall test from a height of 30 cm on to each of its corners or, if the sample package is cylindrical, on to each quarter of each of the circular rims.

## (3) Target

The target on which the packaging falls must have a rigid, smooth, flat and horizontal surface. It may consist, for example, of the upper surface of a block of a material of sufficient mass to absorb the impacts without appreciable movement. The surface of the target may be covered by a protective steel plate.

Compression test

## Method

3645

The sample package must be subjected for not less than 24 hours to a compressive force equal to the greater of the following two values: five times its weight, or the product of  $1300 \text{ kg/m}^2$  by the vertically-projected area of the sample package expressed in  $\text{m}^2$ . This force shall be applied uniformly to two opposite sides of the package, one of them being the base on which it normally stands.



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Penetration test

## Method

(1) The sample package is placed on a rigid, flat and horizontal surface which must not move significantly while the test is being carried out. 3646

(2) A bar 32 mm in diameter, weighing 6 kg, and having a hemispherical end is, with its longitudinal axis vertical, released above the sample package and so guided that its end strikes the centre of the weakest part of the packaging and will strike the containment vessel if it penetrates far enough.

(3) The height of fall of the bar, measured from the latter's lower end to the upper surface of the sample package, must be 1 m. The bar must be made of a material which will not suffer significant deformation during the test.

Methods prescribed for the tests referred to in marginal 2452 (5), (b) and (c)

## (1) Exemptions 3647

The following are exempted from this test:

- (a) Type-A packagings intended for liquids and satisfying the provisions of marginal 2452 (5)(b) 1. or 2.;
- (b) containment vessels of Type-A packagings intended for tritium having an activity below 200 Ci or for other gases having a total activity below 20 Ci.

## (2) Method

- (a) (i) In the case of Type-A packagings intended for liquids, the package is dropped on to the target in such a way as to sustain the maximum damage with respect to containment;
- (ii) in the case of Type-A packagings intended for gases, the containment vessel is dropped on to the target in such a way as to sustain the maximum damage with respect to containment;
- (b) the height of fall, measured from the lower part of the sample package in the case referred to in (a)(i) or of the containment vessel in the case referred to in (a)(ii) to the upper surface of the target, must be 9 m,

## Appendix A.6

3647  
contd.

## (3) Target

The target must have a flat, horizontal surface such that any increase in its resistance to displacement or deformation under impact does not significantly increase the damage sustained by the sample package or the containment vessel. Such a surface may, for example, be a steel plate placed on a concrete block of a mass not less than ten times that of any sample package subjected to the test. The concrete block must rest on firm ground, and the steel plate, not less than 1.25 cm thick, must be placed on the concrete when the latter is fresh, so as to ensure perfect adhesion.

Methods prescribed for the tests referred to in marginals 2452 (3)(i) and (6)(a); 2455 (1)(b), (4)(a), (d), (f) and (h), and (6)(b); 2456 (7)(a)1. and (b)2., and (10)(a) and (b)2.; and 3622 (1)(b).

3648

The sample package must be subjected to the cumulative effects of the mechanical test referred to in marginal 3649, the thermal test referred to in marginal 3650 and, unless it is specifically exempted therefrom, the immersion test referred to in marginal 3651, in that order.

Mechanical test

3649

## (1) Exemptions: none

(2) The test consists of the two falls mentioned below, sustained in an order chosen to cause damage such that the thermal test to which the package must then be subjected will produce the maximum effect. These two falls are described in paragraphs (3) and (4) below.

(3) (a) The sample package is dropped on to a target in such a way as to sustain the maximum damage;

(b) the target must be as specified in marginal 3647 (3);

(c) the height of fall, measured from the lowest point of the sample package to the upper surface of the target, must be 9 m.

(4) (a) The sample package is dropped on to a target in such a way as to sustain the maximum damage;

(b) the target consists of a solid mild-steel bar of circular cross-section 15 cm  $\pm$  0.5 cm in diameter, mounted vertically and rigidly on

## Appendix A.6

the base described in marginal 3647 (3). The surface of the target must be flat and horizontal, its edge being rounded to a radius of not more than 6 mm; the bar must be 20 cm long unless a longer bar would cause greater damage, in which case a bar sufficiently long to cause the maximum damage shall be used;

3649  
(contd)

(c) the height of fall, measured from the lowest point of the sample package to the upper surface of the target, must be 1 m.

Thermal test

(1) Exemptions: none

3650

(2) A thermal test shall be considered satisfactory if the quantity of heat received by the sample package is not smaller than it would be if the whole package were exposed for 30 minutes to a radiant environment at 800° having a radiation coefficient of 0.9, the surfaces of the package being assumed to have an absorption coefficient of 0.8.

If the packaging possesses a thermal insulation capable of being partly lost in conditions other than those simulated by the tests prescribed in marginals 3643 to 3646 and 3649 (e.g. rough scraping of the package), then only 50 per cent of the packaging shall be assumed to be protected by that insulation.

(3) Method

The thermal test method described below is regarded as meeting the conditions specified in (2) above:

- (a) the sample package, at ambient temperature, is exposed to an open fire satisfying the conditions of paragraph (b) below. The package is so held that its bottom is 1 m above the bottom of the tank containing the fuel. The structure supporting the package must be such as to withhold only an insignificant fraction of the surface of the package from the direct action of the heat. The position of the package must be such that maximum damage occurs;
- (b) the fire must be produced by burning in the open air a hydrocarbon which, obtained by the distillation of petroleum at a temperature not exceeding 330°C, has a flash-point of not less than 46°C and a gross

## Appendix A.6

3650  
(contd)

calorific value of 11,100 to 11,700 kilocalories/kg. The fire must be such that all the sides of the package are exposed to a luminous flame between 0.7 m and 3 m thick. The tank must be of such a depth that the fuel fills it almost to the brim;

- (c) the sample package is exposed to the fire for 30 minutes in the conditions described above. It must not be artificially cooled until three hours have elapsed, unless it can be shown by means of a thermocouple or by any other means that the internal temperature has begun to fall.

Immersion test

3651

(1) Exemptions: packages other than those of Nuclear Safety Classes I and II.

## (2) Method

- (a) The package must be so immersed in water that the joint or joints to be tested are not less than 0.9 m below the surface for at least 8 hours;
- (b) the temperature of the sample package at the time of immersion must be 5° to 15°C higher than that of the water.

Verifying containment and shielding

3652

(1) Leakproofness

Any commonly accepted test may be used to establish that the conditions of marginal 3641 (4) are met.

(2) Shielding

- (a) For packagings of Types A and B following the tests described in marginals 3642 to 3646.
1. The entire surface of the sample package containing a suitable source is examined by means of a radiographic film or a suitable instrument to verify that the effectiveness of the shielding has not materially diminished.
  2. The phrase "the effectiveness of the shielding has not materially diminished" means that the dose rate of the radiation on the surface of the sample package, when the latter contains an

## Appendix A.6

iridium-192 source, has not notably increased at any point after the pertinent tests. If the packaging is intended for one particular radionuclide only, the latter may be used as the source instead of iridium-192.

3652  
(contd)

- (b) For packagings of Type B following the tests described in marginals 3648 to 3651.
1. The entire surface of the sample package containing a suitable source is examined by means of a suitable instrument to determine whether the effectiveness of the shielding has diminished.
  2. If it is ascertained that the effectiveness of the shielding has diminished at any point on the surface of the sample package, it must be established by measurements and by calculation that the radiation emerging from the package meets the conditions specified in marginal 2452 (6)(a)(11).

3653-  
3660

## Appendix A.6

II. Capsules[Marginal 2450, Note 4(b)]General

- 3661 (1) The design of the sample capsule to be tested must be that prescribed for carriage and its contents must resemble as closely as possible, particularly as regards radiation and specific activity, the radioactive substance which the sample capsule concerned is to contain.
- (2) A different sample capsule may be used for each of the tests listed in marginal 3662.
- (3) After each test, a check of tightness (leakproofness) shall be carried out by a method which must not be less sensitive than the method described in marginal 3663.

Test methods

- 3662 (1) Impact test
- The sample capsule is dropped on to a target from a height of 9 m. The target must have a flat, horizontal surface such that any increase in its resistance to displacement or deformation under the impact of the capsule does not significantly increase the damage sustained by the capsule.
- (2) Percussion test
- The sample capsule is placed on a lead sheet lying on a hard, smooth surface; it is struck with the flat face of a steel hammer so that the impact is equivalent to that of a weight of 1.4 kg falling freely from a height of 1 m. The flat face of the hammer must be 2.5 cm in diameter, its edge being rounded to a radius of not less than 3 mm. The lead sheet, which must have a Vickers hardness of 3.5 to 4.5, must not be more than 25 mm thick and must be larger than the capsule. If the test is repeated, the capsule must be placed on an intact part of the lead each time.
- (3) Thermal test
- The sample capsule is heated in air to a temperature of 800°C, kept at that temperature for ten minutes, and then allowed to cool.

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## (4) Immersion test

3662  
(contd)

The sample capsule is immersed for twenty-four hours in water at ambient temperature. The water must have a pH value between 6 and 8 and a conductivity not exceeding 10 micromhos per cm.

Method of assessing leakproofness

## (1) Test 1

3663

Immerse the sample capsule in a solution which cannot attack the material of the capsule and which, in the conditions of the test, has shown itself to be capable of entraining the radionuclide in question. Heat the solution to  $50^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and keep it at that temperature for eight hours.

## (2) Test 2

Keep the sample capsule for not less than seven days and then repeat test 1.

If the total activity of each solution is below 0.05 microcurie, the capsule is to be considered leak-proof.

3664-  
3699

## APPENDIX A.7

3700-  
3799      Reserved

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## APPENDIX A.8

3800-  
3899      Reserved

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## APPENDIX A.9

1. Provisions relating to danger labels

With the exception of labels Nos. 6A and 6B, the dimensions laid down for labels are those of standard format A5 (148 x 210 mm). The dimensions of the labels to be affixed to packages may be reduced to format A7 (74 x 105 mm). Labels 6A and 6B must have sides 10 cm long. 3900

(1) Danger labels, where they are required under the provisions of this Annex, must be stuck on packages or affixed in some other suitable manner. Only where the state of the outside of a package does not permit this should labels be stuck on cards or tablets securely attached to the package. On outer packagings, indelible danger markings corresponding exactly to the prescribed models may be used instead of labels. 3901

(2) It is the sender's duty to affix the labels to packages, and, where appropriate, to containers.

2. Explanation of symbols

The danger labels prescribed for substances and articles of Classes I to VII (see annexed plate) have the following meanings: 3902

- |  |                      |
|--|----------------------|
| No. 1 (black bomb on orange ground):<br>prescribed in marginals<br>2037(1), 2075 and 2713;   | liable to explosion; |
| No. 2 (black flame on orange ground):<br>prescribed in marginals<br>2154(3), 2188(2), 2213(1),<br>2307(1), 2344(1), 2432(1)<br>and 2713; | danger of fire;      |

## Appendix A.9

- 3902  
(condt.)
- No. 3 (flame over a circle;  
black on orange ground):  
prescribed in marginal  
2381(1);
- Oxidizing substance;
- No. 4 (black death's head  
on orange ground):  
prescribed in marginals  
2307(2), 2316(3),  
2432(1), 2443(3);
- toxic substance;  
to be kept apart from foodstuffs  
and other articles of  
consumption in vehicles and at  
loading, unloading or transloading  
points;
- No. 4A (black St. Andrew's Cross on  
orange ground, unframed):  
prescribed in marginals  
2342(1), 2443(3);
- harmful substance;
- No. 5 (liquid dripping from a  
test-tube on to a plate and  
from another test-tube on  
to a hand; black on orange  
ground):  
prescribed in marginals  
2381(1), 2524(1),  
2535(3);
- corrosive substance;

Note: The earlier label showing a black carboy on orange ground may be used instead of label No. 5 during a transitional period extending to the end of the year 1968.

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- No. 6A (square label standing on one corner, stylized trefoil, inscription RADIOACTIVE, a vertical stripe in the lower half, with following text:  
Contents ...  
Activity ...  
Symbol and inscriptions black on white ground, vertical stripe red:  
prescribed in marginal 2459(1);
- radioactive substance in packages of Category I - WHITE; in the event of damage to the packages, danger to health by ingestion or inhalation of, or contact with, spilled contents; 3902 (contd.)
- No. 6B (like the foregoing, but with two vertical stripes in the lower half and the following text:  
Contents ...  
Activity ...  
Transport index.  
Symbol and inscriptions black; upper half of ground yellow; lower half of ground white; vertical stripes red:  
prescribed in marginal 2459(1);
- radioactive substance in packages of Category II - YELLOW; packages to be kept away from packages containing undeveloped radiographic or photographic plates or films; in the event of damage to packages, danger to health by ingestion or inhalation of, or contact with, spilled contents, and risk of external irradiation at a distance;

## Appendix A.9

- 3902 (contd.)
- |        |   |  |
|--------|---|--|
| No. 6C | (like the foregoing, but with three vertical stripes in the lower half):<br>prescribed in marginal 2459(1);   | radioactive substance in packages of Category III - YELLOW; packages to be kept away from packages containing undeveloped radiographic or photographic plates or films; in the event of damage to packages, danger to health by ingestion or inhalation of, or contact with, spilled contents, and risk of external irradiation at a distance; |
| No. 7  | (open black umbrella on white ground):<br>prescribed in marginal 2188(1);   | keep dry   |
| No. 8  | (two black arrows on white ground):<br>prescribed in marginals 2037(2), 2154(2), 2188(3), 2213(2) and (3), 2307(3), 2344(2), 2381(2), 2432(2), 2459(3), 2524(2) and (3), 2614, 2713(2); | this side up:<br>label to be affixed, with arrows pointing upwards, on two opposite sides of the package;  |
| No. 9  | (red wineglass on white ground):<br>prescribed in marginals 2037(2), 2112, 2154(1), (2) and (3), 2188(3), 2213(3), 2307(3), 2344(2), 2381(2), 2432(2), 2459(3), 2524(2), 2614, 2713(2). | handle with care, or:<br>do not drop.  |

APPENDIX A.9  
DANGER LABELS  
(See marginal 3902)

Reproduction on reduced scale from standard format A5 (148 x 210 mm)

N° 1



Marginals 2037, 2075  
and 2713

N° 2



Marginals 2154, 2188  
2213, 2307, 2344, 2432  
and 2713

N° 3



Marginal 2381

N° 4



Marginals 2307, 2316,  
2432, 2443

N° 4 A



Marginals 2432, 2443

N° 5



Marginals 2381, 2524,  
2535

N° 6 A



Marginal 2459,

N° 6 B



Marginal 2459

N° 6 C



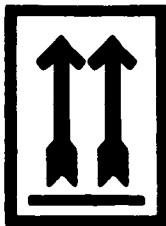
Marginal 2459

N° 7



Marginal 2188

N° 8



Marginals 2037, 2154,  
2188, 2213, 2307, 2344,  
2381, 2432, 2459, 2524,  
2614, 2713

N° 9



Marginals 2037, 2112,  
2154, 2188, 2312, 2307,  
2344, 2381, 2432, 2459,  
2524, 2614, 2713



## ANNEX B

## PROVISIONS CONCERNING TRANSPORT EQUIPMENT AND TRANSPORT OPERATIONS

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Plan of the Annex

10 000

- (1) This Annex comprises:
  - (a) general provisions applicable to the carriage of dangerous substances of all Classes (Chapter I);
  - (b) special provisions applicable to the carriage of dangerous substances of Classes I to VII (Chapter II);
  - (c) Appendices as follows:
    - Appendix B.1 concerning fixed tanks and large movable tanks;
    - Appendix B.1a containing requirements and recommendations concerning the materials and construction of fixed tanks and large movable tanks intended for the carriage of deeply-refrigerated liquefied gases of Class Id;
    - Appendix B.2 concerning electrical equipment;
    - Appendix B.3 containing a model certificate of approval for vehicles;
    - Appendix B.4 containing tables concerning the carriage of substances of Class IVb and a model label to be affixed to vehicles carrying these substances.
- (2) The general provisions of Chapter I and the special provisions of Chapter II are divided into sections with the following headings:
  - Section 1. General (this section contains, inter alia, the provisions concerning authorizations for the carriage of goods in bulk, in containers or in tanks);
  - Section 2. Special requirements to be fulfilled by vehicles and their equipment;

10 000  
(contd)

- Section 3. General service provisions;
- Section 4. Special provisions concerning loading, unloading and handling (this section contains the provisions concerning methods of despatch, restrictions on forwarding and prohibitions on mixed loading);
- Section 5. Special provisions concerning the operation of vehicles;
- Section 6. Transitional provisions, derogations, and provisions peculiar to certain countries.

10 001 Applicability of other regulations, national or international

(1) If the vehicle carrying out a transport operation subject to the provisions of ADR is conveyed over a section of the journey otherwise than by road haulage, then any national or international regulations which govern the carriage of dangerous goods on that section by the mode of transport used for conveying the road vehicle shall alone be applicable to that section of the journey.

(2) In cases where a transport operation subject to the provisions of ADR is likewise subject over the whole or a part of the road journey to the provisions of an international convention which regulates the carriage of dangerous goods by a mode of transport other than road carriage by virtue of clauses extending the applicability of that convention to certain motor-vehicle services, then the provisions of that international convention shall apply, over the journey in question, concurrently with those of ADR which are not incompatible therewith; the other clauses of ADR shall not apply over the journey in question.

10 002 Applicability of the provisions of Chapter I of this Annex

Where provisions of Chapter II or of the Appendices to this Annex conflict with provisions of Chapter I, those provisions of Chapter I shall not apply.

Nevertheless

- (a) the provisions of marginal 10 100 shall take precedence over those of Chapter II;
- (b) the provisions of marginals 10 402 and 10 403 (1) shall take precedence over the prohibitions on mixed loading prescribed in the Sections 4 of Chapter II.

10 003-  
10 099

Chapter IGENERAL PROVISIONS APPLICABLE TO THE CARRIAGE OF  
DANGEROUS SUBSTANCES OF ALL CLASSES

(see, however, marginal 10 002)

Section 1GeneralScope of this Annex

(1) Annex A exempts from the provisions of the present Annex carriage 10 100  
performed under the conditions (of packaging, weight, etc.) laid down in  
marginals 2131a, 2181a, 2201a, 2301a, 2331a, 2371a and 2501a.

It also exempts from the provisions of this Annex, other than those of  
marginal 42 302 (1) and (2), carriage performed under the conditions ( of  
packaging, weight, etc.) laid down in marginal 2451a.

- (2) (a) Limited quantities of dangerous substances in packages  
may be carried without application of the provisions of  
this Annex relating:
- to the types of vehicles (marginals "... 104" of Chapters  
I and II, and marginals 11 105 and 11 106 of Chapter II  
concerning Classes Ia, Ib and Ic);
  - to the crews of vehicles and to supervision (marginals  
"... 171" of Chapters I and II);
  - to the carriage of passengers (marginal 10 172);
  - to instructions in writing (marginals 10 181(1)(b),  
10 185 and 41 185);
  - to the special certificate of approval for vehicles  
(marginals 10 182 and 11 182);
  - to the special requirements to be fulfilled by vehicles  
and their equipment (all Sections 2 of Chapters I and II),  
subject, however, to compliance with the provisions of  
marginal 14 212;
  - to places of loading and unloading (marginals 11 407,  
14 407 and 41 407); and

## Section 1

10 100  
(contd)

- to the operation of vehicles (all Sections 5 of Chapters I and II), subject, however, to compliance with the provisions of marginals 14 515 and 41 515.
- (b) The exemptions under (a) above shall apply to the loading on one transport unit of:
1. one or more of the following dangerous substances, whatever the weight:
    - Class Ia - empty packagings of 1<sup>o</sup>;
    - Class Ic - safety matches of 1<sup>o</sup>(a);
    - Class Ie - empty receptacles of 5<sup>o</sup>;
    - Class II - empty packagings of 14<sup>o</sup> and 15<sup>o</sup>;
    - Class IIIa - empty receptacles of 6<sup>o</sup>;
    - Class IIIb - substances of 9<sup>o</sup> and 10<sup>o</sup>;
    - Class IIIc - empty packagings of 11<sup>o</sup>;
    - Class IVa - empty packagings of 91<sup>o</sup> and 92<sup>o</sup>;
    - Class V - sodium sulphide of 36<sup>o</sup> and empty receptacles of 51<sup>o</sup>;
    - Class VI - articles of 12<sup>o</sup>; and
    - Class VII - empty packagings of 55<sup>o</sup>;
  2. one only of the dangerous substances listed below, on condition that the gross weight of all the packages containing the dangerous substance does not exceed the weight shown:
    - Class Ib - articles of 2<sup>o</sup>(b) or 4<sup>o</sup>: 100 kg;
    - Class Ic - slow-combustion fuses of 3<sup>o</sup>: 100 kg;
    - Class Id - cyanogen chloride : 5 kg;
    - phosgene (carbonyl chloride) of 8<sup>o</sup>(a): 25 kg;
    - fluorine or hydrogen fluoride of 5<sup>o</sup>: 50 kg;
    - Class Ie - calcium carbide of 2<sup>o</sup>(a), calcium silicide of 2<sup>o</sup>(d) or manganese calcium silicide of 2<sup>o</sup>(d) : 1,000 kg;

## Section 1

- |            |  |                   |
|------------|--|-------------------|
| Class IIIa | - diethyl ether, carbon disulphide of 1°(a) or mixtures of 1°(b) such as collodions and semi-collodions containing diethyl ether : 3 kg;<br>- acetaldehyde, acetone or acetone mixtures of 5° : 75 kg  | 10 100<br>(contd) |
| Class IIIb | - sulphur of 2°(a), naphthalene of 11°(b): 250 kg;   |                   |
| Class IVa  | - substances of 41°, 61° and 62°, 71° to 75°, 83° and 84° : 100 kg;  |                   |
| Class V    | - substances of 6°(a), 7°, 9°, 11°, 12°, 14°, 15°, 22°, 23°, 34° and 35° : 10 kg;  |                   |
| Class VII  | - substances of 45°, 46°(a), 47°(a) and (b) packed in conformity with the provisions of marginal 2709 : 2 kg <sup>*/</sup> ;<br>- substances of 1° to 22°, 30° and 31° packed in conformity with the provisions of marginal 2711 : 5 kg; and<br>- substances of 1° to 22°, 30°, 31° and 40° packed in conformity with the provisions of marginals 2703 to 2706 and 2708 : 10 kg; |                   |
3. one or more dangerous substances listed below of the same class, on condition that the total gross weight of all the packages containing each dangerous substance does not exceed the weight indicated:
- |          |  |
|----------|--|
| Class Ia | - any dangerous substance of the Class other than those listed in 1 above : 5 kg ;       |
| Class Ib | - any article of the Class other than those listed in 2 above : 10 kg;                   |
| Class Ic | - any dangerous substance of the Class other than those listed in 1 and 2 above : 15 kg; |
| Class Id | - any dangerous substance of the Class other than those listed in 2 above : 300 kg;      |

<sup>\*/</sup> Not including the weight of the refrigerating system, if any.

## Section 1

10 100  
(contd)

- Class Ie - any substance of the Class other than those listed in 1 and 2 above : 10 kg;
- Class II - substances of the Class other than those of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup>, and 4<sup>o</sup> and the empty packagings listed in 1 above : 250 kg;
- Class IIIa - any substance of the Class other than those listed in 1 and 2 above : 250 kg;
- Class IIIb - any substance of the Class other than those listed in 1 and 2 above : 50 kg;
- Class IVa - any substance of the Class other than those listed in 1 and 2 above : 5 kg;
- Class V - any substance of the Class other than those listed in 1 and 2 above : 250 kg; and
- Class VI - any substance of the Class other than those listed in 1 above : 300 kg.

(3) For the purposes of paragraph (2) above, the weights of liquids or gases carried in the ordinary fixed tanks of vehicles for propelling the vehicles or operating their special-purpose equipment (e.g. refrigerating equipment) and for ensuring their safety shall not be taken into account.

(4) The only provisions of Chapter I of this Annex which are applicable to the carriage of dangerous substances of Class VI shall be those of Chapter II which relate to this Class and those of the marginals of this Chapter I which are expressly rendered applicable by the aforesaid provisions of Chapter II.

(5) Derogations from the provisions of this Annex may be made in the case of emergency transport to save human life.

10 101

10 102 Definitions

(1) For the purposes of this Annex:

- the term "competent authority" means the authority designated as such in each country and in each specific case by the Government;



## Section 1

- the term "fragile package" means a package containing a fragile receptacle (i.e. a receptacle made of glass, porcelain, stoneware or similar materials) which is not enclosed in a packaging with complete sides protecting it effectively against shock  
10 102  
(cont'd)  
[see also Annex A, marginal 2001(5)];
- the term "gas" means a gas or vapour;
- the term "dangerous substances", when used alone, means the substances and articles designated as being substances and articles of ADR;
- the term "RID" means the International Regulations concerning the Carriage of Dangerous Goods by Rail [Annex 1 to the International Convention concerning the Carriage of Goods by Rail (CIM)];
- the term "carriage in bulk" means the carriage of a solid substance without packaging;
- the term "container" means an article of transport equipment (lift-van, demountable tank or other similar structure)
  - of a permanent character and accordingly strong enough to be suitable for repeated use;
  - specially designed to facilitate the carriage of goods, by one or more means of transport, without breakage of load;
  - fitted with devices permitting its ready handling, particularly when being transloaded from one means of transport to another;
  - so designed as to be easy to fill and empty, and having an internal volume of not less than one cubic metre;
- the term "container" does not cover conventional packagings, or vehicles, or tank containers;
- the term "large container" means a container having an internal volume of more than 3 cubic metres;
- the term "small container" means a container having an internal volume of not less than one cubic metre and not more than 3 cubic metres;
- the term "tank-container" means an article of transport equipment conforming to the definition of "container" given above and built to contain liquids or gases without packaging;

## Section 1

10 102  
(contd)

- the term "large tank container" means a tank-container having an internal volume of more than 3 cubic metres;
- the term "small tank-container" means a tank-container having an internal volume of not less than 1 cubic metre and not more than 3 cubic metres;
- the term "battery of receptacles" means an assembly comprising a number of receptacles (called "elements") whose individual or average capacity is over 150 litres and which are interconnected by a manifold and permanently mounted on a frame For frames of gas cylinders, see Annex A, marginal 2142(1)(d) ;
- the term "demountable tank" means a tank, other than a fixed tank, a tank-container or a battery of receptacles, which has a capacity of over 1,000 litres, is not designed for the carriage of goods without breakage of load, and normally cannot be handled except when it is empty;
- the term "large movable tank" means a large tank-container, a demountable tank, or a battery of receptacles;
- the term "fixed tank" means a tank which is structurally attached to a vehicle (which then becomes a tank-vehicle) or is an integral part of the frame of such vehicle;
- the term "tank", when used alone, means a fixed tank, a large movable tank, or a small tank-container (see, however, a limitation of the meaning of the word "tank" in Note 2 at the beginning of Appendix B.1);
- the term "transport unit" means a motor vehicle without an attached trailer, or a combination consisting of a motor vehicle and an attached trailer;
- the term "closed vehicle" means a vehicle having a body capable of being closed;
- the term "open vehicle" means a vehicle the platform of which has no superstructure or is merely provided with side boards and a tailboard;

## Section 1

- the term "sheeted vehicle" means an open vehicle provided with a sheet to protect the load;
- the term "tank-vehicle" means a vehicle built to carry liquids or gases and comprising one or more fixed tanks;
- the term "battery-vehicle" means a tank-vehicle comprising a number of fixed tanks (called "elements") interconnected by a manifold.

10 102  
(contd)

(2) For the purposes of this Annex, tanks [see definition in (1) above] are not placed on the same footing as receptacles, the term "receptacle" being used in a restrictive sense. Provisions concerning receptacles apply to fixed tanks, large movable tanks and small tank-containers only if this is expressly stipulated.

(3) The term "complete load" means any load originating from one sender, for which the use of a vehicle or a large container is exclusively reserved and all operations for loading and unloading which are carried out in conformity with the instructions of the sender or consignee [see marginal 10 108].

(4) Unless expressly stated otherwise, the sign "%" or the expression "per cent" in this Annex represents:

- (a) in the case of mixtures of solids or of liquids, and also in the case of solutions and of solids wetted by a liquid: a percentage by weight based on the total weight of the mixture, the solution or the wetted solid;
- (b) in the case of gaseous mixtures: a percentage by volume based on the total volume of the gaseous mixture.

(5) All weights mentioned for packages in this Annex are, unless otherwise specified, gross weights. The weight of containers or tanks used for the carriage of goods is not included in the gross weight.

(6) Pressures of all kinds relating to receptacles (such as test pressure, internal pressure, safety-valve opening pressure) are always indicated in  $\text{kg/cm}^2$  gauge pressure (pressure in excess of atmospheric pressure); however, the vapour pressure of substances is always expressed in  $\text{kg/cm}^2$  absolute pressure.

## Section 1

10 102 (7) Where this Annex specifies a degree of filling for receptacles  
(contd) or tanks, that degree of filling is always referred to a temperature of  
the substances of 15°C unless some other temperature is indicated.

10 103

10 104 Types of vehicles

(1) A transport unit loaded with dangerous substances may in no case include more than one trailer or semi-trailer.

(2) Special provisions concerning the types of vehicles to be used for the carriage of certain dangerous substances will, where appropriate, be found in Chapter II of this Annex (see also the marginals dealing with carriage in containers, the carriage of solid substances in bulk, carriage in tanks, and tanks).

10 105-  
10 107

10 108 Complete load

Where the provisions relating to carriage as a "complete load" are applied, the competent authorities may require the vehicle or large container used for such carriage to be loaded at only one point and unloaded at only one point.

10 109-  
10 110

10 111 Carriage in bulk

(1) Solid dangerous substances may not be carried in bulk unless this mode of carriage is expressly authorized for the said substances by the provisions of Chapter II of this Annex, and then only under the conditions stipulated by those provisions.

(2) For carriage in bulk in containers, see marginal 10 118(2) and (5).

10 112-  
10 117

## Section 1

Carriage in containers

10 118

Note: The provisions concerning carriage in small and large tank-containers will be found in the marginals headed "Carriage in tanks".

- (1) The carriage of packages in containers is authorized.
- (2) Substances may not be carried in bulk in containers unless their carriage in bulk is expressly authorized (see marginal 10 111); small containers must be of the closed type and have complete walls.
- (3) Large containers must meet the requirements concerning the body of the vehicle which are laid down in this Annex for the load in question; the body of the vehicle need not then satisfy those provisions.
- (4) Subject to the provisions of the last phrase in (3) above, the fact that dangerous substances are enclosed in one or more containers shall not affect the conditions required to be met by the vehicle by reason of the nature and quantities of the dangerous substances carried.
- (5) If the dangerous substances carried in a container are such that, under Annex A, one or more danger labels are required to be affixed to the packages containing them, the same label or labels shall be affixed to the outside of the container containing those substances in packages or in bulk. However, label No. 8 need not be affixed if the container comprises a device or inscription clearly showing which way up it should be kept.

10 119-  
10 120Carriage in tanks

10 121

- (1) Dangerous substances may be carried in tanks only if this mode of carriage is expressly authorized for those substances by the provisions of Chapter II of this Annex; carriage must then comply with the provisions of this Annex.
- (2) If the substances carried in a large movable tank or in a small tank-container are such that, under Annex A, one or more danger labels are required to be affixed to the packages containing them, the same label or labels shall be affixed to the outside of the large movable tank or small tank-container. However, label No. 8 need not be affixed if the container comprises a device or inscription clearly showing which way up it should be kept.

## Section 1

10 122-  
10 126

10 127 Tanks

(1) The provisions concerning the design, inspection, filling and use of large movable tanks and fixed tanks, and various provisions concerning tank-vehicles and their use, will be found in Appendix B.1 and, so far as the design of fixed tanks and large movable tanks intended for the carriage of refrigerated liquefied gases of Class Id is concerned, in Appendix B.1a (for the approval of tank-vehicles, see marginal 10 182).

(2) The provisions concerning small tank-containers are to be found in this Annex, in the marginals " ... 127" of Chapter II (for receptacles, see Annex A).

10 128-  
10 170

10 171 Crews of vehicles: Supervision

(1) Where the provisions of this Annex concerning specific goods require the driver to be accompanied by an assistant, the assistant must be able to take over from the driver.

(2) No transport unit containing dangerous substances may be parked unless it remains under the supervision of a driver, a driver's assistant or some other competent person.

10 172 Carriage of passengers

No passengers not members of the vehicle's crew may be carried in transport units conveying dangerous substances.

10 173-  
10 180

10 181 Transport documents

(1) In addition to the documents required under other regulations, the following documents shall be carried on the transport unit:

- (a) the transport documents prescribed in Annex A, marginal 2002(3) and (4), covering all the dangerous goods carried; and
- (b) instructions, as prescribed in marginal 10 185, relating to all the dangerous substances carried.

## Section 1

- (2) Where the provisions of this Annex require the following documents to be drawn up, the said documents shall likewise be carried on the transport unit:
- (a) the special certificate of approval referred to in marginal 10 182, for each vehicle; and
- (b) the permit authorizing the transport operation.

10 181  
(contd)Approval of vehicles

10 182

(1) Tank-vehicles and, where so required under the provisions of Chapter II of this Annex, other vehicles shall be subject to technical inspection in their country of registration to make sure that they conform to the provisions of this Annex, including those of its Appendices, and to the general safety regulations (concerning brakes, lighting etc.) in force in their country of origin; if these vehicles are trailers or semi-trailers coupled behind a drawing vehicle, the drawing vehicle shall be subject to technical inspection for the same purposes.

(2) A special certificate of approval shall be issued by the competent authority of the country of registration for each vehicle whose inspection yields satisfactory results. It shall be drawn up in the language or one of the languages of the country issuing it, and also, if that language is not English, or French, or German, in English, French or German, unless agreements concluded between the countries concerned in the transport operation provide otherwise. It shall conform to the model shown in Appendix B.3.

(3) A special certificate of approval issued by the competent authorities of one Contracting Party for a vehicle registered in the territory of that Contracting Party shall be accepted, so long as its validity continues, by the competent authorities of the other Contracting Parties.

(4) The validity of special approval certificates shall expire not later than one year after the date of the technical inspection of the vehicle preceding the issue of the certificate. However, in the case of tanks subject to compulsory periodic inspection this provision shall not have the result of requiring tightness (leakproofness) tests, hydraulic pressure tests or internal inspections of tanks to be carried out at intervals shorter than those laid down in Appendix B.1.

## Section 1

10 183-  
10 184

10 185 Instructions in writing

(1) As a precaution against any accident or emergency that may occur or arise during carriage, the driver shall be given instructions in writing specifying concisely:

- (a) the nature of the danger inherent in the dangerous substances being carried, and the safety measures that need to be taken to avert it;
- (b) the action to be taken and treatment to be given in the event of persons coming into contact with the goods being carried or with any substances which might escape therefrom;
- (c) the measures to be taken in case of fire and, in particular, the fire-fighting equipment or equipments not to be used;
- (d) the measures to be taken in case of breakage or deterioration of packagings or of the dangerous substances being carried, particularly where such dangerous substances have spilled over the road.

(2) These instructions shall be prepared for each dangerous substance or Class of dangerous substances by the manufacturer or the sender, in a language of the country of origin; where that language is not the same as those of the countries of transit or destination, the instructions shall also be drawn up in the languages of those countries. A set of these instructions shall be kept in the driver's cab.

(3) All necessary steps shall be taken by the carrier to ensure that the personnel members concerned take note of these instructions and are capable of carrying them out appropriately.

10 186-  
10 199



Section 2Special requirements to be fulfilled by vehicles and their equipment

10 200 -

10 239

Fire-fighting appliances

10 240

(1) Every transport unit carrying dangerous substances shall be equipped with

- (a) at least one portable fire extinguisher of adequate total capacity, suitable for fighting a fire in the engine or in any other part of the transport unit, and such that, if it is used to fight a fire in the load, it does not aggravate the fire and, if possible, controls it; however, if the vehicle is equipped with a fixed fire-extinguisher, automatic or easily brought into action, for fighting a fire in the engine, the portable extinguisher need not be suitable for fighting a fire in the engine;
- (b) in addition to the equipment prescribed under (a) above, at least one portable fire extinguisher of adequate total capacity, suitable for fighting a fire in the load, and such that, if it is used to fight a fire in the engine or in any other part of the transport unit, it does not aggravate the fire and, if possible, controls it;

(2) The fire-extinguishing agents contained in the fire extinguishers with which a transport unit is equipped shall be such that they are not liable to release toxic gases into the driver's cab or under the influence of the heat of a fire.

(3) Where a transport unit comprises a trailer and the laden trailer is uncoupled and left on the public highway, at a distance from the drawing vehicle, the trailer shall be equipped with at least one fire extinguisher conforming to the provisions of sub-paragraph (1)(b) of this marginal.

10 241 -

10 250

## Section 2

10 251 Electrical equipment

The provisions concerning the electrical equipment of vehicles carrying various dangerous substances will be found in Appendix B.2.

10 252-  
10 259

10 260 Miscellaneous equipment

(1) Every transport unit carrying dangerous goods shall be equipped with:

- (a) a tool kit for emergency repairs to the vehicle;
- (b) for each vehicle, at least one scotch of a size suited to the weight of the vehicle and to the diameter of the wheels;
- (c) two amber lights. These lights shall be independent of the electrical equipment of the vehicle and be so designed that their use cannot cause the goods being carried to ignite; they shall be steady or flashing.

(2) The provisions of sub-paragraph (1)(c) of this marginal shall not apply in the territory of the United Kingdom.

10 261-  
10 299

Section 3General service provisions10 300-  
10 339Fire-fighting appliances

10 340

The crew of the vehicle must know how to use the fire-fighting appliances.

10 341-  
10 352Portable lighting apparatus

10 353

A vehicle may not be entered by persons carrying lighting apparatus comprising a flame. In addition, the lighting apparatus used shall not exhibit any metal surface liable to produce sparks.

10 354-  
10 373Prohibition of smoking

10 374

Smoking shall be prohibited during handling operations, in the vicinity of packages awaiting handling, near halted vehicles, and inside the vehicles.

10 375-  
10 399

Section 4Special provisions concerning loading, unloading  
and handling

10 400

10 401 Limitation of the quantities carried

The fact that dangerous substances are enclosed in one or more containers shall not affect the weight limitations laid down by this Annex regarding carriage in a single vehicle or in a single transport unit.

10 402

Prohibition of mixed loading on one transport unit

Unless the contrary is explicitly prescribed by the provisions of the Sections 4 of Chapter II of this Annex, the prohibitions of mixed loading on one transport unit shall not apply to consignments of goods packed together in the manner permitted by the provisions on mixed packing contained in Annex A.

10 403

Prohibition of mixed loading on one vehicle

Unless the contrary is explicitly prescribed by the provisions of the Sections 4 of Chapter II of this Annex, the prohibitions of mixed loading on one vehicle shall not apply to consignments of goods packed together in the manner permitted by the provisions on mixed packing contained in Annex A.

10 404

Prohibition of mixed loading in one container

The prohibitions of mixed loading on one transport unit or on one vehicle shall also be observed within each container.

10 405

Prohibition of mixed loading with goods contained in a container

For the purpose of the application of the prohibitions of mixed loading on one transport unit or on one vehicle, no account shall be taken of substances contained in closed containers with complete sides.

10 406-

10 412

10 413

Cleaning before loading

All the provisions in this Annex which relate to the cleaning of vehicles before loading shall also apply to the cleaning of containers.

## Section 4

Handling and stowage

10 414

(1) the various components of a load comprising dangerous substances shall be suitably stowed on the vehicle and wedged by appropriate means to prevent them from being displaced in anyway in relation to each other and to the walls of the vehicle.

(2) If the load comprises goods of different categories the packages of dangerous substances shall be separated from the other packages.

(3) All the provisions in this Annex which relate to the loading and unloading of vehicles and to the stowage and handling of substances shall also apply to the loading, stowage and unloading of containers on to, and from vehicles.

(4) Nothing whatsoever may be loaded on top of a fragile package.

(5) A driver or a driver's assistant may not open a package containing dangerous substances.

Cleaning after unloading

10 415

(1) If, when a vehicle which has been loaded with packed dangerous substances is unloaded, some of the contents are found to have escaped from the packagings, the vehicle shall be cleaned as soon as possible and in any case before reloading.

(2) Vehicles which have been loaded with dangerous substances in bulk shall be suitably cleaned before reloading unless the new load consists of the same dangerous substance as did the preceding load.

(3) All the provisions of this Annex which relate to the cleaning or decontamination of vehicles shall also apply to the cleaning or decontamination of containers.

10 416-  
10 418Loading and unloading of dangerous substances in containers

10 419

The provisions of this Annex which relate to the loading and unloading of vehicles and the stowage and handling of dangerous substances shall also apply to the loading and unloading of dangerous substances in containers.

## Section 4

10 420-  
10 430

10 431 Running the engine during loading or unloading

Except where the engine has to be used to drive the pumps or other appliances for loading or unloading the vehicle and the laws of the country in which the vehicle is operating permit such use, the engine shall be shut off during loading and unloading operations.

10 432-  
10 499

Section 5Special provisions concerning the operation  
of vehiclesVehicle signs

10 500

(1) When carrying dangerous substances, vehicles shall show two orange-coloured rectangular plates of 40 cm side.

(2) One of these signs shall be fixed at the front of the vehicle and the other at the back; their plane shall be perpendicular to the axis of the vehicle; they shall be clearly visible.

(3) The use of these plates when not expressly prescribed shall be prohibited; they shall then be removed or covered.

(4) The provisions of this marginal shall not apply in the territory of the United Kingdom.

10 501-  
10 502Parking in general

10 503

No transport unit carrying dangerous substances may be parked without the parking brake's being applied.

10 504

Parking at night or when visibility is poor

10 505

(1) If a vehicle is parked at night, or when visibility is poor, and its lights are not working, the amber lights referred to in marginal 10 260 (1)(c) shall be placed on the road,

one about 10 m ahead of the vehicle, and

the other about 10 m to the rear of the vehicle.

(2) The provisions of this marginal shall not apply in the territory of the United Kingdom.

10 506

Parking of a vehicle constituting a special danger

10 507

Without prejudice to the measures prescribed in marginal 10 505 above, if the nature of the dangerous substances carried in the parked vehicle constitutes a source of special danger to road-users (e.g. in the event of substances dangerous to pedestrians, animals or vehicles spilling

## Section 5

10 507  
(contd)

over the road) and the crew of the vehicle is unable to eliminate the danger quickly, the driver shall alert the nearest competent authorities, or cause them to be alerted, immediately. He shall also, where necessary, take the measures prescribed in the instructions provided for in marginal 10 185.

10 508-  
10 598

10 599

Other provisions

As to provisions not included in this Chapter or in Chapter II of this Annex which concern the operation of vehicles carrying dangerous goods, the relevant measures adopted in this sphere by each Contracting Party on the basis of its domestic legislation and relating to domestic carriage shall be applicable to international carriage using its territory.

Section 6

Transitional provisions, derogations, and provisions peculiar to certain countries

10 600-  
10 601

10 602

Rapid procedure for authorizing derogations for the purpose of trials

For the purpose of carrying out the trials necessary with a view to amending the provisions of this Annex in order to adapt them to technological and industrial developments, the competent authorities of the Contracting Parties may agree directly among themselves to authorize certain transport operations in their territories by temporary derogation from the provisions of this Annex. The authority which has taken the initiative with respect to the temporary derogation so granted shall notify the competent service of the United Nations Secretariat of the derogation, which service shall bring it to the attention of the Contracting Parties.

10 603-  
10 999



Chapter IISPECIAL PROVISIONS APPLICABLE TO THE CARRIAGE OF  
DANGEROUS SUBSTANCES OF CLASSES I to VIIClasses Ia Explosive substances and articlesIb Articles filled with explosive substancesIc Igniters, fireworks and similar goods

---

Section 1GeneralTypes of vehicles

(See also marginals 11 105 and 11 106)

Dangerous substances of Classes Ia, Ib and Ic may be carried only in closed vehicles or in sheeted vehicles fitted with side boards and a tail-board. The sheet of a sheeted vehicle must be of impermeable material not readily inflammable. It must be tautened so as to cover the vehicle on all sides, with an overlap of not less than 20 cm down the sides of the vehicle, and be kept in position by lockable metal bars or chains.

Categories of vehicles

For the purposes of this Annex, transport units authorized to carry dangerous substances of Classes Ia, Ib and Ic are classified as follows:

(1) "A" transport units : Transport units whose engines use a liquid fuel with a flash-point below 55°C.

(2) "B" transport units : Transport units whose engines use a liquid fuel with a flash-point of 55°C or more; this category B comprises the following sub-categories:

11 000-

11 103

11 104

11 105

## Classes Ia, Ib and Ic

11 105  
(contd)(a) "B.I" transport units:

These have either no trailer or a trailer meeting the following conditions:

its coupling device is quickly detachable and is robust; and

it is fitted with an effective braking device acting on all the wheels, actuated by the drawing vehicle's service-brake control, and automatically stopping the trailer in the event of breakage of the coupling.

(b) "B.II" transport units:

These have the following characteristics in addition to those of sub-category B.I:

1. Engine and exhaust system

The engine and the exhaust system are placed forward of the front wall of the body. The exhaust-pipe outlet is directed outwards from the vehicle.

2. Fuel tank

The fuel tank is placed well away from the engine, the electric wiring and the exhaust-gas piping, and in such a manner that in the event of leakage from the tank the fuel drains directly on to the ground and cannot reach the load of explosives. The fuel tank is well away from the storage battery, or is at least separated from it by a leak-proof partition. It is so placed as to be so far as possible protected in a collision. The engine is not gravity-fed.

## Classes Ia, Ib and Ic

3. Driver's cab11 105  
(contd)

No inflammable material has been used in the construction of the driver's cab, except in the seating equipment.

(c) "B.III" transport units

These have all the characteristics of sub-category B.II and, in addition, their body exhibits the following features:

1. It is closed and has a continuous surface; it is separated from the driver's cab by a space of not less than 15 cm; it is robustly constructed in such a manner and of such materials that it adequately protects the goods carried; the materials used for the lining are incapable of producing sparks; the insulating and heat-resisting properties of the body are at all points at least equivalent to those of a partition consisting of a layer of asbestos board 5 mm thick between two metal walls or to those of a partition consisting of an outer metal wall lined with a layer of fire-proofed wood 10 mm thick.
2. The door or doors are provided with a lock and key; all joints and closures are of overlapping type. The door or doors must be so constructed as to reduce the strength of the body as little as possible.

Restrictions on the use of vehicles of certain categories

11 106

(1) "A" transport units may carry only articles of Class Ib, 2<sup>o</sup>(b), 4<sup>o</sup>(a), (b) and (e), and of Class Ic, 1<sup>o</sup>(a) and 3<sup>o</sup>.

No special limitation of weight is prescribed for such carriage.

(2) "B.I" transport units may carry

- (a) without special weight limitations, articles of Class Ib, 2<sup>o</sup>(b) and 4<sup>o</sup>, and of Class Ic, 1<sup>o</sup>(a) and 3<sup>o</sup>;
- (b) subject to the weight limitations prescribed in marginal 11 401 the dangerous substances referred to in that marginal.

## Classes Ia, Ib and Ic

11 106 (contd) (3) The provisions relating to restrictions, in the light of the weight and nature of the load, on the use of "B.II" and "B.III" transport units will be found in marginal 11 401.

11 107-  
11 117

11 118 Carriage in containers

Small containers shall satisfy the requirements prescribed in respect of the body of the vehicle for the transport operation concerned; it will then not be necessary for the body of the vehicle to satisfy those requirements.

11 119-  
11 170

11 171 Crews of vehicles: Supervision

A driver's assistant shall be carried on every transport unit. If the national regulations so provide, the competent authority of a contracting country may require an approved official to be carried in the vehicle at the carrier's expense.

11 172-  
11 181

11 182 Approval of vehicles

The requirements of marginal 10 182 shall be applicable to "B.III" transport units.

11 183-  
11 199

## Classes Ia, Ib and Ic

Section 2Special requirements to be fulfilled by vehicles  
and their equipmentMaterials to be used in the construction of vehicle bodies 11 200

In the construction of the body, no materials shall be used which are likely to form dangerous compounds with the explosives carried (e.g. lead in the case of the carriage of hexyl, picric acid, picrates, explosive organic nitro-compounds soluble in water, or explosives of an acid nature [see also marginal 11 105(2)(c)]

11 201-  
11 215Driver's cab

[See marginal 11 105(2)(b)3]

11 216

11 217-  
11 224Combination of drawing vehicle and trailer

[See marginal 11 105(2)(a)]

11 225

11 226-  
11 230Engine and exhaust system

[See marginal 11 105(2)(b)1]

11 231

11 232-  
11 239Fire-fighting appliances

The provisions of marginal 10 240(1)(b) and (3) shall not apply to the carriage of dangerous substances of Class Ic, 1<sup>o</sup> to 3<sup>o</sup>, 5<sup>o</sup> to 20<sup>o</sup>, 24<sup>o</sup>, 25<sup>o</sup> and 27<sup>o</sup>.

11 240

11 241-  
11 250

## Classes Ia, Ib and Ic

11 251 Electrical equipment

(1) The rated voltage of the electric lighting system shall not exceed 24 V.

(2) No circuit shall be installed inside the bodies of "B.II" and "B.III" transport units.

(3) The provisions of Appendix B.2, marginal 220 000(2), shall not apply to the electrical equipment of vehicles carrying articles of Class Ic, 1<sup>o</sup>(a) and 3<sup>o</sup>, or carrying articles of Class Ic, 1<sup>o</sup>(b) in a quantity not exceeding 500 kg.

(4) The provisions of Appendix B.2, marginal 220 000(2)(a) and (c), shall not apply to the electrical equipment of vehicles carrying dangerous substances of Class Ic; 2<sup>o</sup>, 5<sup>o</sup> to 20<sup>o</sup>, 24<sup>o</sup>, 25<sup>o</sup> and 27<sup>o</sup>, or carrying articles of Class Ic, 1<sup>o</sup>(b) in a quantity exceeding 500 kg.

11 252-  
11 299

Classes Ia, Ib and Ic

Section 3

General service provisions

/No special provisions/

11 300-  
11 399

## Classes Ia, Ib and Ic

Section 4Special provisions concerning loading,  
unloading and handling11 400 Method of despatch and restrictions on forwarding

Substances of Class Ia, 13<sup>o</sup> and 14<sup>o</sup>(a) and (b), may be carried only as a complete load. However, packages weighing not more than 10 kg and handed over for carriage in a quantity not exceeding 100 kg may be carried otherwise than as a complete load.

11 401 Limitation of the quantities carried

The quantity of dangerous substances of Classes Ia, Ib and Ic which may be carried on one transport unit shall be limited as follows (see also marginals 11 402 and 11 403 as regards the prohibition of mixed loading).

(1) A "B.I" transport unit may carry only

- (a) one of the loads authorized by marginals 11 106(1) and (2)(a); or
- (b) not more than 500 kg of articles of Class Ic, 1<sup>o</sup>(b); or
- (c) not more than 300 kg of dangerous substances of Class Ia, 12<sup>o</sup>; or
- (d) not more than 100 kg of substances of Class Ia, 11<sup>o</sup>, 13<sup>o</sup> and 14<sup>o</sup>.

(2) A "B.II" transport unit may carry only

- (a) one of the loads authorized in (1) above for "B.I" transport units; or
- (b) not more than 500 kg of substances of Class Ia, 1<sup>o</sup> to 10<sup>o</sup> and 12<sup>o</sup>; of articles of Class Ib, 1<sup>o</sup> to 4<sup>o</sup> and 6<sup>o</sup> to 11<sup>o</sup>; or of dangerous substances of Class Ic. However, substances of Class Ia, 3<sup>o</sup>, 4<sup>o</sup> and 5<sup>o</sup> must be packed in accordance with what is proscribed for consignments carried otherwise than as a complete load.



## Classes Ia, Ib and Ic

- (3) A "B,III" transport unit may carry only 11 401  
(contd)
- (a) one of the loads authorized in (2) above for "B.II" transport units; or,
- (b) provided that the weight of the load of dangerous substances does not exceed 90 per cent of the weight of the load of ordinary goods declared permissible for the vehicle by the competent authority of the country of registration of the vehicle, not more than 9,000 kg of the dangerous substances of Classes Ia, Ib or Ic per articulated vehicle or vehicle without trailer, or than 15,000 kg of those dangerous substances per transport unit of another kind. However, if the load includes one or more substances of Class Ia, 11<sup>o</sup>, 13<sup>o</sup> or 14<sup>o</sup>, or one or more articles of Class Ib, 5<sup>o</sup>, 6<sup>o</sup> and 11<sup>o</sup>, these limits shall be reduced to 6,000 kg and 10,000 kg respectively.

Prohibition of mixed loading on one transport unit

11 402

The following shall not be loaded together on one transport unit:

- (1) dangerous substances of Class Ia with
- (a) articles of Class Ib, 1<sup>o</sup>(d), 3<sup>o</sup>, 4<sup>o</sup>(c), 5<sup>o</sup>, 6<sup>o</sup> and 8<sup>o</sup> to 11<sup>o</sup>;
- (b) articles of Class Ic, 1<sup>o</sup>(b) and 16<sup>o</sup>;
- (c) dangerous substances of Class Id, 1<sup>o</sup> to 7<sup>o</sup>, 8<sup>o</sup>(a) and 9<sup>o</sup> to 17<sup>o</sup>;
- (d) substances of Class II, 3<sup>o</sup>, 4<sup>o</sup> and 11<sup>o</sup>, and also the other dangerous substances of Class II if the outer packaging of these substances does not consist of metal receptacles;
- (e) substances of Class IIIa, 1<sup>o</sup>, 2<sup>o</sup> and 5<sup>o</sup>;
- (f) substances of Class IIIc, 1<sup>o</sup>; and
- (g) substances of Class IVa, 1<sup>o</sup> to 5<sup>o</sup> and 11<sup>o</sup>(a);
- (2) articles of Class Ib with substances of Class II, 3<sup>o</sup>, 4<sup>o</sup> and 11<sup>o</sup>, and also with the other dangerous substances of Class II if the outer packaging of these substances does not consist of metal receptacles;

## Classes Ia, Ib and Ic

11 402  
(contd)

- (3) articles of Class Ib, 1<sup>o</sup>(d), 3<sup>o</sup>, 5<sup>o</sup>, 10<sup>o</sup> and 11<sup>o</sup> with:
  - (a) articles of 6<sup>o</sup> of that Class; and
  - (b) dangerous substances of Class IIIa;
- (4) articles of Class Ib, 1<sup>o</sup>(d), 3<sup>o</sup> and 5<sup>o</sup> with articles of 7<sup>o</sup>, 8<sup>o</sup> and 11<sup>o</sup> of that Class;
- (5) articles of Class Ib, 10<sup>o</sup> with articles of 3<sup>o</sup>, 5<sup>o</sup>, 7<sup>o</sup>, 8<sup>o</sup> and 11<sup>o</sup> of that Class;
- (6) articles of Class Ib, 11<sup>o</sup> with articles of 3<sup>o</sup>, 5<sup>o</sup>, 7<sup>o</sup>, 8<sup>o</sup> and 10<sup>o</sup> of that Class;
- (7) dangerous substances of Class Ic with substances of Class II, 4<sup>o</sup>; and
- (8) articles of Class Ic, 21<sup>o</sup>, 22<sup>o</sup> and 23<sup>o</sup> with substances of 1<sup>o</sup> and 2<sup>o</sup>, or with acetaldehyde, acetone and acetone mixtures of Class IIIa, 5<sup>o</sup>.

11 403 Prohibition of mixed loading on one vehicle

The following shall not be loaded together on one vehicle:

- (1) dangerous substances of Class Ia with:
  - (a) articles of Class Ic, 1<sup>o</sup>(a), 2<sup>o</sup>, 4<sup>o</sup> to 6<sup>o</sup>, 7<sup>o</sup>(b), 8<sup>o</sup> to 15<sup>o</sup> and 17<sup>o</sup> to 27<sup>o</sup>;
  - (b) dangerous substances of Class Id other than those referred to under 11 402(1)(c);
  - (c) dangerous substances of Class Ie;
  - (d) dangerous substances of Class II other than those referred to under 11 402(1)(d) [see also 11 402(1)(d)];
  - (e) dangerous substances of Class IIIa other than those referred to under 11 402(1)(e);
  - (f) dangerous substances of Class IIIb;
  - (g) dangerous substances of Class IIIc, 2<sup>o</sup> to 11<sup>o</sup>;
  - (h) dangerous substances of Class IVa other than those referred to under 11 402(1)(g);
  - (i) dangerous substances of Class IVb;
  - (j) dangerous substances of Class V; and
  - (k) dangerous substances of Class VII;

## Classes Ia, Ib and Ic

- (2) dangerous substances of Class Ib with: 11 403  
(contd)
- (a) fluorine of Class Id, 3<sup>o</sup>;
  - (b) dangerous substances of Class Ie;
  - (c) dangerous substances of Class IIIc;
  - (d) substances of Class IVa, 5<sup>o</sup>;
  - (e) dangerous substances of Class IVb;
  - (f) substances of Class V, 2<sup>o</sup>(a) and 3<sup>o</sup>(a); and
  - (g) dangerous substances of Class VII;
- (3) dangerous substances of Class Ic with:
- (a) substances of Class IVa, 5<sup>o</sup>; and
  - (b) substances of Class IVb;
- (4) igniters, fireworks and similar articles of Class Ic with dangerous substances of Class VII.

11 404

Prohibition of mixed loading with goods contained in a container

11 405

(1) The prohibitions of mixed loading laid down in marginals 11 402 and 11 403 shall apply within each container.

(2) The provisions of marginal 11 402 shall apply as between the dangerous substances contained in a container and the other dangerous substances loaded on the same transport unit, whether or not the latter substances are enclosed in one or more other containers.

(3) The provisions of marginal 11 403 shall apply as between the dangerous substances contained in a container and the other dangerous substances loaded on the same vehicle, whether or not the latter substances are enclosed in one or more other containers.

11 406

Places of loading and unloading

11 407

- (1) The following operations are prohibited:
- (a) loading or unloading dangerous substances of Classes Ia, Ib and Ic in a public place in a built-up area without special permission from the competent authorities;

## Classes Ia, Ib and Ic

11 407  
(contd)

- (b) loading or unloading dangerous substances of the said Classes in a public place elsewhere than in a built-up area without prior notice there of having been given to the competent authorities, unless the said operations are justified for serious reasons of safety.

(2) If, for any reason, handling operations have to be carried out in a public place, then:

- substances and articles of different kinds shall be separated according to the labels; and packages fitted with handles or supports shall be kept flat.

11 408-  
11 41211 413 Cleaning before loading

Before dangerous substances of Classes Ia, Ib or Ic are loaded, all remnants of straw, rags, paper and similar materials, and all iron objects (nails, screws, etc.) not being an integral part of the body of the vehicle, shall be removed.

11 414 Handling and stowage

(1) The use of readily inflammable materials for stowing packages in vehicles is prohibited.

(2) Packages containing dangerous substances of Classes Ia, Ib and Ic shall be loaded in such a manner that they can be unloaded one by one at the point of destination without its being necessary to rearrange the load.

(3) Packages shall be so stowed in the vehicle that they cannot be displaced therein. They shall be protected against any friction or impact. If casks are carried lying on their sides, they shall be so arranged that their longitudinal axis lies parallel to that of the vehicle, and wooden wedges shall be applied to prevent any lateral movement.

11 415-  
11 499

## Classes Ia, Ib and Ic

Section 5Special provisions concerning the operation of vehicles11 500-  
11 507Halts for passage through Customs

11 508

When a transport unit or convoy of vehicles carrying dangerous substances of Classes Ia, Ib and Ic is to pass a frontier Customs post, the transport unit (or convoy) shall stop at least 50 m from the Customs post. The driver's assistant shall proceed to the Customs post to inform the authorities of the arrival of the transport unit (or convoy) carrying dangerous substances.

Halts of limited duration for service requirements

11 509

So far as is possible, halts for service requirements shall not be made near inhabited places or places of resort. A halt near such a place may not be prolonged except with the agreement of the competent authorities.

11 510-  
11 519Convoys

11 520

(1) When vehicles carrying dangerous substances of Classes Ia, Ib and Ic travel in convoy, a distance of not less than 80 m shall be maintained between each transport unit and the next.

(2) If, for any reason, the convoy is obliged to halt and if, in particular, loading or unloading operations have to be carried out in a public place, a distance of not less than 50 m shall be maintained between the halted vehicles.

(3) The competent authorities may lay down rules for the order or composition of convoys.

11 521-  
11 599

## Classes Ia, Ib and Ic

Section 6Transitional provisions, derogations, and provisions peculiar to certain countries

11 600-  
11 604

11 605 Transitional provisions

By derogation from article 4, paragraph 2, of the Agreement, vehicles which were in service in the territory of a Contracting Party at the time of the entry into force of this Annex or were put into service there within two months after its entry into force may be used for the international carriage of dangerous substances of Classes Ia, Ib and Ic only during a period of one year from such entry into force if their design and equipment do not fully satisfy the requirements laid down in this Annex for such carriage.

11 606-  
11 609

11 610 Provisions peculiar to certain countries

The carriage of dangerous substances of Classes Ia, Ib and Ic shall be subject in the territory of the United Kingdom to the regulations in force in that country at the time of carriage.

11 611-  
13 999

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Class Id

Gases: compressed, liquefied or  
dissolved under pressure

Section 1GeneralCarriage in containers

The carriage in small containers of packages containing phosgene, cyanogen chloride [8<sup>o</sup>(a)] or gases of 11<sup>o</sup> is prohibited. Nevertheless, phosgene packed in conformity with Annex A, marginal 2135, may be carried in small containers on condition that the total weight of the packages containing this substance does not exceed 25 kg in one container.

14 000-  
14 117  
14 118

Carriage in tanks

(1) Substances of Class Id other than fluorine (3<sup>o</sup>), cyanogen chloride [8<sup>o</sup>(a)] and dissolved acetylene (15<sup>o</sup>) may be carried in fixed tanks or in large movable tanks.

(2) Substances of Class Id other than fluorine (3<sup>o</sup>), cyanogen chloride [8<sup>o</sup>(a)] and gases of 12<sup>o</sup> and 13<sup>o</sup> may be carried in small tank-containers.

14 119-  
14 120  
14 121

14 122-  
14 126

## Class Id

14 127 Tanks

(1) The requirements concerning small tank-containers are the same as those set forth in Appendix B.1, more particularly those of marginal 210 150 for fixed tanks and large movable tanks. [See transitional provisions in marginal 14 605(3)]

(2) Small tank-containers for liquefied gases of 4° to 11° shall be marked with a continuous orange band about 30 cm in width painted round them at mid height.

14 128 Empty tanks

To be accepted for carriage, empty tanks [see Annex A, marginal 2131, 18°, Note 1] which have contained gases of 1° and 2°, boron trifluoride or fluorine of 3°, or gases of 4° to 10° and 12° to 15° shall be closed as though they were full.

14 129-  
14 199



## Class Id

Section 2Special requirements to be fulfilled  
by vehicles and their equipment

	14 200-
	14 211
<u>Ventilation</u>	14 212
If packages containing gases of 1 <sup>o</sup> to 10 <sup>o</sup> and 15 <sup>o</sup> are carried in a closed vehicle, the vehicle shall be provided with adequate ventilation.	
	14 213-
	14 239
<u>Fire-fighting appliances</u>	14 240
The provisions of marginal 10 240(1)(b) and (3) shall not apply to carriage other than that of inflammable gases or articles listed in marginal 220 002, or of empty packagings of 16 <sup>o</sup> which have contained such gases.	
	14 241-
	14 250
<u>Electrical equipment</u>	14 251
The provisions of appendix B.2 shall not apply to carriage other than that of inflammable gases or articles listed in marginal 220 002, or of empty packagings of 16 <sup>o</sup> which have contained such gases.	
	14 252-
	14 259
<u>Special equipment</u>	14 260
When compressed gases as referred to in marginal 210 140(1)(b)4. (i) or liquefied gases as referred to in marginal 210 140(1)(b)4.(iii) are being carried, the crew of the vehicle shall be provided with gas masks (respirators) of a type appropriate to the gases being carried.	
	14 261-
	14 299

Class 1d

Section 3

General service provisions

14 300

14 352

14 353

Portable lighting apparatus

When inflammable gases or articles listed in marginal 220 002 are being carried, a closed vehicle may not be entered by persons carrying lighting apparatus other than portable lamps so designed and constructed that they cannot ignite any gases which may have penetrated into the interior of the vehicle.

14 354

14 399

## Class Id

Section 4Special provisions concerning loading,  
unloading and handlingMethod of despatch and restrictions on forwarding 14 400

Gases of 12<sup>o</sup> and 13<sup>o</sup> may be carried only in fixed tanks or in large movable tanks.

14 401

Prohibition of mixed loading on one transport unit 14 402

Dangerous substances of Class Id, 1<sup>o</sup> to 7<sup>o</sup>, 8<sup>o</sup>(a) and 9<sup>o</sup> to 17<sup>o</sup> shall not be loaded together on one transport unit with dangerous substances of Class Ia.

Prohibition of mixed loading on one vehicle 14 403

The following shall not be loaded together on one vehicle:

(1) dangerous substances of Class Id with dangerous substances of Class VII;

(2) dangerous substances other than those listed under 14 402 with dangerous substances of Class Ia;

(3) fluorine (3<sup>o</sup>) with articles of Class Ib;

(4) phosgene and cyanogen chloride [8<sup>o</sup>(a)] with:

(a) dangerous substances of Class IIIC; or

(b) substances of Class V, 2<sup>o</sup>(a) and 3<sup>o</sup>(a).

14 404-

14 406

Places of loading and unloading 14 407

(1) The following operations are prohibited:

(a) loading or unloading the following substances in a public place, in a built-up area without special permission from the competent authorities: hydrogen bromide, hydrogen fluoride, hydrogen sulphide, chlorine, sulphur dioxide or nitrogen dioxide (5<sup>o</sup>), phosgene [8<sup>o</sup>(a)] and liquefied hydrogen chloride (10<sup>o</sup>);

## Class Id

14 407  
(contd)

- (b) loading or unloading the substances listed under (a) above in a public place elsewhere than in a built-up area without prior notice thereof having been given to the competent authorities, unless the said operations are justified for serious reasons of safety.

(2) If, for any reason, handling operations have to be carried out in a public place, then:

- substances and articles of different kinds shall be separated according to the labels;  
packages fitted with means of handling shall be kept flat.

14 408-

14 413

14 414

Handling and stowage

- (1) Packages shall not be thrown or subjected to impact.  
(2) Receptacles shall be so stowed in the vehicle that they cannot overturn or fall and that the following requirements are met:  
(a) the cylinders referred to in marginal 2142(1)(a) shall be laid parallel to or at right angles to the longitudinal axis of the vehicle; however, those situated near the forward transverse wall shall be laid at right angles to the said axis.

Short cylinders of large diameter (about 30 cm and over) may be stowed longitudinally with their closures directed towards the middle of the vehicle.

Cylinders which are sufficiently stable may be placed upright.

Cylinders which are laid flat shall be so wedged or attached that they cannot be displaced;

- (b) receptacles containing gases of 11<sup>o</sup> shall always be placed with the opening at the top and be protected against any possibility of being damaged by other packages;  
(c) receptacles designed to be rolled shall be laid with their longitudinal axis parallel to that of the vehicle and shall be secured against any lateral movement.

14 415

14 499

## Class Id

Section 5Special provisions concerning  
the operation of vehicles

14 500-

14 508

14 509

Halts of limited duration for service requirements

In the carriage of dangerous substances of Class Id other than those of 3<sup>o</sup>, 11<sup>o</sup> and 16<sup>o</sup>, halts for service requirements shall so far as is possible not be made near inhabited places or places of resort. A halt near such a place may not be prolonged except with the agreement of the competent authorities.

14 510-

14 514

14 515

Protection against action of sun

During the period April to October inclusive, when a vehicle carrying packages containing gases of 1<sup>o</sup> to 10<sup>o</sup> and 15<sup>o</sup> is stationary the said packages shall, if the legislation of the country in which the vehicle is halted so requires, be effectively protected against the action of the sun, e.g. by means of sheets placed not less than 20 cm above the load.

14 516-

14 599

## Class Id

Section 6Transitional provisions, derogations, and provisions  
peculiar to certain countries

14 600-  
14 604

14 605 Transitional provisions

(1) The period of three years prescribed by article 4, paragraph 2, of the Agreement shall be reduced to six months for tank-vehicles carrying the following substances:

- (a) liquafied hydrogen chloride of 10°;
- (b) ammonia dissolved under pressure in water, of 14°(a), unless the tank has been subjected to a test pressure of not less than 10 kg/cm<sup>2</sup>.

(2) The period of three years prescribed by article 4, paragraph 2, of the Agreement shall also be reduced to six months for tank-vehicles whose tanks are fitted with safety valves not conforming to the requirements of marginal 210 140(1)(a)3. and are used for the carriage of gases of 1° to 10° and 14°, unless the said valves are equipped with a suitable blocking device and the blocking position is shown.

(3) (a) For a period of three years from the date of entry into force of the Agreement, tanks other than those which are structurally attached to tank-vehicles may be used for the international carriage of substances of Class Id as authorized by the provisions of marginal 14 121, even if their design and equipment do not fully satisfy the requirements laid down elsewhere in this Annex for such carriage.

- (b) This period shall be reduced to six months for tanks as referred to under (a) intended to hold the following substances:
- liquefied hydrogen chloride of 10°; and
  - ammonia dissolved under pressure in water, of 14°(a), unless the tank has been subjected to a test pressure of not less than 10 kg/cm<sup>2</sup>.

## Class Id

- (c) This period shall also be reduced to six months for tanks as referred to under (a) fitted with safety valves not conforming to the provisions of marginal 210 140(1)(a)3. and used for the carriage of gases of 1<sup>o</sup> to 10<sup>o</sup> and 14<sup>o</sup>, unless the said valves are equipped with a suitable blocking device and the blocking position is shown.

14 605  
(contd)

14 606-

14 609

14 610

Provisions peculiar to certain countries

The carriage of dangerous substances of Class Id shall be subject in the territory of the United Kingdom to the regulations in force in that country at the time of carriage.

14 611-

14 999





Class IeSubstances which give off inflammable gases  
on contact with waterSection 1General

	15 000-
	15 103
<u>Types of vehicles</u>	15 104
<p>Dangerous substances of Class Ie in packages shall be loaded on to closed or sheeted vehicles. However, receptacles containing calcium carbide [2<sup>o</sup>(a)] may also be loaded on to open vehicles.</p>	
	15 105 -
	15 110
<u>Carriage in bulk</u>	15 111
<p>(1) Calcium carbide [2<sup>o</sup>(a)] and calcium silicide in lumps [2<sup>o</sup>(d)] may be carried in bulk in closed or sheeted vehicles.</p>	
<p>(2) The receptacles of vehicles, and their closures, shall conform to the general conditions of packing set forth in marginal 2182(1), (2) and (3). They shall be so designed that their openings used for loading or unloading can be closed hermetically.</p>	
	15 112 -
	15 117
<u>Carriage in containers</u>	15 118
<p>Small containers used for the carriage in bulk of the substances referred to in marginal 15 111 shall conform to the provisions of that marginal concerning vehicles and the receptacles of vehicles.</p>	
	15 119 -
	15 120
<u>Carriage in tanks</u>	15 121
<p>Sodium, potassium and alloys of sodium and potassium [1<sup>o</sup>(a)] may be carried in tanks.</p>	
	15 122 -
	15 126

## Class Ie

15 127 Tanks

The requirements concerning small tank-containers are the same as those set forth in Appendix B.1, more particularly those of marginal 210 150 for fixed tanks and large movable tanks.

15 128 Empty tanks

To be accepted for carriage, empty tanks which have contained sodium, potassium or alloys of sodium and potassium [1°(a)] shall be closed in the same manner and leak-proof in the same degree as though they were full.

15 129 -  
15 170

15 171 Crews of vehicles: Supervision

A driver's assistant shall be carried on every transport unit carrying substances of Class Ie other than calcium carbide [2°(a)] and calcium silicide [2°(d)].

15 172 -  
15 199

## Class Ie

Section 2Special requirements to be fulfilled by vehicles and their equipment

15 200 -  
15 299

(No special requirements)

## Class Ie

Section 3General service provisions

15 300 -  
15 399

(No special provisions)

## Class Ie

Section 4

<u>Special provisions concerning loading, unloading and handling</u>	15 400
	15 402
<u>Prohibition of mixed loading on one vehicle</u>	15 403

Dangerous substances of Class Ie shall not be loaded together on one vehicle with:

- (a) dangerous substances of Class Ia;
- (b) articles of Class Ib; or
- (c) dangerous substances of Class VII.

	15 404 -
	15 413
	15 414

Handling and stowage

Packages shall be so stowed in the vehicle that they cannot be displaced therein. They shall be protected against any friction or impact. While packages are being handled, special measures shall be taken to prevent them from coming into contact with water.

	15 415 -
	15 499

## Class Ie

Section 5Special provisions concerning the operation of vehicles

(No special provisions)

	15 500 -
	15 599

## Class Ie

Section 6Transitional provisions, derogations, and provisions peculiar to certain countries

(No special provisions)

	15 600 -
	20 999

Class IISubstances liable to spontaneous combustionSection 1General

21 000-

21 103

21 104

Types of vehicles

- (a) Packages containing substances of 1<sup>o</sup> and 3<sup>o</sup> shall be loaded on to open vehicles; however, packages weighing not more than 25 kg may also be loaded on to closed vehicles;
- (b) Packages containing substances of 4<sup>o</sup> shall be loaded on to closed vehicles, and packages containing substances of 10<sup>o</sup> shall be loaded on to closed vehicles or on to sheeted open vehicles.

21 105-

21 110

21 111

Carriage in bulk

Substances of 5<sup>o</sup>, dust from blast-furnace filters [6<sup>o</sup>(a)] and substances of 10<sup>o</sup> may be carried in bulk. Substances of 5<sup>o</sup> and 10<sup>o</sup> shall in that case be carried in closed vehicles with a metal body, and dust from blast-furnace filters in closed vehicles with a metal body or in sheeted vehicles with a metal body.

21 112-

21 120

21 121

Carriage in tanks

The only substance of Class II whose carriage in tanks is authorized is phosphorus of 1<sup>o</sup>. However, this substance may not be carried in small tank-containers.

21 122-

21 127

## Class II

Empty tanks

21 128

To be accepted for carriage, tanks which have contained phosphorus of 1<sup>o</sup> shall either

- be filled with nitrogen, in which case the transport document shall be required to certify that the tank, after closure, is gas-tight; or
- be filled to not more than 96% of their capacity with water; between 1 October and 31 March this water shall contain, in a concentration making it impossible for the water to freeze during carriage, one or more non-corrosive anti-freezing agents not liable to react with phosphorus.

21 129-  
21 170Crews of vehicles; Supervision

21 171

A driver's assistant shall be carried on every transport unit carrying substances of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> and 4<sup>o</sup>.

21 172-  
21 199

## Class II

Section 2Special requirements to be fulfilled by vehicles  
and their equipment

21 200-  
21 250

21 251 Electrical equipment

The provisions of Appendix B.2, marginal 220 000, shall not apply to the carriage of dangerous substances of Class II.

21 252-  
21 299

Class II

Section 3

General service provisions

(No special provisions)

21 300-  
21 399

Class IISection 4Special provisions concerning loading,  
unloading and handling

21 400-  
21 401

21 402 Prohibition of mixed loading on one transport unit

The following shall not be loaded together on one transport unit:

- (1) substances of 3<sup>o</sup>, 4<sup>o</sup> and 11<sup>o</sup> and, if their outer packaging does not consist of metal receptacles, dangerous substances of other item numbers of Class II, with:
  - (a) dangerous substances of Class Ia; or
  - (b) articles of Class Ib;
- (2) substances of 4<sup>o</sup> with dangerous substances of class Ic.

21 403 Prohibition of mixed loading on one vehicle

The following shall not be loaded together on one vehicle:

- (1) dangerous substances of Class II with:
  - (a) dangerous substances of Class IVb; or
  - (b) organic peroxides of Class VII;
- (2) dangerous substances of 1<sup>o</sup> and 2<sup>o</sup>, 5<sup>o</sup> to 10<sup>o</sup> and 12<sup>o</sup> to 15<sup>o</sup> with dangerous substances of Class Ia;
- (3) substances of 3<sup>o</sup>, 4<sup>o</sup>, and 11<sup>o</sup> and, if their outer packaging does not consist of metal receptacles, dangerous substances under other item numbers of Class II, with:
  - (a) dangerous substances of Class IIIc; or
  - (b) substances of Class V, 2<sup>o</sup>(a) and 3<sup>o</sup>(a).

21 404-  
21 413



## Class II

Handling and stowage

21 414

(1) Receptacles and packages containing substances of 1<sup>o</sup> and 3<sup>o</sup> must not be subjected to impact. They shall be so placed in the vehicle that they cannot overturn or fall or be displaced in any way.

(2) The use of readily inflammable materials for stowing packages in vehicles is prohibited.

21 415-  
21 499

## Class II

Section 5Special provisions concerning the operation of vehicles21 500 Vehicle signs

The provisions of marginal 10 500 shall apply only to the carriage of substances of 1<sup>o</sup> to 4<sup>o</sup>.

21 501-  
21 599

## Class II

Section 6Transitional provisions, derogations,  
and provisions peculiar to certain countries

21 600-  
30 999

(No special provisions)

## Class IIIa

Inflammable liquidsSection 1General31 000-  
31 103Types of vehicles

31 104

- (1) Packages containing liquids of 1<sup>o</sup>, 2<sup>o</sup> or 3<sup>o</sup>, acetaldehyde, acetone, or acetone mixtures (5<sup>o</sup>) shall be loaded on to open vehicles.
- (2) The following may, however, be loaded on to closed vehicles:
- (a) liquids of 1<sup>o</sup> if enclosed in receptacles made of glass, porcelain, stoneware or similar materials, or of a plastics material, and packed as prescribed in Annex A, marginals 2303 and 2304;
- (b) liquids of 1<sup>o</sup> if contained in metal receptacles and if no package exceeds the following weight:
- for petroleum ether, pentanes, condensation products of natural gas, diethyl ether (sulphuric ether) also if mixed with other liquids of 1<sup>o</sup>(a), carbon disulphide  
 $\overline{1^o(a)}$  ..... 40 kg;
  - for the other liquids of 1<sup>o</sup>(a) and (b) ..... 75 kg;
- (c) packages containing liquids of 2<sup>o</sup> and 3<sup>o</sup>, acetaldehyde, acetone or acetone mixtures (5<sup>o</sup>), if not weighing more than 100 kg. However, these packages may weigh as much as:
- 250 kg if they are in the form of drums as referred to in marginal 2303(6),
  - 225 kg if they are in the form of drums as referred to in marginal 2303(7),
  - 500 kg if they are in the form of sheet-steel drums with a wall thickness of not less than 1.5 mm and fitted with rolling hoops, as referred to in marginal 2303(4), or other drums of the same strength and leakproofness, as referred to in marginal 2303(5);

## Class IIIa

31 104  
(cont'd) (d) collective packages weighing not more than 100 kg each and containing receptacles which, under (a), (b) or (c) above, may be loaded on closed vehicles.

31 105-  
31 117

31 118 Carriage in containers

Fragile packages within the meaning of marginal 10 102 (1) may not be carried in small containers

31 119-  
31 120

31 121 Carriage in tanks

All the liquids of Class IIIa except nitromethane (3°) may be carried in tanks. However, carbon disulphide and chloroprene [1°(a)] may not be carried in small tank-containers.

31 122-  
31 126

31 127 Tanks

The small tank-containers used shall be filled in conformity with the requirements prescribed by Annex A, marginal 2305, for the filling of receptacles containing these substances. Small tank-containers shall undergo a hydraulic pressure test at a pressure of 2 kg/cm<sup>2</sup>; however, small tank-containers intended for the carriage of petroleum ether, pentanes, diethyl ether, methyl formate and acrylaldehyde of 1°, or of acetaldehyde, acetone and acetone mixtures of 5°, shall undergo a hydraulic pressure test at a pressure of 4 kg/cm<sup>2</sup>. The pressure test shall be repeated every six years. The small tank-containers shall show in clearly legible and indelible characters the test pressure, the date (month, year) of the most recent test undergone, and the stamp of the expert who carried out the test.

31 128 Empty tanks

To be accepted for carriage, empty tanks which have contained inflammable liquids of Class IIIa shall be closed in the same manner and leak-proof in the same degree as though they were full.

## Class IIIa

Crews of vehicles; Supervision

The provisions of marginal 10 171 (2) shall not apply to the carriage of substances of 4<sup>o</sup>.

31 129-

31 170

31 171

31 172-

31 199

## Class IIIa

Section 2Special requirements to be fulfilled by vehicles  
and their equipment

31 200-  
31 250

31 251 Electrical equipment

The provisions of Appendix B.2, marginal 220 000, shall not apply to the carriage of dangerous substances of Class IIIa other than inflammable liquids of 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> and acetaldehyde, acetone and acetone mixtures of 5<sup>o</sup>.

31 252-  
31 299

## Class IIIa

Section 3General service provisionsUse of portable lighting apparatus

A closed vehicle may not be entered by persons carrying lighting apparatus other than portable lamps so designed and constructed that they cannot ignite any gas which may have penetrated into the interior of the vehicle.

31 300-

31 352

31 353

31 354-

31 399

## Class IIIa

Section 4Special provisions concerning loading, unloading  
and handling

31 400-  
31 401

31 402 Prohibition of mixed loading on one transport unit

The following shall not be loaded together on one transport unit:

- (1) dangerous substances of Class IIIa with articles of Class Ib, 1<sup>o</sup>(d), 3<sup>o</sup>, 5<sup>o</sup>, 10<sup>o</sup> and 11<sup>o</sup>;
- (2) substances of Class IIIa, 1<sup>o</sup>, 2<sup>o</sup> and 5<sup>o</sup>, with dangerous substances of Class Ia;
- (3) liquids of Class IIIa, 1<sup>o</sup> and 2<sup>o</sup>, acetaldehyde, acetone and acetone mixtures of 5<sup>o</sup>, with articles of Class Ic, 21<sup>o</sup>, 22<sup>o</sup> and 23<sup>o</sup>.

31 403 Prohibition of mixed loading on one vehicle

The following shall not be loaded together on one vehicle:

- (1) liquids of Class IIIa with:
  - (a) dangerous substances of Class IIIC;
  - (b) substances of Class IVa, 5<sup>o</sup>;
  - (c) substances of Class V, 2<sup>o</sup>(a) and 3<sup>o</sup>(a); or
  - (d) dangerous substances of Class VII;
- (2) dangerous substances of Class IIIa, 3<sup>o</sup>, 4<sup>o</sup> and 6<sup>o</sup>, with dangerous substances of Class Ia.
- (3) liquids of 1<sup>o</sup>, 2<sup>o</sup> and 5<sup>o</sup> with dangerous substances of Class IVb.

31 404-  
31 413

31 414 Handling and stowage

The use of readily inflammable materials for stowing packages in vehicles is prohibited.

31 415-  
31 499



## Class IIIa

Section 5Special provisions concerning the operation of vehiclesVehicle signs

31 500

The provisions of marginal 10 500 shall apply only to the carriage of substances of 1<sup>o</sup> and 2<sup>o</sup> and of methanol, acetaldehyde, acetone and acetone mixtures of 5<sup>o</sup>.

31 501-  
31 599

## Class IIIa

Section 6Transitional provisions, derogations,  
and provisions peculiar to certain countries

31 600-  
31 604

31 605 Transitional provisions

Tanks which were in service in the territory of a Contracting Party at the time of the entry into force of the Agreement under article 7, paragraph 1, or were put into service there within two months after its entry into force, may be used for the international carriage of dangerous substances during a period of three years from such entry into force even if their design and equipment do not fully satisfy the requirements laid down in Appendix B.1.

31 606-  
31 609

31 610 Provisions peculiar to certain countries

The carriage of liquids of Class IIIa whose flash-point is below 23°C shall be subject in the territory of the United Kingdom to the regulations in force in that country at the time of carriage.

31 611-  
31 999

Class IIIbInflammable solidsSection 1General

32 000

32 103

32 104

Types of vehicles

Where packagings containing substances of 3<sup>o</sup> to 8<sup>o</sup> are loaded on to open vehicles, the vehicles shall be covered with a fireproof sheet unless the substances are packed in metal drums.

32 105-

32 110

32 111

Carriage in bulk

(1) Sulphur of 2<sup>o</sup>(a) may be carried in bulk.

(2) Naphthalene of 11<sup>o</sup>(a) and (b) may be carried in bulk; it must in that case be carried in closed vehicles with a metal body or in sheeted vehicles with a non-inflammable sheet and either having a metal body or having a sheet of closely-woven material spread on the floor. For the carriage of naphthalene of 11<sup>o</sup>(a), the floors of vehicles shall be protected by an oil-proof lining.

32 112-

32 117

32 118

Carriage in containers

For the carriage of naphthalene of 11<sup>o</sup>(a) and (b), small wooden containers shall be fitted with an oil-proof lining.

32 119-

32 120

32 121

Carriage in tanks

Sulphur in the melted state [2<sup>o</sup>(b)] and naphthalene in the melted state [11<sup>o</sup>(c)] may be carried only in tank-vehicles.

32 122-

32 170

32 171

Crews of vehicles: Supervision

A driver's assistant shall be carried on every transport unit carrying more than 300 kg of substances of 6<sup>o</sup>.

32 172-

32 199

## Class IIIb

Section 2Special requirements to be fulfilled by vehicles  
and their equipment32 200-  
32 25032 251 Electrical equipment

The provisions of Appendix B.2, marginal 220 000, shall not apply to carriage other than that of substances of 3<sup>o</sup> to 7<sup>o</sup>.

32 252-  
32 299

## Class IIIb

Section 3General service provisions32 300-  
32 399

(No special provisions)

## Class IIb

Section 4Special provisions concerning loading,  
unloading and handlingMethod of despatch and restrictions on forwarding

32 400

Sulphur in the melted state [2°(b)] and naphthalene in the melted state [11°(c)] may be carried only in tank-vehicles.

32 401-

32 402

Prohibition of mixed loading on one vehicle

32 403

Substances of Class IIb shall not be loaded together on one vehicle with:

- (a) dangerous substances of Class Ia;
- (b) dangerous substances of Class IIIc;
- (c) substances of Class IVa, 5°;
- (d) substances of Class V, 2°(a) and 3°(a); or
- (e) dangerous substances of Class VII.

32 404-

32 499

## Class IIb

Section 5Special provisions concerning the operation of vehicles32 500 Vehicle signs

The provisions of marginal 10 500 shall be applicable only to the carriage of sulphur in the melted state [2°(b)], substances of 4° to 8°, and naphthalene in the melted state [11°(c)].

32 501-  
32 599

## Class IIb

Section 6Transitional provisions, derogations, and provisions peculiar to certain countries

32 600-  
32 999

(No special provisions)

Class IIIcOxidizing substancesSection 1General33 000-  
33 103Types of vehicles

33 104

Where packages containing substances of 4<sup>o</sup>, 6<sup>o</sup>, 7<sup>o</sup> or 8<sup>o</sup> are loaded on to open vehicles, the vehicles shall be sheeted unless the substances are packed in metal drums.

33 105-  
33 110Carriage in bulk

33 111

(1) Substances of 4<sup>o</sup> to 6<sup>o</sup> and 7<sup>o</sup> (a) and (b) may be carried in bulk as a complete load.

(2) Substances of 4<sup>o</sup> and 5<sup>o</sup> shall be carried in open metal "vat vehicles" (véhicules cuves) covered with an impermeable non-inflammable sheet, or in metal containers [see marginal 33 118(2)].

(3) Substances of 6<sup>o</sup> and 7<sup>o</sup> (a) and (b) shall be carried in closed vehicles or in vehicles covered with an impermeable non-inflammable sheet, the vehicles being so constructed either that the substance cannot come into contact with wood or any other combustible material or that the entire surface of the floor and walls, if combustible, has been provided with an impermeable and incombustible surfacing or treated with substances rendering the wood incombustible.

33 112-  
33 117Carriage in containers

33 118

(1) Fragile packages within the meaning of marginal 10 102(1) and those containing hydrogen peroxide or solutions of hydrogen peroxide (1<sup>o</sup>) or tetranitromethane (2<sup>o</sup>) may not be carried in small containers.

## Class IIIc

33 118  
(contd)

(2) Containers intended for the carriage of substances of 4<sup>o</sup> and 5<sup>o</sup> shall be made of metal, be leak-proof, be covered with a lid or an impermeable sheet resistant to combustion, and be so constructed that the substances held in the containers cannot come into contact with wood or any other combustible material.

(3) Containers intended for the carriage of substances of 6<sup>o</sup> and 7(a) and (b) shall be covered with a lid or an impermeable sheet resistant to combustion and be so constructed either that the substances held in the containers cannot come into contact with wood or any other combustible material or that the entire surface of the floor and walls, if made of wood, has been provided with an impermeable surfacing resistant to combustion or has been coated with sodium silicate or a similar substance.

33 119-  
33 12033 121 Carriage in tanks

(1) Liquids of 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> and solutions of substances of 4<sup>o</sup> may be carried in fixed tanks or in large movable tanks.

(2) Solutions of substances of 4<sup>o</sup> may also be carried in small tank-containers.

33 122-  
33 12633 127 Tanks

The requirements concerning small tank-containers are the same as those set forth in Appendix B.1 for fixed tanks and large movable tanks.

33 128 Empty tanks

(1) To be accepted for carriage, empty tanks which have contained substances of Class IIIc shall be closed in the same manner and leak-proof in the same degree as though they were full.

(2) Empty tanks which have contained a chlorate, a perchlorate, a chlorite (4<sup>o</sup> and 5<sup>o</sup>), an inorganic nitrite (8<sup>o</sup>) or substances of 9<sup>o</sup> and 10<sup>o</sup> and have residues from their previous contents adhering to the outside, are not to be accepted for carriage.



## Class IIIc

33 129-  
33 170Crews of vehicles: Supervision

33 171

A driver's assistant shall be carried on every transport unit carrying substances of Class IIIc, 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup>.

33 172-  
33 199

## Class IIIo

Section 2Special requirements to be fulfilled by vehicles and their equipment

(No special requirements)

33 200-  
33 299

## Class IIIo

Section 3General service provisions33 300-  
33 302Precautions with respect to articles of consumption

33 303

In vehicles and at places of loading, unloading or transloading, tetranitromethane of 2<sup>o</sup>, barium chlorate of 4<sup>o</sup>(a), barium perchlorate of 4<sup>o</sup>(b), barium nitrate and lead nitrate of 7<sup>o</sup>(o), inorganic nitrites of 8<sup>o</sup>, barium dioxide of 9<sup>o</sup>(b) and barium permanganate of 9<sup>o</sup>(o) shall be kept away from foodstuffs and other articles of consumption.

33 304-  
33 399

## Class IIIc

Section 4Special provisions concerning loading, unloading  
and handling33 400-  
33 40133 402 Prohibition of mixed loading on one transport unit

Substances of Class IIIc, 1<sup>o</sup>, shall not be loaded together on one transport unit with dangerous substances of Class Ia.

33 403 Prohibition of mixed loading on one vehicle

The following shall not be loaded together on one vehicle:

- (1) dangerous substances of Class IIIc with:
  - (a) articles of Class Ib;
  - (b) phosgene and cyanogen chloride of Class Id, 8<sup>o</sup>(a);
  - (c) substances of Class II, 3<sup>o</sup>, 4<sup>o</sup> and 11<sup>o</sup>, or any other dangerous substances of Class II unless their outer packaging consists of metal receptacles;
  - (d) dangerous substances of Class IIIa;
  - (e) dangerous substances of Class IIIb;
  - (f) dangerous substances of Class IVb; or
  - (g) dangerous substances of Class VII;
- (2) dangerous substances of 2<sup>o</sup> to 11<sup>o</sup> with dangerous substances of Class Ia;
- (3) substances of 3<sup>o</sup> with substances of Class IVa, 32<sup>o</sup> and 33<sup>o</sup>;
- (4) substances of 4<sup>o</sup>(a), 4<sup>o</sup>(c) and 4<sup>o</sup>(d) with dangerous substances of Class V;
- (5) substances of 4<sup>o</sup> and 5<sup>o</sup> with aniline [Class IVa, 11<sup>o</sup>(b)], except in quantities not exceeding 5 kg, packed in conformity with marginal 2408(2)(a).
- (6) substances of Class IIIc, 4<sup>o</sup>(a), 8<sup>o</sup> and 9<sup>o</sup>(c), with substances of 6<sup>o</sup>(a), (b) or (c), or with other ammonium salts or with a mixture having an ammonium-salt base, of the same Class.

## Class IIIc

33 404-  
33 413Handling and stowage

33 414

(1) Packages containing substances of Class IIIc shall be placed flat on their bottoms. In addition, receptacles containing liquids of Class IIIc shall be so wedged that they cannot overturn.

(2) The use of readily inflammable materials for stowing packages in vehicles is prohibited.

Cleaning after unloading

33 415

After unloading, vehicles which have been carrying substances of 4<sup>o</sup> to 6<sup>o</sup> and 7<sup>c</sup>(a) and (b) in bulk shall be copiously swilled.

33 416-  
33 499

## Class IIIc

Section 5Special provisions concerning the operation of vehicles33 500 Vehicle signs

The provisions of marginal 10 500 shall apply only to the carriage of substances of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup>, barium chlorate of 4<sup>o</sup>(a), barium perchlorate of 4<sup>o</sup>(b), substances of 8<sup>o</sup> and 9<sup>o</sup>(b) and barium permanganate of 9<sup>o</sup>(c).

33 501-  
33 599.

## Class IIIc

Section 6Transitional provisions, derogations, and provisions peculiar to certain countries

(No special provisions)

33 600-  
40 999

Class IVaToxic substancesSection 1General41 000-  
41 103Types of vehicles

41 104

(1) Substances of 54°, pesticides of 83° packed in conformity with marginal 2429 (a)5, iii and iv, and substances of 84°, packed in bags, shall be loaded on to closed or sheeted vehicles.

(2) Substances of 3°, 4°, and 12°(a) and (b) shall be loaded on to open vehicles. Cases containing substances of 4° and 12°(a) and (b) may also be loaded on to closed vehicles.

41 105-  
41 110Carriage in bulk

41 111

(1) Substances of 41° and 73° may be carried in bulk as a complete load.

(2) Substances of 41° shall be carried in closed or sheeted vehicles and those of 73° in open, sheeted or movable-roof vehicles.

41 112-  
41 117Carriage in containers

41 118

Fragile packages within the meaning of marginal 10 102 (1) may not be carried in small containers.

41 119-  
41 120Carriage in tanks

41 121

(1) Liquids of 1°(b), 31°(b) and 81° to 83°, acrylonitrile [2°(a)], acetonitrile [2°(b)], allyl chloride [4°(a)], 2-cyanopropan-2-ol [1°(a)], aniline [11°(b)], 1-chloro-2, 3-epoxypropane [12°(a)], glycol chlorohydrin [12°(b)], allyl alcohol [13°(a)], dimethyl sulphate [13°(b)], phenol [13°(c)], cresols [22°(a)] and xylenols [22°(b)] may be carried in fixed tanks or in large movable tanks.

## Class IVa

41 121  
(contd)

(2) Liquids of 14<sup>o</sup> may be carried in tank-vehicles or large movable tanks built for the purpose.

(3) Aniline  $\sqrt{11^o(b)}$  may be carried in small tank-containers.

41 122-  
41 126

41 127

Tanks

(1) The requirements concerning small tank-containers containing aniline  $\sqrt{11^o(b)}$  are the same as those set forth in Annex A for receptacles containing this substance.

(2) The outside of the tanks must not be contaminated with toxic substances.

41 128

Empty tanks

(1) To be accepted for carriage, empty tanks must not be contaminated on the outside with toxic substances; they shall be closed in the same manner and leak-proof in the same degree as though they were full.

(2) Large movable tanks, when empty, and small tank-containers of 91<sup>o</sup>, if forwarded otherwise than as a complete load, shall bear labels conforming to model No. 4 (see Annex A, Appendix A.9).

41 129-  
41 170

41 171

Crews of vehicles; Supervision

A driver's assistant shall be carried on every transport unit carrying more than one metric ton of substances of Class IVa, 1<sup>o</sup> to 5<sup>o</sup> and 14<sup>o</sup>, or more than 250 kg of fragile packages containing these substances.

41 172-  
41 184

41 185

Instructions in writing

Where substances of 14<sup>o</sup>, or receptacles which have contained them, are carried, the text of the written instructions shall specify, inter alia, the following:

## Class IVa

"(A) Precautions to be observed41 185  
(contd)

The substance being carried is highly toxic. In the event of leakage from one of the receptacles the following precautions should be taken:

1. avoid:
  - (a) contact with the skin;
  - (b) inhalation of vapours;
  - (c) introduction of the liquid into the mouth;
2. when drums which are torn open or damaged or wetted with liquid are being handled, the use of the following is compulsory:
  - (a) respirators;
  - (b) polyvinyl chloride gloves; and
  - (c) polyvinyl chloride or rubber boots.

In the event of a serious accident involving obstruction of the public highway, it is essential that persons arriving to clear the site should be warned of the danger incurred.

(R) Action to be taken

Every effort shall first be made to rope off the site of the accident at an average distance of 15 metres; the notices contained in the equipment box shall be set up round the enclosure and onlookers shall be kept away.

The respirators, gloves and boots will enable one person to approach the load and verify its condition.

Should any of the drums be torn open, the following should be done:

- (a) additional respirators, gloves and boots with which to equip the workmen should be procured urgently;
- (b) drums still intact should be set aside;
- (c) the liquid spilled on the vehicle or on the ground should be neutralized by copious swilling with an aqueous solution of potassium permanganate (a neutralizing agent a bottle of which is kept in the equipment box); the solution is easily prepared by stirring 0.5 kg of permanganate with 15 litres of water in a bucket; swilling should be carried out several

## Class IVa

41 185  
(contd)

times, because it takes 2 kg of potassium permanganate to neutralize completely 1 kg of the substance being carried.

Where practicable, the best way to decontaminate the area is to pour petrol over the spilled fluid and ignite it.

(B) Important notice

In case of accident, one of the first steps which must be taken is to notify by telegram or telephone ... (insert here the addresses and telephone numbers of the establishments to be notified in each of the countries in whose territory carriage is to take place).

A vehicle which has been contaminated with the substance carried shall not be put back into service until it has been decontaminated under the supervision of a competent person. Any wooden parts of the vehicle which have been attacked by the substance carried shall be removed and burnt."

41 186-  
41 199



## Class IVa

Section 2Special requirements to be fulfilled  
by vehicles and their equipmentFire-fighting appliances

The provisions of marginal 10 240(1)(b) and (3) shall not apply to the carriage of dangerous substances of Class IVa.

41 200-  
41 239

41 240

41 241  
41 250

Electrical equipment

The provisions of Appendix B.2, marginal 220 000, shall not apply to the carriage of dangerous substances of Class IVa [see, however, marginal 210 410(3)(d) as regards tanks carrying substances of 14<sup>07</sup>].

41 251

41 252-  
41 259

Special equipment

Whenever substances of 14<sup>0</sup> or receptacles having contained them are carried, the driver shall, when he is given the transport document, at the same time be given a portable equipment box fitted with a handle and containing:

41 260

- three copies of the written instructions specifying the action to be taken in the event of an accident or incident occurring during carriage (see marginal 41 185);
- two pairs of polyvinyl chloride gloves and two pairs of polyvinyl chloride or rubber boots;
- two respirators with an activated-charcoal cartridge of 500 cm<sup>3</sup> capacity;
- a bottle (made of bakelite, for example) containing 2 kg of potassium permanganate and bearing the inscription "dissolve in water before use";

## Class IVa

41 260  
(contd)

six fibreboard notices bearing the inscription "DANGER - volatile  
poison spilled. Do not approach without respirator" in the  
language or languages of each of the countries in whose  
territory carriage takes place.

This equipment box shall be kept in the driver's cab in a place where it can  
easily be found by the decontamination team.

41 261-  
41 299

## Class IVa

Section 3General service provisions

	41 300-
	41 301
<u>Action to be taken in the event of accident</u>	41 302
(See marginal 41 185)	
<u>Precautions with respect to articles of consumption</u>	41 303
In vehicles and at places of loading, unloading or transloading, dangerous substances of Class IVa shall be kept away from foodstuffs and other articles of consumption.	
	41 304-
	41 352
<u>Portable lighting apparatus</u>	41 353
The provisions of marginal 10 353 shall not apply.	
	41 354-
	41 373
<u>Prohibition of smoking</u>	41 374
The provisions of marginal 10 374 shall not apply.	
	41 375-
	41 399

## Class IVa

Section 4Special provisions concerning loading,  
unloading and handling41 400 Method of despatch and restrictions on forwarding

The substances referred to under 2°(a) (acrylonitrile) and 61° (1) (1-chloro-1-nitropropane) may be carried in non-returnable metal drums [see marginal 2404(1)(b)2 and 2423(2)(d)] only as a complete load on open vehicles.

41 401

41 402 Prohibition of mixed loading on one transport unit

Substances of 1° to 5° and 11°(a) shall not be loaded together on one transport unit with dangerous substances of Class Ia.

41 403 Prohibition of mixed loading on one vehicle

The following shall not be loaded together on one vehicle:

- (1) dangerous substances of Class IVa with dangerous substances of Class VII;
- (2) dangerous substances other than those of Class IVa, 1° to 5° and 11°(a), with dangerous substances of Class Ia;
- (3) substances of 5° with
  - (a) dangerous substances of Class Ib;
  - (b) dangerous substances of Class Ic;
  - (c) dangerous substances of Class IIIa; or
  - (d) dangerous substances of Class IIIb;
- (4) aniline [11°(b)] - unless packed in conformity with marginal 2408(2)(a) - with substances of Class IIIc, 4° and 5°;
- (5) substances of 12°(a) and (d) with substances of Class V other than solids of 13°, 15°(a) and 21°; or
- (6) substances of 32° and 33° with substances of Class IIIc, 3°, or with dangerous substances of Class V, 1° to 7° and 9°, chlorosulphonic acid [SO<sub>2</sub>(OH)Cl] of 11°(a), and 21°.

## Class IVa

41 404-

41 406

Places of loading and unloading

41 407

(1) The following operations are prohibited:

- (a) loading or unloading substances of 1° to 5°, 13°(b), 14° and 81° in a public place in a built-up area without special permission from the competent authorities;
- (b) loading or unloading the said substances in a public place elsewhere than in a built-up area without prior notice thereof having been given to the competent authorities, unless the said operations are justified for serious reasons of safety.

(2) If, for any reason, handling operations have to be carried out in a public place, then substances and articles of different kinds shall be separated according to the labels.

41 408-

41 414

Cleaning after unloading

41 415

(1) After unloading, vehicles which have been carrying substances of 41° and 73° in bulk shall be copiously swilled.

(2) A vehicle which has been contaminated with substances of 14° or with a mixture thereof shall not be put back into service until it has been decontaminated under the supervision of a competent person. Any wooden parts of the vehicle which have been attacked by substances of 14° shall be removed and burnt.

41 416-

41 499

## Class IVa

Section 5Special provisions concerning the operation of vehicles41 500 Vehicle signs

(1) The provisions of marginal 10 500 shall apply only to the carriage of substances of 1° to 5°, 11° to 14°, 21° to 23°, 31° to 33°, 41°, 51° to 54°, 81° and 82°.

(2) Whenever substances of 14° are carried, the vehicle shall display on each side a warning notice to the effect that, if any liquid escapes, the greatest caution must be exercised and the vehicle must not be approached by persons not wearing a respirator, polyvinyl chloride gloves and polyvinyl chloride or rubber boots.

41 501-  
41 508

41 509 Halts of limited duration for service requirements

Halts for service requirements shall so far as possible not be made near inhabited places or places of resort. A halt near such a place may not be prolonged except with the agreement of the competent authorities.

41 510-  
41 514

41 515 Protection against action of sun

During the period April to October inclusive, when a vehicle carrying hydrocyanic acid  $\sqrt{1^{\circ}(a)}$  is stationary the packages shall, if the legislation of the country in which the vehicle is halted so requires, be effectively protected against the action of the sun, e.g. by means of sheets placed not less than 20 cm above the load.

41 516-  
41 599

## Class IVa

Section 6Transitional provisions, derogations, and provisions peculiar to certain countries41 600-  
41 604Transitional provisions

41 605

Pursuant to the last sentence of article 4, paragraph 2, of the Agreement, vehicles which were in service in the territory of a Contracting Party at the time of the entry into force of the Agreement under article 7, paragraph 1, or were put into service there within two months after its entry into force, may be used for the international carriage of substances of 14<sup>o</sup> only during a period of two years from such entry into force if their design and equipment do not fully satisfy the requirements laid down in this Annex for such carriage.

41 606-  
41 999





## Class IVb

Radioactive substancesSection 1General

42 000 -

42 110

42 111

Carriage in bulk

The substances of low specific activity referred to in Annex A, marginal 2457 (1)(a), (b) and (d), may be carried in bulk as a complete load in vehicles ensuring that no leakage of substances to the outside of the vehicle can occur in normal carriage.

42 112-

42 117

Carriage in containers

42 118

(1) The only packages which may be carried in containers are those containing substances of 1<sup>o</sup>, 3<sup>o</sup> and 5<sup>o</sup>.

(2) Packages containing substances of 1<sup>o</sup> or 3<sup>o</sup>, and substances of 5<sup>o</sup> as defined in Annex A, marginal 2457(1)(a) and (b), if packed in conformity with the provisions of Annex A, marginal 2457(2), shall be subject to the following conditions:

- (a) if the container contains only packages of Category I - WHITE it shall itself be deemed to belong to that Category; if it contains packages of Categories II - YELLOW or III - YELLOW, with or without packages of Category I - WHITE, it shall be deemed to belong to Category III - YELLOW or to Category II - YELLOW according as the sum of the transport indices of the packages it contains does or does not exceed 0.5; the dose rates of the radiation emitted by the container must not at any time during carriage exceed 200 mR/h or equivalent at any point on its external surface;
- (b) the container shall be treated as a package according to the category to which it is deemed to belong in the light of (a) above:

## Class IVb

42 118  
(contd)

- (c) the sum of the activities of the contents of packages made up of Type-A packagings shall not exceed the limits stated in marginal 42 401(2)(c); in addition, if the container holds packages containing fissile substances other than packages of Nuclear Safety Class I, II or III, the requirements laid down in Annex A, marginal 2456(2)(a), (c) or (d) shall be complied with in respect of each container.

(3) Packages containing substances of 5<sup>o</sup> packed in conformity with Annex A, marginal 2457(3), may be carried in containers only as a complete load and like the packages referred to in marginal 2457(3). The container shall be of the closed type with complete sides.

(4) Substances of 5<sup>o</sup> may be carried in bulk in containers only as a complete load and like the packages referred to in marginal 2457(3). The container shall be of the closed type with complete metal sides ensuring that no leakage of substances can occur in normal carriage.

(5) The labels to be affixed to containers containing packages will depend on the category to which the container is deemed to belong by virtue of the provisions of paragraph (2) of this marginal; the following shall be entered:

- (a) against the word "Contents", either
- (1) if the contents of all the packages are identical, an identification of the contents as given on the labels affixed to the packages themselves; otherwise
  - (ii) the words "various radioactive substances of Groups ...";
- (b) against the word "Activity" and as the transport index: the sum of the activities and the sum of the transport indices, respectively, of the packages loaded in the containers.

42 119-  
42 120

42 121 Carriage in tanks

The substances of low specific activity referred to in Annex A, marginal 2457(1), may be carried in tanks as a complete load if the tanks ensure that no leakage of substance to the outside of the tanks can occur

## Class IVb

in normal carriage. However, the substances referred to in marginal 2457(1)(c) and those referred to in marginal 2457(1)(a), (b) and (d) may, if they are liquid, dissolved or in suspension in liquids, or both dissolved and in suspension, be carried in fixed tanks only if they are not subject to spontaneous ignition and have a critical temperature of not less than 50°C or, at 50°C, a vapour pressure below 3 kg/cm<sup>2</sup>.

42 121  
(contd)42 122-  
42 126Tanks

42 127

The requirements applicable to small tank-containers are the same as those set forth in Appendix B.1 for fixed tanks and large movable tanks.

Empty tanks

42 128

Empty tanks shall be closed as though they were full.

42 129-  
42 180Transport documents

42 181

The documents referred to in Annex A, marginal 2461(3), shall be annexed to the transport document.

42 182-  
42 184Instructions in writing

42 185

The instructions in writing given to the driver shall incorporate any additional requirements or special precautions to be observed during carriage.

42 186-  
42 191Communication to the carrier of the provisions or requirements to be applied to the transport operation

42 192

The sender shall communicate to the carrier all provisions or requirements to be applied to the transport operation on account of the nature of the goods carried, and in particular, if they have been communicated to the sender, the provisions concerning additional requirements [Annex A, marginals 2455(7)(b) and (9)(c), 2456(11)(c), (11)(f) and (12)(b)3.] or concerning special requirements prescribed by the competent authorities and to be observed during carriage.

42 193-  
42 199

## Class IVb

Section 2Special requirements to be fulfilled  
by vehicles and their equipment

42 200-  
42 206

42 207 Provisions concerning the design and equipment of vehicles where  
the latter are regarded as an integral part of the packaging  
[See marginals 2452(2)(a) and 2455(3), second sub-paragraph]

42 209-  
42 279

42 280 Determination of radioactive contamination of vehicles and equipment

(1) Vehicles used solely for the carriage of radioactive substances shall be subjected to tests to determine the radioactive contamination of their various parts. Such a test shall be carried out not less than once every year. If the total radioactive contamination (whether fixed or non-fixed) in any part of the vehicle exceeds the levels laid down in the table in Annex A, Appendix A.6, marginal 3604 (permissible maximum levels of contamination of packages), the vehicle shall be withdrawn from service and so decontaminated as to meet one or other of the following requirements; that is to say that:

- (a) the total contamination (fixed and non-fixed) shall be below the levels indicated in the table in Appendix A.6, marginal 3604; or
- (b) the non-fixed contamination shall be below the levels indicated in the table in Appendix A.6, marginal 3604, and the vehicle shall be declared by a qualified person not to be dangerous.

In the case of tank-vehicles, these provisions shall apply to fixed tanks only with respect to the outer surface of the tanks.

(2) The provisions of paragraph (1) above shall apply to containers and tanks other than those referred to in that paragraph.

42 281-  
42 299

## Class IVb

Section 3General service provisionsProtection of crew members

42 300

During carriage and during loading and unloading operations, the total dose rate to which any point in the areas set aside on a vehicle for drivers and other crew members is exposed shall not exceed:

- (a) if crew members are not liable to be exposed for more than 15 hours per week on the average, the average being determined over periods of 13 weeks: 2 milliroentgens per hour;
- (b) if crew members are liable to be exposed for more than 15 hours per week on the average, a number of milliroentgens per hour such that the radiation dose to which crew members are liable to be exposed over a period of 13 weeks does not on the average exceed the maximum allowed under sub-paragraph (a) above (30 milliroentgens x 13 = 390 milliroentgens).

To facilitate compliance with this requirement, satisfactory criteria based on the minimum distances to be observed between the radioactive substances and the aforesaid areas when they are not separated by a protective shield are set out in Appendix B.4, marginal 240 000.

42 301  
42 302Action to be taken in the event of leakage of radioactive substances or of accident

(1) If a package containing radioactive substances is broken or shows leakage or is involved in an accident during carriage, the vehicle or the affected area shall be isolated to prevent any contact between persons and radioactive substances and shall, where possible, be appropriately marked or fenced in. No one shall be allowed to remain in the isolated area before the arrival of persons qualified to direct the handling and salvage work. The sender and the authorities

## Class IVb

42 302 concerned shall be notified forthwith. Notwithstanding the foregoing,  
(contd) the presence of radioactive substances shall not be deemed to preclude operations necessary for the rescue of persons or for fire-fighting.

(2) If radioactive substances have leaked, been spilled or been scattered in any way in a vehicle, indoors, on open ground, on goods, or on equipment used for carriage or storage, qualified persons shall be called in as quickly as possible to direct decontamination operations. The vehicles, premises, open ground or equipment so contaminated shall not be put back into service until their use has been declared by qualified persons to be free from danger.

42 303

42 304 Precautions in the storage of radioactive substances

(1) Packages of radioactive substances shall not be stored in the same place as dangerous substances with which their mixed loading is prohibited under marginal 42 403.

(2) The number of packages of Category II - YELLOW and Category III - YELLOW stored in the same premises, such as a goods depot or store, shall be so limited that the sum of the transport indices shown on the labels does not exceed 50 unless the packages are in groups in which the sum of the transport indices for each group does not exceed 50 and unless a distance of not less than 6 metres is maintained between the groups during handling or storage. If limitation is carried out by reference to the red stripes shown on the labels, a package of Category II - YELLOW and a package of Category III - YELLOW shall respectively be considered equivalent to a transport index of 0.5 and to a transport index of 10.

(3) In goods depots, in stations and on platforms or wharfs, packages of Category II - YELLOW or of Category III - YELLOW shall be separated by the safety distances shown in the table in Appendix B.4, marginal 240 001, from packages containing undeveloped radiographic or photographic plates or films. In addition, they shall not be loaded together in the same handling truck.

## Class IV b

42 305-  
42 373Prohibition of smoking

42 374

The provisions of marginal 10 374 shall not apply.

42 375-  
42 399

## Class IVb

## Section 4

Special provisions concerning loading,  
unloading and handling42 400 Method of despatch and restrictions on forwarding

Packages conforming to Annex A, marginals 2453(2), 2455(2)(b), 2455(6)(c) and 2457(3) may not be carried otherwise than as a complete load.

42 401 Limitation of load

(1) In the case of packages carried otherwise than as a complete load, the number of packages to be loaded on to the same vehicle shall be so limited that the sum of the transport indices shown on the labels does not exceed 50. If limitation is carried out by reference to the red stripes shown on the labels, a package of Category II - YELLOW and a package of Category III - YELLOW shall respectively be considered equivalent to a transport index of 0.5 and to a transport index of 10.

(2) In the case of a complete load:

(a) the dose-rate shall not exceed:

200 mR/h or equivalent at any directly accessible point  
on the surface of the vehicle;

10 mR/h or equivalent at a distance of 2 m  
from any external surface of the vehicle;

(b) where the packages are packages of Nuclear Safety Class II, the "permissible number" [marginal 2456 (10)(b)] shall not be exceeded. If the consignment includes packages whose permissible numbers differ, the maximum number of packages per vehicle shall be such that the sum

$$\frac{n_1}{N_1} + \frac{n_2}{N_2} + \frac{n_3}{N_3} \dots, \text{ etc.}, \text{ does not exceed } 1,$$

$n_1, n_2, n_3, \dots, \text{ etc.}$ , representing the number of packages whose "permissible numbers" are  $N_1, N_2, N_3, \dots, \text{ etc.}$ , respectively;



## Class IVb

- (c) where the substances are substances of 5<sup>o</sup>, the estimated total activity of the contents of each vehicle shall not exceed the following values: 42 401 (contd)

0.1 Ci in the case of radionuclides of Group I; or  
5 Ci in the case of radionuclides of Group II; or  
250 Ci in the case of radionuclides of Groups III and IV.

If the substances contain radionuclides of several Groups, the sum of all the values shown below shall not exceed 1:

- (number of curies of Group I) x 10;  
(number of curies of Group II) x 1/5;  
(number of curies of Group III) x 1/250;  
(number of curies of Group IV) x 1/250.

In addition, in the case of the substances referred to in marginal 2457(1)(d) containing fissile substances and carried in bulk in a vehicle, in a container or in fixed tanks, the limits specified in marginal 2456(2)(a), (c) and (d) shall be observed in respect of each vehicle, each container or each fixed tank; however, in the case of carriage in fixed tanks these limits may be exceeded and the requirements of marginal 2456(3) to (13) shall apply, the tank being regarded, for the purposes of those requirements, as a package.

42 402

Prohibitions on mixed loading on one vehicle

42 403

Radioactive substances shall not be loaded together on one vehicle with:

- (a) dangerous substances of Class Ia;  
(b) articles of Class Ib;  
(c) dangerous substances of Class Ic;  
(d) dangerous substances of Class II;  
(e) substances of Class IIIa, 1<sup>o</sup>, 2<sup>o</sup> and 5<sup>o</sup>;  
(f) dangerous substances of Class IIIc;  
(g) substances of Class V, 2<sup>o</sup>(a) and 3<sup>o</sup>(a); or  
(h) dangerous substances of Class VII.

42 404

## Class IVb

42 405 Prohibition of mixed loading with goods contained in a container

The prohibitions on mixed loading laid down in marginal 42 403 shall apply not only within each container, but also as between the dangerous substances contained in a container and the dangerous substances loaded on the same vehicle, whether or not they are contained in a container.

42 406-  
42 413

42 414 Handling, stowage, cleaning

(1) Where substances referred to in marginal 2457(1)(b) are carried in bulk in the form of a massive solid, they shall be so stowed as to prevent movement of any kind liable to cause abrasion of the substance; if they are in some other compact solid form they shall be placed in an inert metal vessel, or in a sheathing of other resistant materials, so that the surfaces of the substances are not exposed;

(2) During carriage and during handling operations, packages of Category II - YELLOW or of Category III - YELLOW shall be separated by the safety distances shown in the table in Appendix B.4, marginal 240 001, from packages containing undeveloped radiographic or photographic plates or films.

(3) After the loading in bulk of substances of 5<sup>o</sup>, the outer surfaces of the vehicles shall be carefully cleaned by the sender.

42 415 Decontamination after unloading

After the unloading of substances of 5<sup>o</sup>, in conformity with marginal 2457(3) or carried in bulk, the vehicles shall, unless they are to be used for carrying the same substances, if necessary be decontaminated by the consignee in such a way as to comply with the requirements of marginal 42 280.

42 416

42 499

Class IVb

Section 5

Special provisions concerning the  
operation of vehicles

Vehicle signs

42 500

(1) Marginal 10 500 shall not apply.

(2) Every road vehicle carrying radioactive substances shall bear on the outside of each side wall and of the rear wall a label conforming to the model shown in Appendix B.4, marginal 240 010. If loading is done by the sender, it shall be his duty to affix these labels to the vehicles.

42 501-  
42 506

Parking of a vehicle constituting a special danger

42 507

[See, in addition to marginal 10 507, marginal 42 302]

42 508-  
42 599

Class IVb

Section 6

Transitional provisions, derogations, and  
provisions peculiar to certain countries

42 600-  
50 999

(No special provisions)

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Class VCorrosive substancesSection 1General51 000-  
51 103Types of vehicles

51 104

(1) Packages containing substances of 1° to 9°, 11°, 14°, 21°(a) 2. and (b) to (e), 32° to 35°, 37° and 41°(a), shall be loaded on to open vehicles. Substances of 13°, 15°, 21(a)1. and 31°, in bags, shall be loaded on to closed or sheeted vehicles; if packed in any other way, these substances shall be loaded on to open vehicles. Substances of 36° shall be loaded on to closed or sheeted vehicles.

(2) The following may, however, be loaded on to closed or sheeted vehicles:

- (a) packages which, containing the substances listed in paragraph (1), consist of strong metal drums, on condition that the latter are so wedged that they cannot roll or overturn;

However, in the case of consignments not carried as a complete load, metal drums containing hydrofluoric acid (6°) or hypochlorite solutions (37°) shall not weigh more than 75 kg;

- (b) packages made up of fragile receptacles, on condition that the receptacles are secured by cushioning materials (which later must comply with the requirements set out in the various marginals of Annex A concerning the packing of each substance) in protective wooden packagings or, in the case of dangerous substances of 1° to 5° and 32°, in iron hampers. However, fragile receptacles containing nitric acid of 2°(a) or mixed nitrating acids of 3°(a) shall be secured by cushioning materials in wooden cases with complete sides;

51 104-  
(contd)

Class V

- (c) storage batteries [I<sup>o</sup>(f) and 33<sup>o</sup>];
- (d) sodium hydroxide (caustic soda) and potassium hydroxide (caustic potash), in lumps, in flakes or in powdered form (31<sup>o</sup>).

51 105-  
51 110

51 111 Carriage in bulk

- (1) Lead sludge containing sulphuric acid [I<sup>o</sup>(e)] and bisulphates (13<sup>o</sup>) may be carried in bulk as a complete load.
- (2) For such carriage, the body of the vehicle shall be lined with lead or with a sufficient thickness of paraffin-waxed or tarred fibreboard, and if the vehicle is sheeted the sheet shall be so placed that it cannot touch the load.

51 112-  
51 117

51 118 Carriage in containers

- (1) Fragile packages within the meaning of marginal 10 102 (1) and those containing dangerous substances of 1<sup>o</sup> to 7<sup>o</sup>, 9<sup>o</sup>, 14<sup>o</sup>, 33<sup>o</sup> and 41<sup>o</sup> shall not be carried in small containers.
- (2) Small containers used for the carriage of bisulphates (13<sup>o</sup>) in bulk shall be lined with lead or with a sufficient thickness of paraffin-waxed or tarred fibreboard.
- (3) The carriage in bulk in small containers of lead sludge containing sulphuric acid of 1<sup>o</sup>(e) is prohibited.

51 119-  
51 120

51 121 Carriage in tanks

- (1) Substances of 1<sup>o</sup>(a) to (d), 2<sup>o</sup> to 7<sup>o</sup>, 9<sup>o</sup>, 14<sup>o</sup>, 21<sup>o</sup>(b), (c) and (e), 23<sup>o</sup>, 32<sup>o</sup>, 34<sup>o</sup>, 35<sup>o</sup>, 37<sup>o</sup> and 41<sup>o</sup>, the named substances of 11<sup>o</sup>(a) and 22<sup>o</sup>, antimony trichloride (12<sup>o</sup>) and antimony pentafluoride [I<sup>o</sup>(b)] may be carried in fixed tanks or in large movable tanks.

## Class V

(2) Substances of 1<sup>o</sup>(a) to (d), 2<sup>o</sup> to 7<sup>o</sup>, 21<sup>o</sup>(b), 32<sup>o</sup>, 34<sup>o</sup>, 35<sup>o</sup>, the named substances of 11<sup>o</sup>(a) and 22<sup>o</sup>, antimony trichloride of 12<sup>o</sup> and antimony pentafluoride of 15<sup>o</sup>(b) may be carried in small tank-containers.

51 121  
(contd)51 122-  
51 126  
51 127Tanks

The requirements concerning small tank-containers containing substances of marginal 51 121(2) are the same as those set forth in Annex A for receptacles containing these substances.

Empty tanks

51 128

(1) Empty tanks of 51<sup>o</sup> shall be closed in the same manner and leak-proof in the same degree as though they were full. Fixed tanks which have contained bromine (14<sup>o</sup>) shall be hermetically closed.

(2) Small tank-containers and large movable tanks which have contained hydrofluoric acid (6<sup>o</sup>) or bromine (14<sup>o</sup>) shall bear a label conforming to model No. 5 (Appendix A.9). They shall have no traces of acid or bromine on the outside.

51 129-  
51 170Crews of vehicles: Supervision

51 171

A driver's assistant shall be carried on every transport unit carrying more than 250 kg of dangerous substances of Class V in fragile packages, or more than three metric tons of substances of 6<sup>o</sup>, 7<sup>o</sup>, 11<sup>o</sup>, 14<sup>o</sup>, 22<sup>o</sup>, 31<sup>o</sup>, 32<sup>o</sup> and 37<sup>o</sup>.

51 172-  
51 199

## Class V

Section 2Special requirements to be fulfilled  
by vehicles and their equipment

51 200-  
51 239

51 240 Fire-fighting appliances

The provisions of marginal 10 240(1)(b) and (3) shall not apply to the carriage of dangerous substances of Class V other than those of 2<sup>o</sup>(a) and 3<sup>o</sup>(a).

51 241-  
51 250

51 251 Electrical equipment

The provisions of Appendix B.2, marginal 220 000, shall not apply to the carriage of dangerous substances of Class V other than those of 2<sup>o</sup>(a) and 3<sup>o</sup>(a).

51 252-  
51 299



## Class V

Section 3General service provisions

	51 300-
	51 352
<u>Portable lighting apparatus</u>	51 353
The provision of marginal 10 353 shall not apply.	
	51 354-
	51 373
<u>Prohibition of smoking</u>	51 374
The provisions of marginal 10 374 shall not apply.	
	51 375-
	51 399

## Class V

Section 4Special provisions concerning loading, unloading  
and handling

51 400-  
51 402

51 403 Prohibition of mixed loading on one vehicle

The following shall not be loaded together on one vehicle:

- (1) dangerous substances of Class V with:
  - (a) dangerous substances of Class Ia; or
  - (b) dangerous substances of Class VII;
- (2) dangerous substances of Class V, other than solids of 13°, 15°(a) and 21°, with substances of Class IVa, 12°(a) and (d);
- (3) dangerous substances of Class V with substances of Class IIIc, 4°(a), (c) and (d);
- (4) dangerous substances of 1° to 7° and 9°, chlorosulphonic acid [1°(a)] and substances of 21° with dangerous substances of Class IVa, 32° and 33°;
- (5) substances of 2°(a) and 3°(a) with:
  - (a) articles of Class Ib;
  - (b) phosgene and cyanogen chloride of Class Id, 8°(a);
  - (c) substances of Class II, 3°, 4° and 11°, or any other dangerous substances of Class II unless their outer packaging consists of metal receptacles;
  - (d) dangerous substances of Class IIIa;
  - (e) dangerous substances of Class IIIb; or
  - (f) dangerous substances of Class IVb;
- (6) sodium sulphide of 36° with dangerous substances of 1° to 7°, 9°, 11°, 12°, 15°, 21°, 22° and 37°.

51 404-  
51 412

## Class V

Cleaning before loading

51 413

Vehicles for the carriage of packages containing substances of 2<sup>o</sup>(a) and 3<sup>o</sup>(a) shall be carefully cleaned and, in particular, cleared of any combustible waste (straw, hay, paper, etc.).

Handling and stowage

51 414

(1) All packages containing substances of 2<sup>o</sup>(a) and 3<sup>o</sup>(a) shall rest on a stout floor, be placed with their openings at the top, and be so wedged that they cannot overturn.

(2) The use of readily inflammable materials for stowing such packages in vehicles is prohibited.

(3) Fragile packages shall be so wedged so as to prevent any displacement and any spilling of the contents.

51 415-  
51 499

## Class V

Section 5Special provisions concerning the operation of vehicles51 500 Vehicle signs

The provisions of marginal 10 500 shall apply only to the carriage of dangerous substances of 1° to 7°, 9°, 11°, 12°, 14°, 15°, 22°, 31° to 35° and 41°(a).

51 501-  
51 599

## Class V

Section 6Transitional provisions, derogations, and provisions peculiar to certain countries

51 600-  
60 999

(No special provisions)

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Class VIRepugnant substances and substances liable to cause infectionSection 1General61 000 -  
61 099Application of Chapter I of this Annex

61 100

The only provisions of this Annex other than those of Sections 1 to 6 below which apply to the carriage of dangerous substances of Class VI are those of marginals 10 001, 10 100, 10 102, 10 111, 10 118, 10 181(1)(a), 10 404, 10 405, 10 413, 10 414, 10 415 and 10 419.

61 101 -  
61 103Types of vehicles

61 104

(1) Packages containing substances of Class VI shall be loaded on to open vehicles.

(2) However, the following may be loaded on to closed vehicles:

- (a) packages containing substances of 1<sup>o</sup>, 8<sup>o</sup> and 11<sup>o</sup> if they consist of metal receptacles fitted with a safety closure yielding to internal pressure;
- (b) packages containing substances of 3<sup>o</sup>, 4<sup>o</sup> and 7<sup>o</sup>.

61 105 -  
61 110Carriage in bulk

61 111

(1) Substances of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> and 5<sup>o</sup> may be carried in bulk. Substances of 9<sup>o</sup> may not be carried otherwise than in bulk.

(2) The following shall be loaded in bulk on to open vehicles:

- (a) substances of 1<sup>o</sup>(a) and (c) and 2<sup>o</sup>, but only during the months from November to February [see paragraph (4) below for the other months]; substances of 1<sup>o</sup>(b) throughout the year on condition that they have been sprayed with suitable disinfectants to remove their bad odour;

## Class VI

61 111  
(contd)

- (b) substances of 3<sup>o</sup>
  - (c) substances of 5<sup>o</sup> on condition that they have been sprayed with limewash so that no putrid odour is discernible;
  - (d) substances of 9<sup>o</sup>.
- (3) The following shall be covered with:
- (a) a sheet impregnated with suitable disinfectants and itself covered with a second sheet: substances of 1<sup>o</sup>(a) and (c) and 2<sup>o</sup>;
  - (b) a sheet or tarred or bituminized fibreboard (and sprayed with suitable disinfectants): fresh horns, claws, hoofs or bones [1<sup>o</sup>(b)];
  - (c) a sheet: substances of 3<sup>o</sup>, unless they are sprayed with suitable disinfectants to prevent any bad odour; and
  - (d) a sheet: substances of 9<sup>o</sup>.
- (4) Substances of 1<sup>o</sup>(a) and (c) and 2<sup>o</sup> may be loaded throughout the year on to specially-fitted covered vehicles equipped with ventilating installations.

61 112 -  
61 117

61 118      Carriage in containers

The carriage of substances of 9<sup>o</sup> in small containers is prohibited.

61 119 -  
61 199

## Class VI

Section 2Special requirements to be fulfilled by vehicles and their equipment61 200 -  
61 299

(No special provisions)

## Class VI

Section 3General service provisions61 300 -  
61 302Precautions with respect to articles of consumption

61 303

In vehicles and at places of loading, unloading and transloading, dangerous substances of Class VI other than substances of 7<sup>o</sup> and than substances of 8<sup>o</sup> packed in conformity with the provisions of Annex A, marginal 2609 (2) (a) or (b), shall be kept away from foodstuffs and other articles of consumption.

61 304 -  
61 399

## Class VI

Section 4Special provisions concerning loading, unloading and handling

61 400 -  
61 402

61 403 Prohibition of mixed loading on one vehicle:

Substances of 9<sup>o</sup> and 10<sup>o</sup> shall not be loaded together on one vehicle with dangerous substances of Class VII.

61 404  
61 414

61 415 Cleaning after unloading

After unloading, vehicles which have been carrying substances of Class VI in bulk shall be copiously swilled and treated with suitable disinfectants.

61 416 -  
61 499

## Class VI

Section 5Special provisions concerning the operation of vehicles

(No special provisions)

61 500 -  
61 599

## Class VI

Section 6Transitional provisions, derogations and provisions peculiar to certain countries

61 600 -  
70 999

(No special provisions)

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Class VIIOrganic peroxidesSection 1General

71 000 -  
71 103  
71 104

Types of vehicles

(1) Substances of 1° to 22°, 30° and 31° shall be loaded on to closed or sheeted vehicles, and substances of 35° on to open, sheeted or closed vehicles. Substances of 45° to 52° enclosed in protective packagings filled with a refrigerant shall be loaded on to closed or sheeted vehicles. If the vehicles used are closed they shall be adequately ventilated. Sheeted vehicles shall be fitted with side boards and a tailboard. The sheets of these vehicles shall be of an impermeable material not readily inflammable.

(2) Where, by reason of the provisions of marginal 71 400, substances are required to be carried in insulated, refrigerated or mechanically-refrigerated vehicles, those vehicles shall satisfy the requirements of marginal 71 248.

71 105 -  
71 117  
71 118

Carriage in containers

Fragile packages within the meaning of marginal 10 102 (1) shall not be carried in small containers.

71 119 -  
71 120  
71 121

Carriage in tanks

Substances of 10°, 14° and 15° may be carried in tanks.

71 122 -  
71 126  
71 127

Tanks

The requirements concerning small tank-containers are the same as those set forth in Appendix B.1, especially those in marginal 210 710 for fixed tanks and large movable tanks.

## Class VII

71 128 Empty tanks

To be accepted for carriage, empty tanks of 55° shall be closed in the same manner and leak-proof in the same degree as though they were full.

71 129 -  
71 170

71 171 Crews of vehicles; Supervision

A driver's assistant shall be carried on every transport unit loaded with substances of 46°(a), 47°(a) and 49°(a) and on every transport unit loaded with more than 2,000 kg of substances of 45°, 46°(b), 47°(b), 48°, 49°(b), 50°, 51° and 52°.

71 172 -  
71 199

## Class VII

Section 2Special requirements to be fulfilled by vehicles  
and their equipment

71 200 -

71 247

Insulated, refrigerated and mechanically-refrigerated vehicles

71 248

Insulated, refrigerated and mechanically-refrigerated vehicles used by reason of the requirements of marginal 71 400 shall conform to the following provisions:

- (a) the vehicle used shall be such and be so equipped as regards its insulation and source of cold that the maximum temperature prescribed in marginal 71 400 is not exceeded whatever the atmospheric conditions may be;
- (b) the vehicle shall be so equipped that vapours from the substances carried cannot penetrate into the cab;
- (c) a suitable device shall be provided enabling the temperature prevailing in the loading space to be determined at any time from the driver's cab;
- (d) the loading space shall be provided with vents or ventilating valves if there is any risk of a dangerous excess pressure arising therein. Care shall be taken where necessary to ensure that refrigeration is not impaired by the vents or ventilating valves;
- (e) the refrigerant used shall not be inflammable;
- (f) the refrigerating appliance of a mechanically-refrigerated vehicle shall be capable of operating independently of the engine used to propel the vehicle.

71 249 -

71 299

Class VII

Section 3

General service provisions

71 300 -  
71 399

(No special provisions)

## Class VII

Section 4Special provisions concerning loading, unloading  
and handlingMethod of despatch and restrictions on forwarding

71 400

(1) Substances of Group E shall be forwarded in such manner that the ambient temperatures indicated below are not exceeded:

substances of 45°	:	maximum temperature + 10°C
" " 46°(a)	:	" " - 10°C
" " 46°(b)	:	" " - 10°C
" " 47°(a)	:	" " - 10°C
" " 47°(b)	:	" " - 10°C
" " 48°	:	" " + 2°C
" " 49°(a)	:	" " - 10°C
" " 49°(b)	:	" " - 10°C
" " with phlegmatizer	"	" " + 2°C
" " with solvent	"	" " - 5°C
" " 50°	:	" " 0°C
" " 51°	:	" " 0°C
" " 52°	:	" " + 20°C

(2) Where substances of Group E are not carried in mechanically-refrigerated vehicles, the quantity of refrigerant in the protective packaging shall be so proportioned that the temperatures specified in paragraph (1) above are not exceeded at any time during carriage, which term here includes loading and unloading.

(3) The use of liquid air or liquid oxygen as a refrigerant is prohibited.

(4) The temperature of refrigeration shall be so selected as to avoid any danger which might arise from the separation of phases.

Limitation of the quantities carried

71 401

A transport unit shall not carry more than 750 kg of substances of 46°(a), 47°(a) and 49°(a), nor more than 5,000 kg of substances of 45°, 46°(b), 47°(b), 48°, 49°(b), 50°, 51° and 52°.

71 402

## Class VII

71 403 Prohibition of mixed loading on one vehicle

Substances of Class VII shall not be loaded together on one vehicle with:

- (a) dangerous substances of Class Ia;
- (b) articles of Class Ib;
- (c) igniters, fireworks and similar articles of Class Ic;
- (d) dangerous substances of Class Id;
- (e) dangerous substances of Class Ie;
- (f) dangerous substances of Class II;
- (g) dangerous substances of Class IIIa;
- (h) dangerous substances of Class IIIb;
- (i) dangerous substances of Class IIIc;
- (j) dangerous substances of Class IVa;
- (k) dangerous substances of Class IVb;
- (l) dangerous substances of Class V; or
- (m) substances of Class VI, 9<sup>o</sup> and 10<sup>o</sup>.

71 404 -

71 412

71 413 Cleaning before loading

Vehicles for the carriage of packages containing substances of Class VII shall be carefully cleaned.

71 414 Handling and stowage

(1) Packages containing substances of Class VII shall be loaded in such a manner that they can be unloaded one by one at the point of destination without its being necessary to rearrange the load.

(2) Packages containing substances of Class VII shall be kept upright and be so secured and fixed that they cannot overturn or fall. They shall be protected against any damage which might be caused by other packages.

(3) The use of readily inflammable materials for stowing packages in vehicles is prohibited.

## Class VII

(4) Packages containing substances of Group E shall not be placed on top of other goods; in addition, they shall be so stowed as to be readily accessible.

71 414  
(contd.)

(5) Substances of Group E shall be loaded and unloaded without intermediate storage, and shall in the event of transloading be transferred directly from one vehicle to another. The prescribed maximum temperatures shall not be exceeded during such handling [see marginal 71 400(1)]

71 415 -  
71 499

## Class VII

Section 5Special provisions concerning  
the operation of vehicles71 500 -  
71 50871 509 Halts of limited duration for service requirements

During the carriage of substances of 46<sup>o</sup>(a), 47<sup>o</sup>(a) and 49<sup>o</sup>(a), halts for service requirements shall so far as possible not be made near inhabited places or places of resort. A halt near such a place may not be prolonged except with the agreement of the competent authorities. The same rule shall apply where one transport unit is loaded with more than 2,000 kg of substances of 45<sup>o</sup>, 46<sup>o</sup>(b), 47<sup>o</sup>(b), 48<sup>o</sup>, 49<sup>o</sup>(b), 50<sup>o</sup>, 51<sup>o</sup> and 52<sup>o</sup>.

71 510 -  
71 599

## Class VII

Section 6Transitional provisions,  
derogations and provisions peculiar to certain countries71 600 -  
209 999

(No special provisions)



## APPENDICES

Appendix B.1PROVISIONS CONCERNING FIXED TANKS AND LARGE MOVABLE TANKS (TANK-VEHICLES,  
BATTERIES OF RECEPTACLES, DEMOUNTABLE TANKS AND LARGE TANK-CONTAINERS)Notes:

1. This Appendix applies to tanks other than small tank-containers and receptacles. However, some of the requirements of this Appendix may be made applicable to small tank-containers by the provisions of Annex B.
2. By derogation from the definition given in marginal 10 102 (1), in this Appendix and in Appendix B.1a the term "tank", when used alone, does not cover "small tank-containers".
3. For small tank-containers (which, in conformity with the definitions in marginal 10 102 (1), are tank-containers with a capacity of 1 to 3 m<sup>3</sup>), see in each specific case the provisions concerning this equipment in Annex B.
4. For receptacles, see the relevant provisions of Annex A (packages).
5. It is recalled that marginal 10 121 (1) prohibits the carriage of dangerous substances in tanks except where such carriage is expressly authorized. This Appendix is therefore confined to provisions applicable to tanks used for transport operations which are expressly authorized.

## Appendix B.1

Section 1

## I. GENERAL PROVISIONS APPLICABLE TO TANKS INTENDED FOR THE CARRIAGE OF SUBSTANCES OF ALL CLASSES

- 210 000 The conditions governing approval and, where appropriate, periodic inspection of tank-vehicles and tanks are given in Annex B, marginal 10 182, and in this Appendix, marginals 210 021 (2), 210 140 (1)(a)7, and 8., 210 141, 210 142 (5) and (6), 210 210 (2)(c), 210 310 (4), 210 320 (3), 210 410 (3)(a)2. and (b)3., 210 510 (4)(c), (5)(f) and (g) and (6), and 210 710 (c).
- 210 001 The materials of which the tanks and their closures are made must not be liable to attack by the contents, or cause the contents to decompose, or form harmful or dangerous compounds therewith.
- 210 002 (1) Tank-vehicles and vehicles carrying large movable tanks shall be robust and so designed that the tanks are not exposed to direct impact, at least at the front and the rear.
- (2) Fixed tanks shall be so secured to the bearing frame of the tank-vehicle that they cannot move in relation to it even if subjected to violent impact.
- (3) Demountable tanks shall be so secured to the bearing frame of the vehicle that they cannot be displaced during carriage even if subjected to violent impact.
- (4) Large tank-containers and batteries of receptacles shall be so stowed on the vehicle carrying them that they cannot be displaced during carriage even if subjected to violent impact.
- 210 003 (1) Tanks, including their closures, shall be sufficiently rigid and well made in all their parts to prevent any loosening during carriage and to meet the normal requirements of carriage, account being taken of pressure which may arise inside them.

## Appendix B.1

(2) In filling tanks a free space shall be left - account being taken of the difference between the temperature of the substances at the time of filling and the highest mean temperature which they are likely to reach during carriage - such that the tanks are not, as a result of variations in the volume of the products carried or of movements of the products due to jolting or impact not damped by suitable devices, likely

210 003  
(contd)

to overflow in the case of tanks in permanent communication with the exterior or fitted with a device able to prevent excess pressure; or to have their leakproofness impaired by the increase in internal pressure - the presence of air being taken into account - in the case of tanks having no possibility of communication with the outside air during carriage.

The closure of tanks shall be rendered leak-proof by a system affording adequate safeguards. The cocks and shut-off valves of tanks shall be so placed as to be protected by the frame of the vehicle or by strong guard plates against impact. Steps shall be taken to ensure that the main drain-cocks and the valves cannot be effectively operated by unauthorized persons.

210 004

Any devices to prevent excess pressure shall be of a type such that there is no likelihood of liquids being ejected, particularly in the event of impacts.

210 005

The filling and emptying devices of tanks shall be so designed and arranged as to prevent, during filling or emptying operations, any spilling on to the ground or dangerous release into the atmosphere of the substances transferred.

210 006

210 007-  
210 020

## Appendix B.1

II. PROVISIONS APPLICABLE TO TANKS INTENDED FOR THE CARRIAGE  
OF SUBSTANCES OTHER THAN THOSE OF CLASS Id (gases:  
compressed, liquefied or dissolved under pressure)

210 021

Without prejudice to the special provisions laid down for each Class in Section III below, tanks intended for the carriage of substances other than those of Class Id shall be subject to the following provisions, it being understood that where the aforesaid special provisions conflict with the provisions of this Section, the latter provisions shall not apply.

(1) The walls of the tanks shall be made of riveted or welded sheet steel or of any other suitable metal. If the walls are made of mild steel sheet they shall be not less than 2.5 mm thick. If the tank is made of some other metal it shall exhibit a degree of safety at least equivalent to that of a tank made of mild steel sheet. The walls shall be completely leak-proof and shall if necessary be protected by a suitable lining against corrosion by the contents; their external protection against atmospheric influences shall be adequate and in good condition.

(2) (a) In conformity with the provisions of (b) and (e) below, all tanks intended for the carriage of liquids shall have been subjected to a tightness (leakproofness) test or a hydraulic pressure test by an expert approved by the competent authority of the country in which the test is carried out. They shall have withstood the test without permanent deformation and without leakage or seepage.

## Appendix B.1

- (b) A hydraulic pressure test is mandatory for tanks which are not in permanent communication with the exterior and are intended for the carriage of liquids whose vapour pressure at 50°C is more than 2 n of water in the case of liquids having a lower specific gravity than water and not less than  $\frac{2}{3} \sqrt{D} (3 + H) - \frac{H}{7}$  n of water (where D is the specific gravity of the liquid and H the height of the tank in metres) in the case of other liquids. The test pressure shall be not less than 1.5 times the vapour pressure of the liquids at 50°C. 210 021 (contd)
- (c) The hydraulic pressure test shall be repeated every six years; it shall be accompanied by an inspection of the inside of the tank.
- (d) Tanks required to undergo a hydraulic pressure test shall bear in clear and permanent characters particulars of the test pressure, the date of the last test undergone, and the stamp of the expert who carried out the test.
- (e) Tanks not subject to a hydraulic pressure test shall undergo, before they are put into service, a tightness (leakproofness) test under a hydraulic pressure in relation to the bottom of the tank or under a pneumatic pressure. The level of whichever of these pressures is applied shall not be lower than the highest of the following three values:
- twice the static pressure of the liquid carried;
  - twice the water pressure for a height corresponding to that of the liquid carried in the tank;
  - 0.25 kg/cm<sup>2</sup>.

## Appendix B.1

## III. SPECIAL PROVISIONS APPLICABLE TO TANKS INTENDED FOR THE CARRIAGE OF SUBSTANCES OF DIFFERENT CLASSES

Class IdGases: compressed, liquified or dissolved under pressure

210 140

(1) The conditions relating to receptacles forwarded as packages (see Annex A, marginals 2132 (3) and 2133 to 2151) shall also apply to tanks carrying gases of 1<sup>o</sup> to 10<sup>o</sup> and 14<sup>o</sup>, subject to the following derogations and special requirements:

- (a) 1. By derogation from Annex A, marginal 2133 (2)(b), tanks shall not be made of aluminium alloys.
2. By derogation from Annex A, marginal 2141 (2), tanks whose test pressure does not exceed 60 kg/cm<sup>2</sup> may only be of seamless construction or welded or riveted. Welded tanks shall be carefully manufactured and their construction shall be verified as regards both the materials used and the soundness of the welds.
3. Tanks may be fitted with safety valves having an opening of adequate cross-sectional area. If tanks are fitted with safety valves, each tank shall have one or at most two valves whose aggregate clear cross-sectional area of passage at the seating shall be not less than 20 cm<sup>2</sup> per 30 m<sup>3</sup> or part thereof of the tank's capacity. These valves shall be capable of opening automatically at a pressure of 90 per cent to 100 per cent of the test pressure of the tank to which they are fitted; they shall be of a type able to withstand dynamic stresses. The use of dead-weight or counter-weight valves is prohibited.

## Appendix B.1

4. Piping and other accessories likely to be in communication with the inside of the tank shall be constructed to withstand the same test pressure as the tank. 210 140 (contd)
5. For gases which may reach a minimum temperature of  $-10^{\circ}\text{C}$  or below during loading or carriage, only tanks whose metals and welds have been guaranteed by the manufacturer to be resistant to impact at that minimum temperature may be used.
6. Tanks intended for the carriage of hydrogen fluoride ( $5^{\circ}$ ) shall not be riveted. They shall have all their openings above the level of the liquid phase, and no piping other than piping leading to the upper part of the tank shall pass through their walls.
7. The capacity of each tank intended for the gases of  $4^{\circ}$  to  $8^{\circ}$  and  $14^{\circ}$  shall be determined under the supervision of an expert approved by the competent authority, by weighing or by volumetric measurement of the quantity of water which fills the tank; the measurement of volumetric capacity of the tank must be accurate to within less than 1 per cent. Determination by a calculation based on the dimensions of the tank shall not be permitted.

## Appendix B.1

210 140  
(contd)

8. By derogation from the provisions of Annex A, marginal 2146 (3), the periodic inspections shall be repeated:
  - i. every three years in the case of tanks intended for the carriage of town gas [1° (b)], boron trifluoride (3°), hydrogen bromide, hydrogen fluoride, hydrogen sulphide, chlorine, sulphur dioxide, nitrogen dioxide (5°), phosgene [8° (a)] and liquefied hydrogen chloride (10°);
  - ii. every six years in the case of tanks intended for the carriage of the other compressed and liquefied gases and of ammonia dissolved under pressure (14°).
- (b) The following requirements shall apply to batteries of receptacles and to battery vehicles.
  1. The elements of a battery of receptacles or of a battery vehicle shall all contain the same compressed or liquefied gas.
  2. If one of the elements is fitted with a safety valve, all shall be so fitted.
  3. The filling and emptying devices may be connected to the manifold.
  4. 1. If the elements are intended to contain compressed gases harmful to the respiratory organs or entailing a poison risk, each element shall be isolated by a stop-cock. (The following are regarded as compressed gases harmful to the respiratory organs or entailing a poison risk: carbon monoxide, water gas, synthetic gases, town gas, compressed oil gas, boron trifluoride, and mixtures of carbon monoxide, water gas, synthetic gases or town gas.)



## Appendix B.1

- ii. If the elements are intended to contain compressed gases harmless to the respiratory organs and entailing no poison risk, it shall not be necessary for each element to be isolated by a stop-cock. (The following are regarded as compressed gases harmless to the respiratory organs and entailing no poison risk: hydrogen, methane, mixtures of hydrogen with methane, oxygen, mixtures of oxygen with carbon dioxide, nitrogen, compressed air, a mixture of 20% nitrogen and 80% oxygen,\*/ helium, neon, argon, krypton, mixtures of rare gases, mixtures of rare gases with oxygen, mixtures of rare gases with nitrogen.) 210 140 (contd)
- iii. If the elements are intended to contain either liquefied gases harmful to the respiratory organs or entailing a poison risk, or ammonia dissolved under pressure in water, each element shall be filled separately and shall be kept isolated by a closed and sealed stop-cock. (The following are regarded as liquefied gases harmful to the respiratory organs or entailing a poison risk: hydrogen bromide, hydrogen fluoride; hydrogen sulphide,

\*/ Note by the reviser: the word nitrox, used in the French text to describe this gaseous mixture, has a different meaning in English.

## Appendix B.1

210 L40  
(contd)

ammonia, chlorine, sulphur dioxide, nitrogen dioxide, T gas, methyl vinyl ether, chloromethane, bromomethane, phosgene, cyanogen chloride, vinyl bromide, methylamine, dimethylamine, trimethylamine, ethylamine, ethylene oxide, methanethiol, mixtures of carbon dioxide with ethylene oxide, and liquefied hydrogen chloride.)

- iv. If the elements are intended to contain liquefied gases harmless to the respiratory organs and entailing no poison risk, and it is not possible to fit each element with a gauge enabling the maximum permissible level of its contents to be easily verified, they shall not be capable of being isolated by means of stop-cocks. If each element can be fitted with a gauge enabling the maximum permissible level of its contents to be easily verified, such gauges shall be fitted and each element shall be capable of being isolated by means of a stop-cock. (The following are regarded as liquefied gases harmless to the respiratory organs and entailing no poison risk: liquefied oil gas, propane, cyclopropane, propene, butane, isobutane, butadiene, butene, isobutene, mixtures A, A O, A 1, B and C, dimethyl ether, chloroethane, vinyl chloride, dichlorodifluoromethane, dichlorofluoromethane, chlorodifluoromethane, dichlorotetrafluoroethane, chlorotrifluoroethane, chlorodifluoroethane, chlorotrifluoroethylene, bromochlorodifluoromethane, difluoroethane, octofluorocyclobutane, mixtures F 1, F 2 and F 3, xenon, carbon dioxide, nitrous oxide, ethane, ethylene, sulphur hexafluoride, chlorotrifluoromethane, monobromotrifluoromethane, trifluoromethane, vinyl fluoride and difluoroethylene.

- (c) The following requirements shall apply to demountable tanks:
1. They shall not be interconnected by a manifold.
  2. If the demountable tanks can be rolled, the stop-cocks shall be fitted with protective caps.

## Appendix B.1

(2) By derogation from Annex A, marginal 2132 (3), tanks may be used for the carriage of different liquefied gases successively (multi-purpose tanks) on the following conditions: 210 140 (contd)

- (a) These tanks may carry any of the substances listed in any one of the following groups:

Group 1: hydrocarbons of 6° and 7°;

Group 2: chloro and fluoro derivatives of the hydrocarbons of 8°(b) and 8°(c);

Group 3: ammonia (5°), methylamine, dimethylamine, trimethylamine and ethylamine [8°(a)];

Group 4: chloromethane, bromomethane and chloroethane [8°(a)];

Group 5: T gas (5°) and ethylene oxide [8°(a)]

- (b) The test pressure prescribed in marginal 210 141 (2) for the substance actually carried shall not exceed that for which the tank has been tested.
- (c) The permissible maximum load in kg shall be determined on the basis of the degree of filling prescribed in marginal 210 141 (2) for the substance actually carried.
- (d) Tanks which have been filled with one of the substances of a group shall be completely emptied of liquefied gas and blown down before being loaded with another substance belonging to the same group.

(3) If the tanks intended for the carriage of liquefied gases of 4° to 8° are equipped with thermal insulation, the insulation shall:

- (a) 1. consist of a shield made of sheet metal not less than 1.5 mm thick, or of wood or some other suitable material having a similar protective effect. This shield shall be mounted over not less than the upper third and not more than the upper half of the tank and shall be separated from the tank by an air space about 4 cm across; or

## Appendix B.1

210 140  
(contd)

2. consist of a complete cladding, of adequate thickness, of insulating materials (e.g. cork or asbestos);
- (b) be so designed as not to hinder inspection of the filling and emptying devices.

Notes: 1. With regard to the thermal insulation of batteries of receptacles and of tank-vehicles used for the carriage of gases of 9° and 10°, see marginal 210 141 (3)(b).

210 141

2. The painting of a tank shall not be regarded as thermal insulation.
  - (1) For tanks intended for the carriage of gases of 1° to 3°, the test pressures shall be as prescribed in Annex A, marginal 2149 (1), and the maximum filling pressures as prescribed in Annex A, marginal 2149 (2).
  - (2) For tanks intended for the carriage of liquefied gases of 4° to 8°, the test pressures and the maximum degrees of filling allowed shall be:
    - (a) if the diameter of the tanks does not exceed 1.5 m, the values given in Annex A, marginal 2150 (2);
    - (b) if the diameter of the tanks exceeds 1.5 m, the values given below:\*/

\*/ 1. The prescribed test pressures are:

- (a) if the tanks are equipped with thermal insulation, at least equal to the vapour pressures of the liquids at 60°C less 1 kg/cm<sup>2</sup>, and not less than 10 kg/cm<sup>2</sup>;
  - (b) if the tanks are not equipped with thermal insulation, at least equal to the vapour pressures of the liquids at 65°C less 1 kg/cm<sup>2</sup>, and not less than 10 kg/cm<sup>2</sup>;
2. In view of the high toxicity of phosgene [3°(a)] the minimum test pressure for this gas is fixed at 15 kg/cm<sup>2</sup> if the tank is equipped with thermal insulation and at 17 kg/cm<sup>2</sup> if it is not so equipped.
  3. The maximum values in kg/litre prescribed for the degree of filling are calculated as follows: maximum degree of filling allowed = 0.95 x specific gravity of the liquid phase at 50°C.

Appendix B.1

210 141  
(contd)

	Item number	Minimum test pressure for tanks		Maximum weight of liquid per litre of capacity kg
		with insulation kg/cm <sup>2</sup>	without insulation kg/cm <sup>2</sup>	
Liquefied oil gas	4°	33	37	0.38
Hydrogen bromide	5°	50	55	1.23
Hydrogen fluoride	5°	10	10	0.84
Hydrogen sulphide	5°	43	48	0.67
Anhydrous ammonia	5°	26	29	0.53
Chlorine	5°	17	19	1.25
Sulphur dioxide	5°	10	12	1.23
Nitrogen dioxide	5°	10	10	1.30
T gas	5°	24	26	0.73
Propane	6°	21	23	0.43
Cyclopropane	6°	18	21	0.53
Propene	6°	25	28	0.43
Butane	6°	10	10	0.51
Isobutane	6°	10	10	0.49
Butadiene	6°	10	10	0.55
Butene	6°	10	10	0.53
Isobutene	6°	10	10	0.52
Mixture A	7°	10	10	0.50
Mixture A 0	7°	12	14	0.47
Mixture A 1	7°	16	18	0.46
Mixture B	7°	20	23	0.43
Mixture C	7°	25	27	0.42
Dimethyl ether	8° (a)	14	16	0.58
Methyl vinyl ether	8° (a)	10	10	0.67
Chloromethane	8° (a)	15	15	0.81
Bromomethane	8° (a)	10	10	1.51
Chloroethane	8° (a)	10	10	0.80
Phosgene	8° (a)	15	17	1.23
Vinyl chloride	8° (a)	10	10	0.81
Vinyl bromide	8° (a)	10	10	1.37
Methylamine	8° (a)	10	11	0.58
Dimethylamine	8° (a)	10	10	0.59
Trimethylamine	8° (a)	10	10	0.56
Ethylamine	8° (a)	10	10	0.61
Ethylene oxide	8° (a)	10	10	0.78
Methanethiol	8° (a)	10	10	0.78
Dichlorodifluoromethane	8° (b)	15	16	1.15
Dichlorofluoromethane	8° (b)	10	10	1.23
Chlorodifluoromethane	8° (b)	24	26	1.03
Dichlorotetrafluoroethane	8° (b)	10	10	1.30
Chlorotrifluoroethane	8° (b)	10	10	1.20
Chlorodifluoroethane	8° (b)	10	10	0.99
Chlorotrifluoroethylene	8° (b)	15	17	1.13
Bromochlorodifluoromethane	8° (b)	10	10	1.61
1, 1-difluoroethane	8° (b)	14	16	0.79
Octofluorocyclobutane	8° (b)	10	10	1.34
Mixture F 1	8° (c)	10	11	1.23
Mixture F 2	8° (c)	15	16	1.15
Mixture F 3	8° (c)	24	27	1.03

## Appendix B.1

210 141  
(contd).

(3) For tanks intended for the carriage of liquefied gases of 9° and 10°, the test pressures and the maximum degrees of filling allowed shall be:

- (a) if the conditions laid down under (b) below are not fulfilled, those of Annex A, marginal 2150 (3) and (4);
- (b) in the case of a battery vehicle or a battery of receptacles in which the elements on the one hand cannot be isolated from one another, in conformity with marginal 210 140 (1) (b)4.iv., and on the other hand are equipped with thermal insulation (conforming to the intention of marginal 210 140 (3), the values<sup>\*/</sup> shall be:

	Item number	Minimum test pressure kg/cm <sup>2</sup>	Maximum weight of liquid per litre of capacity kg
Xenon	9°	120	1.30
Carbon dioxide	9°	(225 (190)	(0.78 (0.73)
Nitrous oxide	9°	225	0.78
Ethane	9°	120	0.32
Ethylene	9°	(225 (120)	(0.36 (0.25)
Sulphur hexafluoride	10°	120	1.34
Chlorotrifluoromethane	10°	(225 (120)	(1.12 (0.96)
Bromotrifluoromethane	10°	120	1.50
Trifluoromethane	10°	250	0.99
Vinyl fluoride	10°	225	0.65
1, 1-difluoroethylene	10°	225	0.78

<sup>\*/</sup> Under marginal 210 140 (1) (b)4.iii., mixtures of carbon dioxide with ethylene oxide (9°) and liquefied hydrogen chloride (10°) are not to be accepted for carriage in a battery of receptacles or in a battery vehicle.

## Appendix B.1

(4) The permissible maximum load of the battery of receptacles or of the battery vehicle under (3) (b) shall be prescribed by the expert approved by the competent authority. 210 141 (contd)

(5) In cases where, for the carriage of substances of 9° and 10°, tanks are used which have been subjected to a test pressure lower than that indicated under (3) (b) above, the degree of filling shall be such that the pressure reached in the tank by the substance in question at 55°C does not exceed the test pressure stamped on the tank. In this case, the permissible maximum load shall be prescribed by the expert approved by the competent authority.

(6) For tanks intended for the carriage of ammonia dissolved under pressure (14°), the test pressures and the permissible maximum degrees of filling shall be:

	Item Number	Minimum test pressure kg/cm <sup>2</sup>	Maximum weight of liquid per litre of capacity kg
Ammonia dissolved under pressure in water			
With more than 35% and not more than 40% ammonia	14°(a)	10	0.80
With more than 40% and not more than 50% ammonia	14°(b)	12	0.77

(1) Tanks carrying gases of 11° to 13° shall be subject to the provisions of Annex A, marginal 2141 (1), marginal 2143 (1), first sub-paragraph and second sub-paragraph, first sentence, and marginal 2145 (1), and to the following requirements. 210 142

- (a) The materials and construction of the tanks shall conform to the requirements of Appendix B.1a, marginals 211 050 to 211 055. All the mechanical and technical characteristics of the materials used shall be determined for each tank at the first test; as regards the impact strength and the bending coefficient, see Appendix B.1a, marginals 211 065 to 211 066.

## Appendix B.1

210 142  
(contd)

- (b) Except in the case of gases of 11<sup>o</sup>, where tanks are in communication with the atmosphere they shall be so closed and leak-proof that the gases cannot escape.
- (c) Tanks containing gases of 11<sup>o</sup> and not in permanent communication with the atmosphere, and tanks containing gases of 12<sup>o</sup> and 13<sup>o</sup>, shall be fitted with two independent safety valves, each designed and constructed to allow gas to escape from the tank in such a way that the pressure at no time exceeds by more than 10 per cent the working pressure indicated on the tank.

On tanks containing gases of 11<sup>o</sup> and not in communication with the atmosphere, and on tanks containing gases of 13<sup>o</sup>, one of the valves may be replaced by a bursting disc yielding at a pressure not exceeding the test pressure of the tank.

The safety valves shall be able to open at the working pressure indicated on the tank. They shall be so designed and constructed that they function faultlessly even at the lowest operating temperature. Their reliability of operation at the lowest temperature shall be determined and verified by testing either each valve or a sample of the valves of every type of construction.

- (d) The safety valves of tanks intended for the carriage of gases of 12<sup>o</sup> shall be equipped with efficient flame-traps.
  - (e) The tanks shall be electrically earthed by construction.
- (2) Tanks intended for the carriage of deeply-refrigerated liquefied gases of a particular item number may be used for the carriage of any such gas on condition that all the requirements prescribed for the several gases to be carried in the tanks are observed. Such multiple use shall require authorization by an approved expert.



## Appendix B.1

(3) Tanks containing gases of 11° to 13° shall be thermally insulated. The thermal insulation shall be protected against impact by means of a continuous metal sheath. If the space between the tank and the metal sheath is evacuated (vacuum), the protective sheath shall be so dimensioned as to withstand without deformation an external pressure of at least 1 kg/cm<sup>2</sup>. If the sheath is so closed as to be gas-tight (e.g. where insulation is by vacuum), there shall be a device to prevent the occurrence of a dangerous pressure in the insulating layer in the event of inadequate gas-tightness of the tank or of its fittings. The device shall prevent the ingress of moisture into the insulation.

210 142  
(contd)

(4) Tanks intended for the carriage of liquid air, liquid oxygen or liquid mixtures of oxygen and nitrogen of 11° shall include no combustible material either in their thermal insulation or in their fastening to the underframe. Substances containing grease or oil shall not be used to ensure gas-tightness of the joints or in maintaining the closures.

(5) Every tank intended for the carriage of gases of 11° to 13° shall, before being put into service for the first time, undergo a hydraulic pressure test; it must sustain no permanent deformation through that test. The test pressure shall be:

- (a) in the case of tanks intended for gases of 11° and in permanent communication with the atmosphere, 2 kg/cm<sup>2</sup>;
- (b) in the case of tanks fitted with safety valves, 1.5 times the permissible maximum working pressure indicated on the tank, but not less than 3 kg/cm<sup>2</sup>. In the case of vacuum-insulated tanks the test pressure shall be 1.5 times the permissible working pressure, increased by 1 kg/cm<sup>2</sup>.

The hydraulic pressure test shall be carried out before the thermal insulation is placed in position.

(6) Each tank shall be subjected to a periodic inspection every six years. This inspection shall comprise:

## Appendix B.1

210 142  
(contd)

- (a) in the case of tanks intended for the carriage of gases of 11<sup>o</sup> and in permanent communication with the atmosphere, a check of the internal condition and a tightness (leakproofness) test carried out, either with the gas contained in the tank or with an inert gas, at a pressure of 1 kg/cm<sup>2</sup>;
- (b) in the case of tanks fitted with safety valves:
  - 1. after six years' service and thereafter every twelve years, a check of the internal condition and a tightness (leakproofness) test. The tightness (leakproofness) test shall, after the check of the internal condition, be carried out, either with the gas contained in the tank or with an inert gas, at a pressure equivalent to 1.2 times the permissible maximum working pressure indicated on the tank. If this test pressure exceeds 10 kg/cm<sup>2</sup>, the tightness (leakproofness) test shall, where the national regulations so require, be performed as a hydraulic pressure test. The tightness (leakproofness) test shall be carried out solely by pressure-gauge readings, the insulation not being removed. The duration of the test shall be eight hours from the time when temperature equalization has been achieved. The pressure must not drop during the test; however, in the test with gas, account shall be taken of changes of pressure resulting from the nature of the testing medium and from variations of temperature. If the results of the tightness (leakproofness) test are not satisfactory, the reason for this shall be determined, for which purpose the thermal insulation shall if necessary be removed;

## Appendix B.1

2. after twelve years' service, and thereafter every twelve years, a check of the external and internal condition, and a hydraulic pressure test at the pressure prescribed for the first test. The thermal insulation should be removed for this test. 210 142 (contd)

Note: During the gas-tightness (leakproofness) test changes of pressure due to the nature of the testing medium are possible, more particularly because the pressure depends on temperature and temperature variations. A pressure drop of 5 per cent can in general be regarded as permissible. It is the expert's duty to take account in each case of all the circumstances essential to a proper appraisal.

3. The satisfactory condition of the valves and their opening at the working pressure shown on the tank shall be verified by an approved expert every three years.

Note: It is recommended that the sender of the tanks should, at least every six months, check the external condition of each safety valve and at the same time verify the mechanical operation of each valve cone with a suitable tool.

(7) The degree of filling of tanks fitted with valves shall remain below the point at which, if the contents were raised to the temperature at which the vapour pressure would trip the valves, the volume of the liquid would attain in the case of inflammable gases 95 per cent and in the case of other gases 98 per cent of the capacity of the tank at that temperature.

By derogation from Annex A, marginal 2148, the marks prescribed by that marginal and the inscriptions on tank-vehicles and on vehicles on which large movable tanks are placed shall conform to the following provisions: 210 143

(1) The marks shall be engraved either on the tank itself, without weakening it, or on a rustless metal plate welded to the tank; in the case of a battery of receptacles or a battery vehicle the marks shall be affixed to each element.

## Appendix B.1

210 143  
(contd)

The marks on all tanks shall specify:

- the name or mark of the manufacturer and the number of the tank;
- the test pressure, the date (month, year) of the last hydraulic pressure test undergone, and the stamp of the expert who carried out the test;

They shall also specify:

(a) on tanks intended for the carriage of only one substance:

the name of the gas in full;

in the case of compressed gases of 1° to 3°, the maximum loading pressure authorized for the tank;

in the case of liquefied gases of 4° to 13° and of ammonia dissolved under pressure in water (14°), the capacity in litres and the permissible maximum load in kg;

(b) on multi-purpose tanks: the capacity in litres;

(c) on tanks containing deeply-refrigerated liquefied gases of 11° to 13°:

the maximum working pressure for gases of 11° contained in tanks equipped with safety valves and for gases of 12° and 13°; on steel tanks, the lowest temperature at which they may be used;

(d) on tanks equipped with thermal insulation in conformity with marginals 210 140 (5) and 210 142 (3);

the inscription "thermally insulated" in English, French or German. In addition if the particulars specified above are not visible from the outside they shall be repeated on the thermal insulation.

(2) Inscriptions painted on the tanks shall specify:

- the name of the owner or hirer; and
- the tare of the tank, including such fittings and accessories as valves, closures, handling or rolling devices, etc.

**Note:** In the case of batteries of receptacles these inscriptions may be affixed to the frame; in the case of battery vehicles they may be affixed to the body of the vehicle.

## Appendix B.1

(3) Marks engraved on a plate immovably fixed to the body of battery vehicles or to the frame of batteries of receptacles shall specify: 210 143  
(contd)

- the test pressure;
- the number of tanks;
- the total capacity in litres of the elements forming the battery;
- the name of the gas in full; and
- in the case of liquefied gases of 9° and 10°, the permissible maximum load in kg for the battery.

Note: If the plate is not placed near the filling point, the mark specifying the maximum load shall be repeated on the vehicle near that point. This mark may be painted on.

(4) Inscriptions painted on tank-vehicles and vehicles carrying large movable tanks shall specify:

- the name of the owner or hirer; and
  - the tare of the vehicle, including fittings and accessories.
- They shall also specify:

(a) on vehicles whose tanks are intended for the carriage of only one substance:

- the name of the gas in full; and
- in the case of liquefied gases of 4° to 13° and of ammonia dissolved under pressure in water (14°), the permissible maximum load in kg;

(b) on vehicles with multi-purpose tanks:

- the names in full of all the gases which may be carried in these tanks, with particulars of the permissible maximum load in kg for each one.

Note: Only the particulars applying to the gas actually loaded shall be visible; all particulars concerning other gases shall be covered up. If the vehicle is travelling unladen, all particulars concerning gases shall be covered up.

(c) on vehicles whose tanks are equipped with thermal insulation:

- the inscription "thermally insulated" in English, French or German.

## Appendix B.1

210 143  
(contd)

(5) Tanks containing liquefied gases of 4° to 13° shall be marked with a continuous orange band about 30 cm in width painted round them at mid height.

Special requirements for the carriage of the inflammable liquefied gases listed in Appendix B.2, marginal 220 002 (b)

210 144

(1) Valves and safety devices

- (a) An internal flow-control valve or equivalent device shall be fitted to all tank openings more than 1.5 mm in diameter, other than those fitted with the safety valves. However, a non-return valve or equivalent device shall be sufficient in the case of openings not used for emptying the tank.
- (b) Every tank shall be fitted with at least one gauge enabling the permissible degree of filling of the tank to be verified. Transparent-tube and float gauges are prohibited.
- (c) If thermometers are fitted, they may not project directly into the gas or liquid through the wall of the tank.

(2) Piping

The tubes used shall be seamless or be electrically welded.

(3) Pumps, compressors, meters

- (a) Pumps, compressors and meters fitted to the vehicle shall, like their accessories, be specially designed for inflammable liquefied gases and shall be capable of withstanding the same working pressure as the tanks.
- (b) They shall be so placed as to be protected against impacts and against projected stones.
- (c) Where pumps and compressors are driven by an electric motor, the latter and its control gear shall be of the flame-proof type incapable of causing an explosion in a vapour-laden atmosphere.

## Appendix B.1

- (d) Pumps and compressors may be driven by the engine of the vehicle. 210 144 (cont'd)
- (e) Unless the pump is of the constant-speed centrifugal type, a by-pass controlled by a valve opening under pressure and capable of preventing the pump's delivery pressure from exceeding its normal working pressure shall be provided.
- (f) Every compressor shall be fitted with an efficient separator to prevent any liquid from entering the compressor.

(4) Utilization

Except during transloading operations, the valves communicating directly with the tank shall be in the closed position.

Precautions against static electricity

210 145

Vehicles used for the carriage of the liquefied gases listed in marginal 220 602 (b) shall be provided with suitable devices enabling steps to be taken before and during every filling or emptying operation to prevent dangerous differences in electric potential from arising between fixed or movable tanks, piping and the ground.

Engine and exhaust system

210 146

The engine of the vehicle shall be so constructed and placed and the exhaust pipe so directed or protected as to avoid any dangerto the load through heating or ignition.

210 147-

210 149

## Appendix B.1

Class Ia210 150 Substances which give off inflammable gases on contact with water

(1) Tanks shall be free from moisture when filling begins; they shall be so constructed as to prevent any ingress of moisture.

(2) Tanks for the carriage of sodium, potassium, or alloys of sodium and potassium [I<sup>o</sup>(a)] shall conform to the general conditions of packing set forth in marginals 2182 (1), (2) and (3). Their orifices and openings (cocks, casings, manholes, etc.) shall be protected by a cover with a leak-proof joint, which shall be kept closed and locked during carriage. The temperature of the outside surface of the wall shall not exceed 50°C.

210 151-

210 199



## Appendix B.1

Class IISubstances liable to spontaneous combustion

210 200-

210 209

210 210

(1) One of the following two methods shall be used to protect phosphorus during carriage:

- (a) Use of water as the protective agent. In this case the phosphorus shall be covered with water in a quantity such that it forms a layer at least 12 cm deep above the phosphorus. The empty space not occupied by the liquid shall, at a temperature of 60°C, be equal to not less than 2 per cent of the volume of the tank.
- (b) Use of nitrogen as the protective agent. In this case the tank shall be filled to not more than 96 per cent of its capacity with phosphorus at a temperature of not less than 60°C. The space remaining shall be filled with nitrogen in such a way that the pressure never falls below the atmospheric pressure, even after cooling. The tank shall be so closed as to be gas-tight.

(2) Tanks for the carriage of phosphorus shall satisfy the following requirements:

- (a) If the tank is equipped with a heating device, the device shall not project into the body of the tank but shall be external thereto; however, a pipe used for extracting the phosphorus may be equipped with a heating jacket. The heating device of this jacket shall be so regulated as to prevent the temperature of the phosphorus from exceeding the loading temperature of the tank. Other piping may not project into the tank otherwise than in its upper part; the openings shall be above the level of the phosphorus and be capable of being completely closed by lockable caps.

Appendix B.1

210 210  
(contd)

- (b) The tank shall be made of steel and its walls shall not at any point be less than 10 mm thick.
- (c) Before being put into service, the tank shall have successfully withstood a hydraulic pressure test at a pressure of not less than  $4.5 \text{ kg/cm}^2$ .

210 211-  
210 299

## Appendix B.1

Class IIIaInflammable liquids

210 300-

210 309

210 310

- (1) The tanks shall be made of sheet steel or other sheet metal.
- (2) (a) For the carriage in tanks of liquids of 1° to 3° and 5°, only three types of tanks shall be allowed:
1. Type a:  
tanks either equipped with venting devices fitted with a flame-trap and so constructed that they cannot be hermetically sealed and do not allow the liquid to escape, or closed by a safety valve which, opening automatically under an internal manometric pressure of not more than  $0.25 \text{ kg/cm}^2$ , is fitted with a flame-trap and so constructed that it does not allow the liquid to escape;
  2. Type b:  
tanks which, equipped with venting devices fitted with a flame-trap, are closed by a safety valve opening automatically under an internal manometric pressure of  $1.5 \text{ kg/cm}^2$ ; and
  3. Type c:  
tanks having a hermetic closure and fulfilling the requirements of marginals 2133 (1), 2141 (1) and (2)(b).
- (b) The following particulars shall be engraved on tanks of types a, b and c, either on the sides of the tanks themselves, without weakening them, or on a rustless metal plate permanently affixed to the tanks:
- "ADR Type a"; "ADR Type b"; or "ADR Type c", as appropriate.
- (c) In addition, the following particulars shall be engraved on tanks of type c in the manner described under (b):
- the name or mark of the manufacturer and the number of the tank;

Appendix B.1210 310  
(contd)

the test pressure, the date (month, year) of the last test undergone and the stamp of the expert who carried out the test; and

the capacity of the tank, as determined in accordance with the provisions of marginal 210 140 (1) (a)7.

- (d) On all tanks of types b and c or in the case of tank vehicles on the vehicles, the following particulars shall be indicated by any appropriate means, such as a painted inscription:

the name of the owner;

the capacity of the tank;

the tare of the tank (in the case of demountable tanks or large tank-containers); and

the name of the product in full.

Note. The naming of the product for which the tank was built does not preclude the use of the tank for carrying other substances of Class IIIa for which, under the terms of paragraph (3), the same tank can be used without detriment to safety. The names of the liquids mentioned in paragraphs 3 (a) and (b) below need not be indicated on the tank.

- (3) The tanks which may be used are:

- (a) for liquids whose vapour pressure at 50°C does not exceed 1.1 kg/cm<sup>2</sup> and, during the cold season, for motor-vehicle fuels whose vapour pressure at 50°C does not exceed 1.5 kg/cm<sup>2</sup>: tanks of types a, b and c;
- (b) for liquids other than those referred to under (a) whose vapour pressure at 50°C does not exceed 1.75 kg/cm<sup>2</sup>: tanks of types b and c;
- (c) for liquids whose vapour pressure at 50°C exceeds 1.75 kg/cm<sup>2</sup>: tanks of type c.

Note. For petroleum products, the vapour pressure may also be determined by Reid's method according to I.P. 69 or ASTM D 323. The figures to be adopted in that case would be:

instead of a vapour pressure of 1.1 kg/cm<sup>2</sup> at 50°C, a vapour pressure according to Reid of 0.65 kg/cm<sup>2</sup> at 37.8°C;

## Appendix B.1

instead of a vapour pressure of 1.5 kg/cm<sup>2</sup> at 50°C, <sup>2</sup>  
 vapour pressure according to Reid of 0.90 kg/cm<sup>2</sup> at  
 37.8°C; and

210 310  
 (contd)

instead of a vapour pressure of 1.75 kg/cm<sup>2</sup> at 50°C, <sup>2a</sup>  
 vapour pressure according to Reid of 1.05 kg/cm<sup>2</sup> at  
 37.8°C.

(4) Before being brought into service, and thereafter periodically, tanks of type a shall be subjected to a tightness (leakproofness) test in conformity with the provisions of marginal 210 021 (2)(e) and tanks of types b and c to a hydraulic pressure test. For the hydraulic pressure test of tanks of type b the hydraulic pressure to be applied shall be 1.5 kg/cm<sup>2</sup> and for tanks of type c it shall be:

- (a) 3 kg/cm<sup>2</sup> if they are intended for the carriage of liquids with a vapour pressure not exceeding 1.75 kg/cm<sup>2</sup> at 50°C;
- (b) 4 kg/cm<sup>2</sup> if they are intended for the carriage of liquids with a vapour pressure exceeding 1.75 kg/cm<sup>2</sup> at 50°C.

The hydraulic pressure test shall be repeated at least every six years, at the same time as the internal inspection.

In the case of tanks of type a, the tightness (leakproofness) test shall be repeated every six years at the same time as the internal inspection.

(5) The degrees of filling shown below may not be exceeded for tanks of types a and b:

for certain petrols and other liquids

having a coefficient of cubical expansion

of  $60.10^{-5}$  to  $90.10^{-5}$  ..... 97 per cent of capacity;

for toluene, xylene, ethanol,

n propanol, n butanol, primary n amyl

alcohol, petroleum, certain petrols

and other liquids having a coefficient of cubical expansion

of more than  $90.10^{-5}$  but not more than

$120.10^{-5}$  ..... 96 per cent of capacity;

## Appendix B.1

210 310  
(contd)

for carbon disulphide, hexane, heptane,  
octane, benzene, methanol, certain petrols  
and other liquids having a coefficient of cubical expansion  
of more than  $120.10^{-5}$  but not more than  
 $150.10^{-5}$  ..... 95 per cent of capacity;

for diethyl ether, n pentane, acetone,  
certain petrols and other liquids having a coefficient of cubical  
expansion of more than  $150.10^{-5}$  but not more than  
 $180.10^{-5}$  ..... 94 per cent of capacity.

The degrees of filling specified shall also apply to the tanks of  
type c if they are filled with liquids having a vapour pressure of not more  
than  $1.75 \text{ kg/cm}^2$  at  $50^\circ\text{C}$  [see (4)(a) above].

(6) The degrees of filling shown below may not be exceeded for  
liquids having a vapour pressure of more than  $1.75 \text{ kg/cm}^2$  at  $50^\circ\text{C}$  for the  
tanks of type c:

for methyl formate and other liquids  
having a coefficient of cubical expansion  
of more than  $150.10^{-5}$  but not more than  
 $180.10^{-5}$  ..... 91 per cent of capacity;

for acetaldehyde and other liquids having a  
coefficient of cubical expansion  
of more than  $180.10^{-5}$  but not more than  
 $230.10^{-5}$  ..... 90 per cent of capacity.

Note. The degree of filling is computed by the  
following formulae:

(a) for the liquids referred to in paragraph (5):

$$\text{degree of filling} = \frac{100}{1 + 35 \alpha} \text{ per cent of capacity;}$$

(b) for the liquids referred to in paragraph (6):

$$\text{degree of filling} = \frac{97}{1 + 35 \alpha} \text{ per cent of capacity.}$$

## Appendix B.1

In these two formulae,  $\alpha$  represents the mean coefficient of cubical expansion of the liquid between 15 and 50°C, i.e. for a maximum difference of 35°C. 210 310 (contd)

$\alpha$  is computed by the following formula:

$$\alpha = \frac{d_{15} - d_{50}}{35 \cdot d_{50}},$$

$d_{15}$  and  $d_{50}$  being the specific gravities of the liquid at 15° and 50°C, respectively.

(7) Tanks used for the carriage of the substances of 4° shall be so filled that, even after expansion of the liquid due to an increase in the average temperature of the latter up to 50°C, they are not completely filled.

210 311

Precautions against static electricity

Vehicles used for the carriage of liquids of Class IIIa whose flash-point is below 55°C shall be provided with suitable devices enabling steps to be taken before and during every filling or emptying operation to prevent dangerous differences in potential from arising between fixed or movable tanks, piping and the ground.

210 312

Additional provisions governing the carriage of liquids of 1°

In the carriage of liquids of 1° the following additional requirements shall be observed:

210 313

- (a) Brakes The use of inertia brakes on trailers shall in no case be allowed.
- (b) Engine and exhaust system The engine of the vehicle shall be so constructed and placed and the exhaust pipe so directed or protected as to avoid any danger to the load through heating or ignition.

## Appendix B.1

210 313  
(contd)

- (c) Fuel tank The fuel tank supplying the engine of the vehicle shall be so placed that it is protected so far as possible against impact in the event of buffing and that the fuel can drain directly to the ground in the event of leakage. The fuel tank shall not be placed directly above the exhaust pipe. If the tank contains petrol it shall be equipped with an efficient flame-trap fitting the filler hole or with a device by which the filler hole can be kept hermetically closed.
- (d) Air inlet The air inlet of a petrol engine shall be fitted with a filter capable of serving as a flame-trap.
- (e) Cab No readily inflammable material shall be used in the construction of the cab.
- (f) Tanks
1. Tanks of a capacity exceeding 5,000 litres shall be fitted either with surge plates or with partitions dividing them into sections of not more than 5,000 litres capacity.
  2. Where there is no bottom valve, the draining and filling pipes or tanks shall be fitted with quick-closing devices.

210 314-  
210 319



## Appendix B.1

Class IIIbInflammable solids

- (1) Tanks containing sulphur in the melted state of 2<sup>o</sup>(b) or naphthalene in the melted state of 11<sup>o</sup>(c) shall be made of sheet steel not less than 6 mm thick. For sulphur of 2<sup>o</sup>(b) they may, instead, be made of aluminium alloy of sufficient chemical resistance. In determining the wall thickness of aluminium-alloy tanks, account shall be taken of the temperature of filling with liquid sulphur and of the effects of that temperature on the yield stress of the alloy. 210 320
- (2) The tanks shall be thermally insulated in such manner that the external temperature of the thermal insulation cannot exceed 70°C during carriage. The thermally-insulating materials used shall not be readily inflammable.
- (3) The tanks shall possess a valve opening automatically inwards or outwards under a pressure of between 0.2 and 0.3 kg/cm<sup>2</sup>. Valves shall not be necessary if the tank is designed for a working pressure of not less than 2 kg/cm<sup>2</sup> and has undergone a hydraulic pressure test at a pressure of not less than 2.6 kg/cm<sup>2</sup>.
- (4) The emptying (draining) devices shall be protected by a lockable metal cap.
- (5) Tanks containing sulphur in the melted state shall not be filled beyond 98 per cent of their capacity. They shall bear an indication in kg of the maximum filling allowed.

210 321-  
210 329

## Appendix B.1

Class IIICOxidizing substances

210 330

(1) The following provisions shall apply to the carriage of liquids of 1<sup>o</sup>:

- (a) Unless the driver's cab is made of fire-proof materials, a metal shield of the same width as the tank shall be fitted at the back of the cab.
- (b) Any windows in the back of the driver's cab or in the metal shield shall be hermetically closed. They shall be made of fire-resistant safety glass and have fire-proof frames.
- (c) There shall be a free space of not less than 15 cm between the tank and the driver's cab or the shield.
- (d) The engine and (except where the vehicle is driven by a diesel engine) the fuel tank shall be placed forward of the rear wall of the driver's cab or of the shield, or if placed otherwise shall be specially protected.
- (e) The vehicle shall be provided with a metal tank filled with water and of a capacity not less than one-tenth of that of the load-carrying tank. The water tank shall be fitted with a combined suction and force pump and be so designed that it can be emptied of water by gravity flow.
- (f) The tank shall be made of aluminium not less than 99.5% pure or of alloy steel (special steel).
- (g) The tank shall be provided with vents open to the air. The vents shall be so designed as to prevent any entry of foreign matter and any escape of contents of the tank.

## Appendix B.1

- (h) The valves shall be provided with locking devices or cover (blank) flanges and shall be protected by the frame of the vehicle or by strong steel guard plates against impacts. The tank shall have all its openings above the level of the liquid. No piping or connexion shall pass through the walls of the receptacle below the level of the liquid.
- (i) All pipes, pumps and other devices with which hydrogen peroxide will come into contact shall be made of aluminium 99.5 per cent pure or of some other suitable material.
- (j) No wood (unless covered with metal or a suitable synthetic material) shall be used in the construction of any part of the vehicle situated to the rear of the shield prescribed under (a).
- (k) No lubricant other than vaseline, pure liquid paraffin, pure paraffin wax, or silicone lubricant free from metallic soaps shall be applied to pumps, valves or other devices coming into contact with hydrogen peroxide.
- (2) Tanks containing liquids of 1° to 3° shall not be filled beyond 95 per cent of their capacity.

210 330  
(contd)210 331-  
210 399

## Appendix B.1

Class IVaToxic substances

210 400-  
210 409  
210 410

(1) Tanks containing substances of 1°(b), 31°(b), 81° to 83°, acrylonitrile [2°(a)], acetonitrile [2°(b)], allyl chloride [4°(a)], 2-cyanopropan-2-ol [11°(a)], 1 - chloro - 2,3 epoxypropane [12°(a)], glycol chlorohydrin [12°(b)], allyl alcohol [13°(a)] and dimethyl sulphate [13°(b)] shall have all their openings above the level of the liquid; no piping or connexions shall pass through their walls below the level of the liquid. Openings shall be hermetically closed and the closure shall be protected by a metal cap firmly secured. Unless they have double walls, tanks shall have no riveted seams.

(2) For the carriage of the liquids of 2°(a) and (b), 4°(a), 11°(a), 12°(a) and (b), 13°(a) and (b) referred to above, and of substances of 81° to 83°, tanks shall not be filled beyond 93 per cent of their capacity.

(3) Tanks containing liquids of 14° shall be made of welded fine-grain steel with completely reliable welds. In addition, they shall satisfy the following requirements:

(a) In the case of fixed tanks:

1. The tanks shall be made of sheet steel not less than 10 mm thick;
2. The tanks shall undergo a hydraulic pressure test at a pressure of 7 kg/cm<sup>2</sup>. They shall have all their openings above the level of the liquid. No piping or connexion shall pass through their walls below the level of the liquid. They shall be surrounded by a protective covering not less than 75 mm thick held in position by a sheet-steel jacket

## Appendix B.1

not less than 3 mm thick or a jacket of aluminium alloy sheet of equivalent strength. The openings shall be hermetically closed and the closure shall be protected by a metal cap firmly secured;

210 410  
(contd)

3. The capacity of each tank shall be limited to 10,000 litres. It shall be possible to verify the weight of the load, and the permissible maximum weight shall be inscribed on a plate fixed to the outside of the tank.

(b) In the case of large movable tanks:

1. The tanks shall be made of sheet steel not less than 8 mm thick;
2. The tanks shall be designed to withstand a hydraulic pressure test at a pressure of 7 kg/cm<sup>2</sup>. They shall have all their openings above the level of the liquid. No piping or connexion shall pass through their walls below the level of the liquid. The cocks or valves shall not project, and shall ensure hermetic closure. The closure shall be protected by a metal cap firmly secured;
3. The tanks shall be subjected to a tightness (leakproofness) test at a pressure of 2 kg/cm<sup>2</sup> before being put into service and to an internal inspection every two years;
4. The capacity of each tank shall be limited to 6,000 litres; the diameter of a tank shall not exceed 1,500 mm;

(c) The tanks shall not be filled beyond 95 per cent of their capacity;

(d) A switch enabling the entire electric circuit to be opened (cut-out switch) shall be situated near the storage batteries on the carrying vehicle. The electrical equipment shall satisfy the provisions of marginal 220 000 (2)(c)2.

210 411-  
210 419

## Appendix B.1

Class IVbRadioactive substances

- 210 420 (1) The tanks shall have no openings (cocks, valves, etc.) in their lower part and shall close hermetically.
- (2) The tanks shall be made of metal and be electrically earthed.
- (3) Tanks for substances whose vapour pressure at 50°C exceeds 1.1 kg/cm<sup>2</sup> shall satisfy the requirements for tanks of type c of marginal 210 310 and shall be subjected to an internal hydraulic pressure test by an expert approved by the authority competent in the matter of compressed gases. The pressure to be applied shall be:
- (a) 3 kg/cm<sup>2</sup> where the tanks are to be used for the carriage of liquids having a vapour pressure not exceeding 1.75 kg/cm<sup>2</sup> at 50°C;
  - (b) 4 kg/cm<sup>2</sup> where the tanks are to be used for the carriage of liquids having a vapour pressure exceeding 1.75 kg/cm<sup>2</sup> at 50°C.
- The hydraulic pressure test shall be repeated not less often than once every four years, an internal inspection being carried out at the same time.
- (4) The tanks shall not be filled beyond 93 per cent of their capacity.

210 421-  
210 499

## Appendix B.1

Class VCorrosive substances210 500-  
210 509  
210 510

(1) Tanks containing sulphuric acid of 1<sup>o</sup>(c) shall be made of a corrosion-resistant metal or be fitted with a suitable lining. They shall not be filled beyond 95 per cent of their capacity.

(2) Tanks containing liquids of 2<sup>o</sup>(a) and 3<sup>o</sup>(a) shall satisfy the requirements prescribed for metal receptacles [see marginal 2503 (2)].

(3) For the carriage of hydrofluoric acid (6<sup>o</sup>), tanks shall be made of lead-coated steel plates; however, for hydrofluoric acid of 6<sup>o</sup>(a), steel tanks not lead-coated may also be used. The tanks shall have all their openings above the level of the liquid; no piping or connexion shall pass through their walls below the level of the liquid.

(4) Tanks intended for the carriage of stabilized sulphur trioxide (9<sup>o</sup>) shall satisfy the following requirements:

- (a) The thickness of the walls of their cylindrical section shall be not less than 10 mm and that of their ends not less than 12 mm. They shall be thermally insulated and be equipped with a heating device on the outside. If they are designed to be emptied from the bottom, they shall be equipped with a quick-closing device which shall not project beyond the exterior of the body and shall ensure leak-proof closure even in the event of damage to the discharge pipe;
- (b) They shall not be filled beyond 88 per cent of their capacity;
- (c) Before being put into service they shall undergo a hydraulic pressure test at a pressure of not less than 4 kg/cm<sup>2</sup>, and an internal inspection. The pressure test and the internal inspection shall be repeated every three years.

## Appendix B.1

210 510  
(contd)

(5) Tanks intended for the carriage of bromine (14<sup>o</sup>) shall satisfy the following requirements:

- (a) They shall be made of fine-grain sheet steel of satisfactory weldability, with completely reliable welds. The thickness of the sheet steel shall be such that the figure expressing that thickness in millimetres multiplied by the figure expressing the minimum tensile strength in  $\text{kg}/\text{mm}^2$  of the steel used is at least 520. However, a wall thickness of 10 mm shall be sufficient for tanks with a capacity not exceeding 5,000 litres;
- (b) They shall be fitted with a leak-proof lead lining not less than 6 mm thick, or with a lining made of some other material affording equivalent protection;
- (c) They shall have all their openings above the level of the liquid; no piping or connexion shall pass through the walls of the receptacle below the level of the liquid;
- (d) Their openings shall be hermetically closed and the closure shall be protected by a metal cap firmly secured;
- (e) They shall not be filled beyond 92 per cent of their capacity or beyond 2.86 kg per litre of capacity; however, they shall be filled to not less than 90 per cent of their capacity;
- (f) Before being put into service, the tanks shall undergo a tightness (leakproofness) test at a pressure of  $2 \text{ kg}/\text{cm}^2$ . The inside of the tank shall be inspected and, in particular, the condition of the lining verified, every year;
- (g) A plate permanently affixed to the tank shall bear the following particulars:
  - the name or mark of the manufacturer and the number of the tank;
  - the name of the owner;



## Appendix B.1

the word "Bromine";  
the pressure applied in the tightness (leakproofness) test;  
the date (month, year) of the tightness (leakproofness) test and that of the most recent internal inspection;  
the capacity in litres and the permissible maximum load in kilogrammes;  
the stamp of the expert who carried out the tests and inspections.

210 510  
(cont'd)

(6) Tanks intended for the carriage of chlorosilanes (23<sup>o</sup>) shall conform to the requirements of marginal 210 310, account being taken, in the matter of the tests to which they must be subjected, of the vapour pressure of the chlorosilanes and, in the matter of determining the degree of filling, of their coefficient of cubical expansion.

(7) The openings of tanks containing hydrazine [34<sup>o</sup>] shall be hermetically closed and their closures protected by metal caps firmly secured.

(8) For the carriage of liquids of 37<sup>o</sup>(b), tanks shall be fitted with a closure preventing any excess pressure and any leakage of the contents.

(9) For the carriage of the liquids of 41<sup>o</sup>,

- (a) Tanks shall be made of welded aluminium not less than 99.5 per cent pure or of special steel not likely to cause the hydrogen peroxide to decompose;
- (b) Tanks built after the entry into force of this Annex shall have all their openings above the level of the liquid; no piping or connexion shall pass through their walls below the level of the liquid;
- (c) Tanks shall be fitted with a closure preventing any excess pressure, any leakage of the contents, and any entry of foreign matter.

210 511-  
210 699

## Appendix B.1

Class VIIOrganic peroxides

210 700  
210 709  
210 710

The tanks shall satisfy the following requirements:

- (a) They shall be made of aluminium not less than 99.5 per cent pure and have a capacity not exceeding 15 m<sup>3</sup>;
- (b) They shall be equipped with a venting device fitted with a flame-trap and be closed by a safety valve opening automatically under an internal manometric pressure of 1.8 to 2.2 kg/cm<sup>2</sup>. The constituent materials of closures likely to come into contact with the liquid or its vapour shall not exercise a catalytic effect (spring-loaded safety valve made of silumin or V2A stainless steel or a material of equivalent quality);
- (c) Before being put into service they shall undergo a hydraulic pressure test at a pressure of 3 kg/cm<sup>2</sup>, and an internal inspection. The pressure test and the internal inspection shall be repeated not less often than once every six years;
- (d) They shall not be filled beyond 75 per cent of their capacity;
- (e) They shall be equipped with thermal insulation in conformity with marginal 210 140 (3). The shield and the uncovered part of the tank shall be given a coat of white paint which shall be cleaned before each journey and be renewed if it turns yellow or deteriorates;
- (f) They shall be free from impurities at the time of filling.

210 711  
211 049

Appendix B.1aREQUIREMENTS AND RECOMMENDATIONS CONCERNING THE MATERIALS AND CONSTRUCTION  
OF FIXED TANKS AND LARGE MOVABLE TANKS INTENDED FOR THE CARRIAGE OF  
DEEPLY-REFRIGERATED LIQUEFIED GASES OF CLASS Id\*/I. Requirements

(1) The tanks shall be made of steel, aluminium, aluminium alloy, 211 050  
copper or brass. However, tanks made of copper or brass shall be allowed  
only for gases containing no acetylene; ethylene may however contain not  
more than 0.005 per cent acetylene.

(2) For tanks and their fittings and accessories, only materials  
appropriate to the lowest working temperature arising may be used.

The temperature deemed to be the lowest working temperature for any  
given gas shall be that of the liquid phase at the time of filling.

The following shall be allowed for the manufacture of tanks: 211 051

## (a) sheet steel:

1. where the lowest working temperature is  $-40^{\circ}\text{C}$ :  
unalloyed, fully-killed (fine-grained) steel;
2. where the lowest working temperature is  $-110^{\circ}\text{C}$ :  
low-alloy steel (e.g. with 3.5 per cent Ni),  
quenched and tempered;
3. where the lowest working temperature is  $-200^{\circ}\text{C}$ :  
austenitic high-alloy steel (e.g. Cr-Ni 18/8),  
quenched and either stabilized or with a carbon  
content not exceeding 0.07 per cent;
4. where the lowest working temperature is  $-270^{\circ}\text{C}$ :  
austenitic high-alloy steel (e.g. Cr-Ni 18/12),  
quenched and either stabilized or with a carbon  
content not exceeding 0.07 per cent;

- (b) aluminium sheet not less than 99.5 per cent pure and  
aluminium-alloy sheet of the types Al-Mn, Al-Mg and  
Al-Zn-Mg;

\*/ For the use of the word "tank" in this Appendix, see Note 2 at the  
beginning of Appendix B.1.

## Appendix B.1a

- 211 051  
(contd) (c) deoxidized-copper sheet not less than 99.9 per cent pure and alpha-brass sheet with a copper content of 63 to 72 per cent.
- 211 052 (1) Tanks made of steel, aluminium or aluminium alloy shall be either seamless or welded.  
(2) Tanks made of copper or brass shall be either seamless, or welded, or hard-soldered.  
(3) The welds or hard-soldered joints shall be checked for strength.
- 211 053 The fittings and accessories may be secured to the tanks as follows:  
(a) tanks made of steel, aluminium or aluminium alloy: by welding;  
(b) tanks made of copper or brass: by welding or hard-soldering.
- 211 054 The tanks shall be so secured to the underframe of the vehicle as to preclude with certainty any reduction of temperature likely to render any part of the underframe brittle. The tank fastenings shall themselves be so designed that even when the tank is at its lowest working temperature they still possess the necessary mechanical properties.
- 211 055 The outside surfaces of the tanks shall, if necessary, have been treated to prevent corrosion.
- 211 056-  
211 064

## Appendix B.1a

II. Recommendations1. Materials and tanks(a) Steel tanks

The sheets used for the manufacture of the tanks, and the tanks themselves, should meet the requirements set out in the following table:

211 065

211 065  
(contd.)

## Appendix B.1a

Steels for tanks to hold deeply-refrigerated liquefied gases

Group	Working temperature capable of going down to	Material				Tanks or test pieces taken from them		
		Kind	Impact strength <sup>1/</sup>		Heat treatment	Impact strength <sup>1/</sup>	Test temperature	Minimum value
			Condition for test <sup>4</sup>	Test temperature <sup>5</sup>				
I	-40°C	unalloyed, fully-killed steel (fine-grained steel)	aged: compressed 10% and held at 250°C for 30 min.	-40°C	3	stress-relieved at 620 + 20°C for not less than 2 h.	-40°C	4
II	-110°C	low-alloy steel (e.g. with 3.5% Ni), quenched and tempered	stress-relieved at 600 + 20°C for not less than 2 h.	-110°C	5	stress-relieved at 600 + 20°C for not less than 2 h.	-110°C	5
III	-200°C	austenitic high-alloy steel (e.g. Cr-Ni 18/8), quenched and either stabilized or with a carbon content not exceeding 0.07%	as delivered	-196°C <sup>4/</sup>	9	none	-196°C <sup>4/</sup>	9 <sup>3/</sup>
IV	-270°C	austenitic high-alloy steel (e.g. Cr-Ni 18/12), quenched and either stabilized or with a carbon content not exceeding 0.07%	as delivered	-253°C <sup>5/</sup> or -196°C <sup>4/</sup>	7 10	none	-253°C <sup>5/</sup> or -196°C <sup>4/</sup>	7 <sup>2/</sup> 10 <sup>3/</sup>

<sup>1/</sup> See marginals 211 075 to 211 078<sup>2/</sup> See marginal 211 079.<sup>3/</sup> The values relate to test pieces according to VSM 10925 (November 1950); test pieces according to DVM (DIN-50115) and Messager yield practically identical values. For test pieces according to ISO R 83 (1959), values about 20% lower are to be expected.<sup>4/</sup> Normal boiling temperature of nitrogen.<sup>5/</sup> Normal boiling temperature of hydrogen.

## Appendix B.1a

The minimum impact strengths shown apply equally to the sheet, to the seams, and to the transition zone (see however marginal 211 079). 211 066

(b) Tanks made of aluminium and aluminium alloy

The sheets used for the manufacture of the tanks, and their welds, should meet the following requirements as regards the bending coefficient at ambient temperature: 211 067

Thickness of sheet s in mm	Bending coefficient $k^{\frac{1}{2}}$ for		
	Sheet	Weld	
		Root in compression zone	Root in tension zone
$\leq 12$	$\geq 25$	$\geq 15$	$\geq 12$
$> 12$ to 20	$\geq 20$	$\geq 12$	$\geq 10$
$> 20$	$\geq 15$	$\geq 9$	$\geq 8$

<sup>1/</sup> See marginals 211 085 and 211 086

(c) Tanks made of copper and brass

The sheets used for the manufacture of the tanks, and the tanks themselves, should have an impact strength of not less than 3 kgm/cm<sup>2</sup> at a temperature of -196°C (see however marginal 211 075). 211 068

The minimum impact strength shown applies equally to the sheet, to the seams, and to the transition zone. 211 069

211 070-  
211 074

## Appendix B.1a

## 2. Tests

(a) Impact-strength tests

211 075

The impact strengths shown in marginals 211 065 (table) and 211 068 relate to test pieces measuring 10 x 10 mm with a U-shaped notch of 1 mm radius.

Notes: 1. For the shape of the test piece, see footnote 2/ to marginal 211 065 (table).

2. For sheets less than 10 mm but not less than 7 mm thick, test pieces with a cross-section of 10 x s mm ("s" being the thickness of the sheet) shall be used. However, such impact-strength tests generally yield higher values than do such tests on standard test pieces.

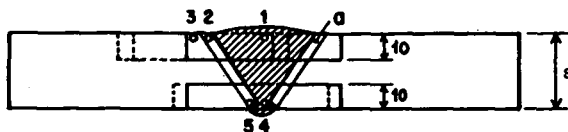
211 076

(1) Test pieces shall be cut from sheets both in and at right angles to the direction of rolling.

The notch shall be perpendicular to the surface of the sheet.

(2) Test pieces for the weld test shall be cut perpendicularly to the line of the weld, as shown in the diagram below:

The notches shall be made in the direction of the weld.



1, 2, 3, 4, 5 = Position of the notch on the test pieces taken from the various zones.

a = Zone affected by heat

s = Thickness of sheet in mm



## Appendix B.1a

(1) On sheets, the impact strength shall be determined on three test pieces in both directions. 211 077

(2) For testing the welds, three test pieces shall be removed at each of the five points shown in the diagram in marginal 211 076 (2).

(1) In the case of sheets, the tests in the direction yielding the lower values shall be decisive. The averaged results of these three tests should satisfy the minimum values shown; none of the individual values should be more than 30 per cent below the minimum shown. 211 078

(2) In the case of welds, the averaged results from the three test pieces removed at each of the sampling points should correspond to the minimum values shown. None of the individual values should be more than 30 per cent below the minimum shown.

In the case of the austenitic steels of groups III and IV of marginal 211 065 (table), the impact strength of the weld and of the transition zone may be 30% below the minimum shown for the unwelded material. 211 079

211 080-  
211 084

(b) Determination of bending coefficient

(1) The bending coefficient  $k$  referred to in marginal 211 067 is defined as follows: 211 085

$$k = 50 \frac{s}{r}$$

where  $s$  = thickness of the sheet in mm, and

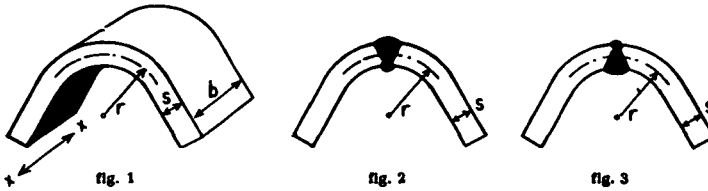
$r$  = mean radius of curvature in mm of the test piece when the first crack appears in the tension zone.

(2) The bending coefficient  $k$  shall be determined both for the sheet and for the weld. The width  $b$  of the test piece shall be equal to 3  $s$ .

## Appendix B.1a

211 085  
(contd.)

(3) The bending coefficient of the sheet shall be determined at right angles to the direction of rolling (figure 1). The test of the weld shall be performed on test pieces with the root in the compression zone (figure 2) and on test pieces with the root in the tension zone (figure 3).



x - x = direction of rolling

211 086

Two tests shall be performed on the sheet and four on the weld (two with the root in the compression zone and two with the root in the tension zone); all individual values obtained should meet the minimum value requirements of marginal 211 067.

211 087-  
219 999

## Appendix B.2

## ELECTRICAL EQUIPMENT

- (1) The lighting of vehicles shall be electrical.
- (2) The electrical equipment of vehicles shall meet the

220 000

following requirements:

Requirements applicable to the electrical equipment as a whole

(a) Wiring. Conductors shall be generously dimensioned to prevent overheating. They shall be appropriately insulated. Circuits shall be protected against excess current by fuses or automatic cut-outs. The wiring shall be firmly attached and so placed that the conductors are protected against impacts, projected stones and heat emitted by the exhaust system.

(b) Storage batteries. A disconnecting switch enabling all the electric circuits to be switched off shall be placed inside the cab in a position where it is clearly visible, readily accessible, and easily distinguishable from the other control knobs or levers. If the storage batteries are situated elsewhere than under the bonnet of the engine, they shall be secured in a case having vents and insulating inner walls.

Requirements applicable to the part of the electrical equipment situated behind the driver's cab

(c) The whole of this equipment shall be so designed, installed and protected as not to be able to cause ignition or short circuiting in normal conditions of use of the vehicles and as to reduce to a minimum the risk of either occurrence in the event of impact or distortion.

In particular:

## Appendix B.2

220 000  
(contd.)1. Wiring

Conductors [see 2(a)] shall consist of cables protected by seamless and rust-proof casings.

2. Lighting

Screw-cap bulbs shall not be used. If the lamps in the body of the vehicle are not fixed in parts of the walls or ceiling so strengthened as to protect them against any mechanical damage, they should be protected by a strong cage or grid.

220 001

220 002

The inflammable gases and articles of Class Id whose carriage is not exempted by the provisions of marginal 14 251 from the application of the requirements of marginal 220 000 are the following:

(a) Compressed gases:

Carbon monoxide [1°(a)]

Hydrogen [1°(a)]

Methane [1°(a)]

Water gas [1°(b)]

Synthetic gases [1°(b)]

Town gas (lighting gas, coal gas) [1°(b)]

Mixtures of marginal 2131, 1°(a) [1°(b)]

Compressed oil gas (rich gas) (2°)

(b) Liquefied gases:

Liquefied oil gas (Z gas) (4°)

Hydrogen sulphide (5°)

Anhydrous ammonia (5°)

T gas (5°)

Propane (6°)

Cyclopropane (6°)

Propene (6°)

## Appendix B.2

- Butane (6°) 220 002  
 Isobutane (6°) (contd.)  
 Butadiene (6°)  
 Butene (6°)  
 Isobutene (6°)  
 Gaseous mixtures A, A O, A 1, B, C (mixed propane and butane) (7°)  
 Dimethyl ether (methoxymethane) [8°(a)]  
 Methyl vinyl ether [8°(a)]  
 Chloromethane (methyl chloride) [8°(a)]  
 Chloroethane (ethyl chloride) [8°(a)]  
 Cyanogen chloride [8°(a)]  
 Vinyl chloride [8°(a)]  
 Vinyl bromide [8°(a)]  
 Methylamine (monomethylamine) [8°(a)]  
 Dimethylamine [8°(a)]  
 Trimethylamine [8°(a)]  
 Ethylamine (monoethylamine) [8°(a)]  
 Ethylene oxide [8°(a)]  
 Methanethiol (methyl mercaptan) [8°(a)]  
 Ethane (9°)  
 Ethylene (9°)
- (c) Deeply-refrigerated liquefied gases:  
 The gases of 12°
- (d) Gas dissolved under pressure:  
 Acetylene (15°)
- (e) Articles containing gas:  
 Aerosol dispensers of 16°(b)  
 Non-refillable containers of gas under pressure of 17°(a).



Appendix B.3

(see marginal 10 182)

CERTIFICATE OF APPROVAL FOR VEHICLES CARRYING  
CERTAIN DANGEROUS GOODS

230 000

239 999

1. CERTIFICATE NO.
2. testifying that the vehicle specified below fulfils the conditions prescribed by the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) for its acceptance for the international carriage of dangerous goods by road.
- 
3. Valid until .....
4. This certificate must be returned to the issuing service when the vehicle is taken out of service; if the vehicle is transferred to another owner; on expiry of the validity of the certificate; and if there is a material change in one or more essential characteristics of the vehicle.
5. Type of vehicle: closed vehicle, open vehicle, tank-vehicle with/without closed/open trailer/semi-trailer (strike out words which do not apply) .....
6. Name and business address of carrier (owner) .....
7. Registration number (if none: chassis number) .....
8. The vehicle described above has undergone at ..... the inspection prescribed by ADR, Annex B, marginal 10 182 and fulfils the conditions required for its acceptance for the international carriage by road of dangerous goods of Classes ..... of item numbers .....
9. Remarks .....
10. .... 19 ..
11. Signature and stamp of issuing service at .....

Appendix B.3

- 12. The validity of this certificate is extended until .....
- 13. Signature and stamp of issuing  
service at .....
- 14. The validity of this certificate is extended until .....
- 15. Signature and stamp of issuing  
service at .....
- 16. The validity of this certificate is extended until .....
- 17. Signature and stamp of issuing  
service at .....

Notes. 1. The dimensions of the certificate shall be 210 x 297 mm (format A 4). Both front and back shall be used. The colour shall be white, with a pink diagonal stripe.

2. Every trailer shall be the subject of a separate certificate unless it is covered by the certificate of the vehicle to which it is coupled.

3. Where a certificate is issued pursuant to article 4, paragraph 2, of the Agreement to a vehicle whose construction does not entirely conform to the requirements laid down in Annex B, the certificate's validity shall not extend beyond the duration of the derogation granted by the said article 4, subject where appropriate to the provisions of marginals 11 605, 14 605, 31 605 and 41 605; and the text of paragraph 8 of the certificate of approval shall be replaced by the following: "The vehicle described above does not entirely conform to the requirements laid down in Annex B, but is entitled to the benefit of the provisions of article 4, paragraph 2, of the Agreement".

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Appendix B.4TABLES CONCERNING THE CARRIAGE OF DANGEROUS SUBSTANCES OF CLASS IVb;  
LABEL TO BE PLACED ON VEHICLES CARRYING THESE SUBSTANCES

The minimum distances shown in the table below between the radioactive substances and the areas set aside on vehicles for drivers and other crew members are compatible with the provisions of marginal 42 300.

240 000

Sum of the transport indices shown on the packages	Minimum distance in metres when there is no protective shield between the radioactive substances and the areas set aside for drivers and other crew members
	Figures applicable where crew members are not liable to be exposed for more than 15 hours per week on the average (basis for computation of average: 13 weeks)
2 or less	1
from 2 to 4	1.5
from 4 to 8	2
from 8 to 12	2.5
from 12 to 20	3
from 20 to 30	4
from 30 to 40	4.5
from 40 to 50	5
Where drivers and other crew members are liable to be exposed for more than 15 but less than 45 hours per week on the average, the minimum distance to be observed shall be determined by multiplying the figures given in the right-hand column above by $\sqrt{\frac{a}{15}}$ , where a = the average number of hours of exposure per week.	

## Appendix B.4

240 001. The minimum safety distances referred to in marginals 42 304 (3) and 42 414 (2) for the loading and storage of packages containing undeveloped radiographic or photographic plates or films together with packages of Category II - YELLOW or of Category III - YELLOW are as follows:

Number of packages of Category		Sum of the transport indices	Duration of carriage, in hours							
III-YELLOW	II-YELLOW		1	2	4	10	24	48	120	240
			Minimum distances in metres							
		0.2	0.3	0.3	0.3	0.5	1	1	2	3
	1	0.5	0.3	0.3	0.5	1	1	2	3	4
	2	1	0.3	0.5	1	1	2	3	4	5
	4	2	0.5	1	1	2	3	3	5	7
	8	4	1	1	2	2	3	5	7	10
1	20	10	1	2	2	4	5	7	11	16
2	40	20	2	2	3	5	7	10	16	22
3	60	30	2	3	4	6	9	12	19	27
4	80	40	2	3	4	7	10	14	22	31
5	100	50	3	4	5	7	11	16	25	35

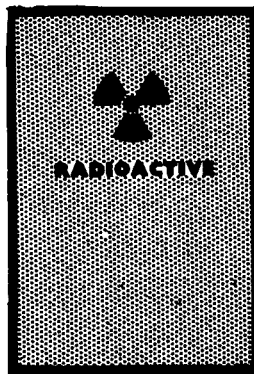
240 002-  
240 009

## Appendix B.4

The label to be affixed to the walls of vehicles pursuant to the provisions of marginal 42 500 shall conform to the model reproduced below. Its dimensions shall not be less than 148 x 210 mm.

240 010

(Black symbol and  
inscription on  
orange ground)



240 011-  
240 999

