

GUIDING PRINCIPLES

FOR THE DEVELOPMENT
OF THE MODEL REGULATIONS ON THE
TRANSPORT OF DANGEROUS GOODS

Seventh version (2023)

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PART 0

INTRODUCTION AND GENERAL PRINCIPLES

Introduction

1. The purpose of this document is to explain the underlying principles that have been applied in developing the Model Regulations since their inception in the 1950s. The current document was last updated based on the 23rd revised edition of the Model Regulations, but much of its content applies to other revisions. The Guidelines are intended to be a dynamic set of principles to be reviewed and amended as necessary as each future revised edition of the Model Regulations is adopted.
2. These guiding principles may be used by regulators and other stakeholders who intend to submit proposals for revisions to the Model Regulations as an aide-memoire to the approach taken during the development of some provisions. It does not preclude new approaches or deviations, but it is expected that these must be explained and properly justified.
3. It is hoped that this document may also be useful for those intending to apply the Model Regulations in legislation or those who need to explain the purpose of the regulations or train others in their use to understand the rationale behind their drafting.
4. Some text, particularly in this Part, reproduces text that can be found in the “Recommendations on the Transport of Dangerous Goods” themselves. Whilst wishing to avoid unnecessary duplication, it is felt that including that text in this document will be helpful to the general reader.

General principles underlying the regulation of the transport of dangerous goods

5. The transport of dangerous goods is regulated to prevent or mitigate, as far as possible, incidents that could endanger public safety or harm the environment. At the same time, regulations should be framed so that they do not hamper the movement of dangerous goods, other than those too dangerous to be accepted for transport. The aim of the regulations, therefore, is to make transport feasible and safe by reducing risks to a minimum.
6. The Recommendations on the Transport of Dangerous Goods, the first version of which was published in 1956, have been developed by the United Nations Economic and Social Council’s Sub-Committee of Experts on the Transport of Dangerous Goods¹ (hereafter referred to as the “TDG Sub-Committee”). The Recommendations:
 - (a) are intended to promote public safety in the transport of dangerous goods which includes the safety of human life and health and of property and the environment;
 - (b) take into account scientific and technical progress, the development of new substances and materials and the requirements of modern multi-modal transport systems;
 - (c) are addressed to governments and international organizations concerned with the safety and the regulation of the transport of dangerous goods; and

¹ By resolution 1999/65 of 26 October 1999, the Economic and Social Council extended the mandate of the Committee to the global harmonization of the various systems of classification and labelling of chemicals. The Committee was reconfigured and renamed the Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals with one sub-committee specialized in the transport of dangerous goods and one sub-committee addressing the global harmonization of classification and labelling of chemicals.

- (d) are addressed to all modes of transport (road, rail, marine, inland waterway, air). Modal transport regulations may occasionally apply other requirements for operational reasons.

7. The Recommendations do not apply to the bulk transport of dangerous goods in sea-going or inland navigation bulk carriers or tank-vessels, which is subject to special international or national regulations.

8. The Recommendations on the Transport of Dangerous Goods are presented in the form of “Model Regulations” as an annex to the Recommendations. The Model Regulations present a scheme of basic provisions that will allow uniform development of national and international regulations governing the various modes of transport; yet, they remain flexible enough to accommodate any special requirements that might have to be met.

9. The purpose of presenting the Recommendations on the Transport of Dangerous Goods into the form of a “model regulation” is as follows:

- (a) To provide a basis for internationally harmonized regulations governing the multimodal transport of dangerous goods, and in doing so, enhance the international harmonization already attained through the current Recommendations;
- (b) To “recommend” the Recommendations on the Transport of Dangerous Goods to modal organizations, regional bodies and national governments (in particular those governments considering the development of national regulations affecting the transport of dangerous goods) in a form that can be adopted with little or no modification directly into modal, regional or national regulations;
- (c) To improve the understanding of dangerous goods transport regulations affecting international transport and in doing so, improve compliance and dangerous goods transport safety and facilitate the international transport of dangerous goods.

10. The United Nations Economic and Social Council expects that governments, intergovernmental organizations and international organizations, when revising or developing regulations regarding the transport of dangerous goods will conform to the principles set out in the Model Regulations, thus contributing to worldwide harmonization in the transport of dangerous goods. Furthermore, it is also expected that their structure, format and content be followed to create a more user-friendly approach, to enhance harmonization of regulatory requirements, to facilitate the work of enforcement bodies and to reduce administrative burdens. The Model Regulations have been drafted in the mandatory sense (i.e., the word “shall” is used throughout the text rather than “should”) to facilitate their direct use as a basis for national and international transport regulations.

11. The scope of the Model Regulations should ensure their value for all who are directly or indirectly concerned with the transport of dangerous goods. They include provisions for training, security, principles of classification, definition of classes, listing of proper shipping names and UN numbers for dangerous goods, general packing requirements, testing procedures, marking, labelling or placarding, and transport documents. There are, in addition, special requirements related to particular classes of dangerous goods.

12. With this system of classification, listing, packing, marking, labelling, placarding and documentation in general use, carriers, consignors and enforcement authorities will benefit from harmonized requirements. In general, their task will be facilitated and obstacles to the international transport of dangerous goods reduced accordingly. At the same time, the advantages will become increasingly evident as trade in dangerous goods steadily grows.

13. Whenever possible, a clear distinction should be made between general requirements (i.e. marking, labelling, documentation and packing requirements) and technical requirements (i.e. specifications and test requirements for packagings, Intermediate Bulk Containers (IBCs) and tanks). The regulations should also identify responsibilities.

14. To provide the greatest international consistency, the Model Regulations should be as comprehensive as possible.
15. If areas or requirements needing substantial changes are identified in the course of the work, they should be brought to the attention of the TDG Sub-Committee (including if appropriate, proposed solutions).
16. Specifications for single mode cargo transport units (i.e. rail tank cars, tank vehicles) and modal specific operational requirements should in general not be provided in the Model Regulations. However, provision for their insertion by modal, regional or national authorities should be made (i.e. additional columns in the list of dangerous goods).
- 17. The following text is intended to provide general information on the structure and use of the Model Regulations and is set out in the same “Part” order as the Model Regulations themselves.**

PART 1

GENERAL PROVISIONS, DEFINITIONS, TRAINING AND SECURITY

1. The Model Regulations consist of seven parts (1 to 7), each of which is divided into chapters. Chapters are numbered sequentially within each part, with the first digit identifying the part in which the chapter is located. For example, the second chapter in Part 7 is designated “Chapter 7.2”.
2. Chapters are further divided into sections which, in turn, are normally divided into a number of paragraphs. Sections and paragraphs are numbered sequentially with the first number always being the number of the chapter in which the section or paragraph is located. For example, 7.2.1 would be the first section in Chapter 7.2, and 7.2.1.1 would be the first paragraph in that section.
3. As an exception, and in an effort to maintain a correspondence between the class number and the chapter number in Part 2, the first chapter, “Introduction”, of Part 2 has been numbered Chapter 2.0.
4. When references appear in the text to other provisions of the Regulations, the reference will normally consist of the full section or paragraph reference, as described above. In certain cases, however, broader reference may be made to an entire part, e.g., Part 5, or chapter, e.g., Chapter 5.4.
5. Recommendations on tests and criteria, which are incorporated by reference into certain provisions of the Model Regulations are published as a separate manual entitled “Manual of Tests and Criteria”.

Chapter 1.2 - Definitions and units of measurements

6. Definitions and units of measurements of general applicability used throughout the Model Regulations are listed here. However, some additional definitions that are specific to relevant chapters of the Model Regulations are found at the beginning of those chapters (e.g: the definition of “security” found in Note 2 to Chapter 1.4 or the definitions in chapters 6.5, 6.7 or 6.8).

Chapter 1.3 - Training

7. General training requirements applicable to all persons engaged in the transport of dangerous goods by any mode of transport are included in the Model Regulations. Additional training requirements for security purposes are given in Chapter 1.4. More specific training requirements (such as for drivers of vehicles) are included in the relevant modal provisions.

Chapter 1.4 - Security

8. Until after the events of 11 September 2001, the Model Regulations addressed only the safety of dangerous goods in transport. Since then it has been determined appropriate to consider transport security as a sub-set of safety provisions. The Model Regulations now include general security requirements for all dangerous goods transported above the appropriate limited quantity thresholds. More demanding requirements are included for high consequence dangerous goods. These are dangerous goods that have the potential to cause mass casualties or mass destruction. An indicative list of such dangerous goods is included in table 1.4.1 as guidance. It is open to competent authorities to add or remove goods from such a list depending on their own national circumstances or the perceived level of threat at any particular time, but it is suggested that the list in the Model Regulations offers sound guidance on the minimum applicability of such measures.

Chapter 1.5 - General provisions concerning radioactive material

9. Provisions for the transport of radioactive material have been transposed from the “Regulations for the Safe Transport of Radioactive Material” prepared by the International Atomic Energy Agency (IAEA). No amendments of substance have been made, but they have been reformatted to fit the structure of the Model

Regulations. A table of correspondence between paragraph numbers in the IAEA Regulations and the Model Regulations can be found at the end of Volume II of the Model Regulations.

PART 2

CLASSIFICATION

Classification and definitions of classes of dangerous goods

1. To accommodate the large number of dangerous goods and the consistent, rapid development of new substances, the different descriptions used to identify them and the different emergency response measures needed depending on their hazards, the TDG Sub-Committee developed tests and criteria to determine which substances could be identified as dangerous goods in transport. Instead of trying to regulate each possible good individually, the TDG Sub-Committee devised a system of nine classes keeping in mind the chemical and physical characteristics of the substances, the type of containment to be used, and the response procedures that would be most appropriate in the event of an accidental release.

2. To give an idea of the expanding number of substances, consider the CAS registry. The Chemical Abstracts Service (CAS), based in the United States of America, issues unique numbers to unique substances. In 2020, the registry maintained by CAS identified more than 169 million unique organic and inorganic substances and was being continually updated with around 15 000 additional new substances daily.² Note, however, that not all CAS registered chemicals have physical or chemical characteristics that would make them goods classified as dangerous for transport. Furthermore, not all goods which would be considered as dangerous for transport are included in this registry, for instance articles.

3. Goods considered to be dangerous for transport are listed in the Dangerous Goods List (see chapter 3.1) and assigned a name (called a “Proper Shipping Name”) and a four-digit UN number. Entries in the Dangerous Goods List may cover specific goods or groups of goods. According to the hazard or the most predominant of the hazards it poses in transport, each entry is, in addition, assigned to a class and a packing group (when appropriate). Some of the classes are divided into divisions, e.g., Class 1, while others are not e.g., Class 3. The nine classes are:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable liquids
- Class 4: Flammable solids; substances liable to spontaneous combustion; substances which, on contact with water, emit flammable gases
- Class 5: Oxidizing substances and organic peroxides
- Class 6: Toxic and infectious substances
- Class 7: Radioactive material
- Class 8: Corrosive substances
- Class 9: Miscellaneous dangerous substances and articles, including environmentally hazardous substances

4. The classification of substances by type of hazard was developed to meet technical conditions while at the same time minimizing interference with existing regulations. It should be noted that the numerical order of the classes does not indicate the degree of danger.

5. The objective of the definitions given in 2.0.1.1 and in the first section of chapters 2.1 to 2.9 is to establish which substances are dangerous and in which class, according to their specific characteristics, they should be included. These definitions are intended to provide criteria which should be possible to follow in the various national and international regulations.

6. When these definitions are used with the list of proper shipping names for dangerous goods, they provide guidance to those who are responsible for classifying substances; and a notable degree of standardization while

² <https://www.cas.org/about/cas-content>

retaining a flexibility that allows diverse situations to be taken into account. Classifications for substances in the Model Regulations are made on the basis of consideration of data submitted to the TDG Sub-Committee by governments, intergovernmental organizations and other international organizations in the form recommended in Figure 1 of the Model Regulations. However, the actual data submitted are not formally endorsed by the TDG Sub-Committee.

7. In principle, substances listed by name in column 2 of the Dangerous Goods List should be transported according to the classification indicated in that list. It may happen that new or additional test data provided by experts (e.g. national authorities, industry stakeholders) show that a substance possesses one or more additional hazards not identified in the list. In such a case, a consignor who is aware of this or these additional hazards identified on the basis of test data, may – with the approval of the competent authority and provided that the competent authority has confirmed that it would take steps to inform the TDG Sub-Committee with the view to amending the current classification of the substance – elect to:

- (a) Use the most appropriate generic or “not otherwise specified” (n.o.s.) entry to ensure that all hazards are communicated during transport; or
- (b) Use the same UN number and name but to reflect the additional hazard(s) in the various hazard communication elements required by the Model Regulations (labels, placards, transport documents) provided that the additional hazard(s) would not justify more stringent transport conditions other than those related to hazard communication.

8. Wastes should be transported under the requirements of the appropriate class considering their hazards and the criteria presented in the Model Regulations. Wastes not otherwise subject to the Model Regulations but covered under the Basel Convention³ may be transported under Class 9.

9. Many of the substances included in classes 1 to 9 are deemed dangerous to the environment. Additional labelling or marking is not always specified, other than for UN Nos. 3077 and 3082, except for transport by sea. Criteria for substances and mixtures dangerous to the aquatic environment are given in Chapter 2.9 of the Model Regulations.

10. For the purposes of selecting the appropriate packaging for dangerous goods, some substances are assigned to packing groups in accordance with the degree of danger they present, as follows:

- Packing Group I: high danger
- Packing Group II: medium danger
- Packing Group III: low danger

11. Assignment to packing groups does not apply to:

- (a) articles
- (b) substances of classes 1, 2 and 7
- (c) substances of divisions 5.2 and 6.2
- (d) self-reactive substances of division 4.1.

12. For packing purposes, any requirement for a specific packaging performance level applicable to substances and articles not assigned to packing groups, is set out in the applicable packing instruction.

13. Criteria for classification and assignment to a packing group conform to those set out in the “Globally Harmonized System of Classification and Labelling of Chemicals” (GHS).

³ Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989).

14. The “Manual of Tests and Criteria” describes the tests methods and procedures considered to be the most useful for providing classifiers with the necessary information to arrive at a proper classification. Although the term “classifiers” is used generically throughout the Manual to indicate the entity providing the classification, in some sectors this may be limited specifically to a competent authority or designated testing authority, whereas in others it may allow for self-classification by manufacturers or suppliers. It should be noted that the Manual is not a concise formulation of testing procedures that will unerringly lead to a proper classification. It therefore assumes competence on the part of the testing body.

PART 3

DANGEROUS GOODS LIST, LIMITED QUANTITY AND EXCEPTED QUANTITY PROVISIONS

Chapter 3.2 - Dangerous Goods List

1. The Dangerous Goods List in Chapter 3.2 lists the proper shipping names and UN numbers of substances most commonly transported. The list is not exhaustive but is intended to include, as much as possible, proper shipping names and UN numbers for substances that are of commercial importance. Additional information about the list is provided in Chapter 3.1.
2. A substance or article specifically listed by name in column 2 of the list, such as UN 1203, GASOLINE, is already classified and the requirements in the other columns of the list as well as the requirements in the body of the Model Regulations apply. If a consignor is aware that a substance possesses one or more additional hazards not identified in the list, the consignor can choose to apply the procedure described in paragraph 7 of chapter 2.
3. A substance that is listed in column 2 as "generic" or "not otherwise specified" (n.o.s) such as UN 3010, COPPER BASED PESTICIDE, LIQUID, TOXIC or UN 1481, PERCHLORATES, INORGANIC, N.O.S., must be classified according to the requirements for classification in the Model Regulations. Note that any substance or article that is suspected of having explosive characteristics must first be considered for inclusion in Class 1. The concept of generic and "n.o.s." entries in the list is important to understand mainly because the Dangerous Goods List is not exhaustive and is really not a "list of dangerous goods" but, rather, a list of proper shipping names and UN numbers that can be assigned to substances included in any of the nine classes. These n.o.s. entries in the list represent thousands, if not millions, of substances so that the "dangerous goods list" cannot be considered a list of all dangerous goods.
4. In addition, the dangerous goods list in Chapter 3.2 does not include those substances that are so dangerous they are forbidden for transport without authorization, usually from competent authorities.

Chapter 3.3 - Special provisions

Special provision 274

1. The attention is drawn to the application of special provision (SP) 274: generic and "not otherwise specified" proper shipping names that are assigned to that special provision in column 6 of the Dangerous Goods List shall be supplemented with the technical or chemical group name unless a national law or international convention prohibits its disclosure if it is a controlled substance.
2. The following rationale for assigning SP 274 has been applied:
 - (a) SP 274 is assigned to entries for which a special provision in column 6 refers to the prohibition of transport for one or more substances under this UN number e.g. UN 2627 with special provision 103. This helps carriers and enforcement officers in checking if goods are authorized for transport;
 - (b) SP 274 is assigned to generic and n.o.s. entries of Division 6.1 because the knowledge of the technical name will speed up the provision of appropriate first aid measures. Exception is made for the entries for medicines (UN 1851, 3248 and 3249) to address concerns over the disclosure of controlled medicinal substances whose identity in transport could lead to practical and logistical problems including theft and unauthorized use and distribution;
 - (c) SP 274 is assigned to generic and n.o.s. entries of classes or divisions other than Division 6.1 only if the knowledge of the technical name would lead to different emergency measures;

- (d) SP 274 is not assigned to n.o.s. entries for gas samples (e.g. UN 3167) because this is not required by 2.0.4.1;
- (e) SP 274 is assigned to entries for metal catalysts (e.g. UN 1378) for which the technical name can help emergency services in identifying the appropriate fire extinguishing medium;
- (f) SP 274 is assigned to entries for elevated temperature substances (UN 3256, 3257 and 3258) because the technical name can help emergency services in identifying the appropriate fire extinguishing medium (e.g. presence of alcohol in the substance carried) or in estimating the temperature (e.g. melting point of the substance carried).

Chapter 3.4 - Limited quantities

1. The rationale behind limited quantity provisions is that selected dangerous goods packed in small quantities and in good, robust packaging pose a lesser risk in transport than do the same goods packed in larger volumes, and on this basis some relief from the requirements may be accepted. In summary, the requirements for dangerous goods in limited quantities generally provide relief from:

- (a) The performance packaging requirements provided they are packaged in combination packagings of not more than 30 kg gross mass including strong outer packagings or in shrink wrapped trays of not more than 20 kg gross mass;
- (b) The labelling (except for air transport) and placarding requirements; and
- (c) Segregation requirements.

2. Information on the goods transported as limited quantities is provided by specific marking and documentation.

3. The UN Recommendations require packages containing limited quantities of dangerous goods to be marked with a diamond shaped mark as specified in Chapter 3.4. However, the mark required by the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air includes all of the elements of this mark with the addition of a “Y”, which indicates compliance with the provisions of the ICAO Instructions, some of which are more stringent than those of the UN Model Regulations and of other modes of transport. For example, packages transported in accordance with the air transport regulations require hazard labels, and inner packaging and per-package quantities are in some cases lower than those authorized by the UN Model Regulations. The UN Model Regulations recognize the mark required by these Instructions in order to ensure that packages containing limited quantities of dangerous goods prepared in accordance with these Instructions are acceptable for transport by other modes.

4. Below, a summary table with the methodology for determining limited quantities is given, as well as examples of accepted marking for the different modes of transport.

Table 3.4: Methodology for determining limited quantities

| Class/Division | PG | Quantity |
|---------------------------------|-----|--|
| 1 | | Not permitted except for UN Nos. 0012, 0014 and 0055 |
| 2 | | Aerosols and gas cartridges containing toxic substances: 120 ml/30 kg Other aerosols and gas cartridges: 1 L/30 kg |
| 2.1 | | Not permitted |
| 2.2 (without subsidiary hazard) | | 120 ml/30 kg |
| 2.2 (with subsidiary hazard) | | Not permitted |
| 2.3 | | Not permitted |
| 3 | I | Not permitted ^a |
| 3 | II | 1 L/30 kg ^b |
| 3 | III | 5 L/30 kg ^c |
| 4.1 | | Self-reactive substances for which packing groups have not been assigned: Not permitted Temperature controlled substances: Not permitted Polymerizing substances: Not permitted Others: Type B or C: 25 ml - 100 g/30 kg Type D, E or F: 125 ml - 500 g/30 kg |
| 4.1 | I | Not permitted |
| 4.1 | II | Desensitized explosives: not permitted Others: 1 kg/30 kg ^d |
| 4.1 | III | 5 kg/30 kg ^e |
| 4.2 | | Not permitted ^f |
| 4.3 | I | Not permitted |
| 4.3 | II | 500 ml - 500 g/30 kg ^g |
| 4.3 | III | 1 L - 1 kg/30 kg ^h |
| 5.1 | I | Not permitted |
| 5.1 | II | 1 L - 1 kg/30 kg ⁱ |
| 5.1 | III | 5 L - 5 kg /30 kg |
| 5.2 | | Temperature controlled substances: Not permitted Others: Types B or C: 25 ml - 100 g/30 kg Types D, E or F: 125 ml -500 g/30 kg |
| 6.1 | I | Not permitted |
| 6.1 | II | 100 ml - 500 g/30 kg ^j |
| 6.1 | III | 5 L - 5 kg/30 kg |
| 7 | | Not permitted |
| 8 | I | Not permitted |
| 8 | II | 1 L - 1 kg/30 kg ^k |
| 8 | III | 5 L - 5 kg/30 kg ^l |
| 9 | II | 1 L - 1 kg/30 kg ^m |
| 9 | III | 5 L - 5 kg/30 kg ⁿ |

^a UN Nos. 1133, 1139, 1210, 1263, 1267, 1268, 1863, 1866 and 3295: 500 ml/30 kg.

^b UN Nos. 1133, 1139, 1169, 1197, 1210, 1263, 1266, 1286, 1287, 1306, 1866, 1999, 3065 and 3269: 5 L. Chlorosilanes (UN Nos. 1162, 1196, 1250, 1298, 1305, 2985): not permitted. UN Nos. 3064, 3343 and 3357: not permitted.

^c UN Nos. 3256 and 3343: not permitted.

^d UN 3176 (molten substance): not permitted. For UN No. 3527: 5kg/30kg.

^e UN Nos. 2304, 2448 and 3176 (molten substances): not permitted.

- f UN 3400: 500 g/30 kg (Packing Group II) and 1 kg/30 kg (Packing Group III).
- g UN Nos. 1418, 1436, 3135, 3209 and 3292: not permitted.
- h UN Nos. 1418, 1436, 3135 and 3209: not permitted.
- i UN Nos. 3100, 3356 and 3375: not permitted.
- j UN Nos. 1569, 1600, 1693, 1697, 1700, 1701, 1737, 1738, 2016, 2017, 2312, 3124, 3250, 3361, 3362, 3416, 3417 and 3448: not permitted.
- k Chlorosilanes (UN Nos. 1724, 1728, 1747, 1753, 1762, 1763, 1766, 1767, 1769, 1771, 1781, 1784, 1799, 1800, 1801, 1804, 1816, 1818, 2434, 2435, 2437, 2986, 2987): not permitted. UN Nos. 1818, 2028, 2442, 2576, 2826 and 3301: not permitted.
- l UN 2215 (molten): not permitted.
- m UN 2969: 5 kg/30 kg. UN Nos. 3090, 3091, 3480 and 3481: not permitted.
- n UN Nos. 2216, 2590, 3257, 3258 and 3268: not permitted.

Figure 3.4.1: Limited quantity for air and acceptable for other modes of transport (in accordance with paragraph 3.4.9 in the Model Regulations)

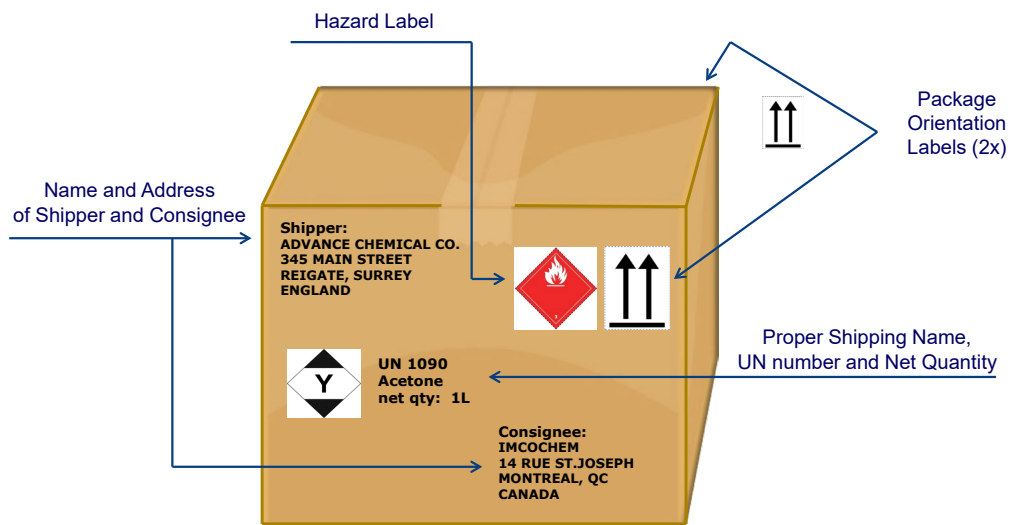
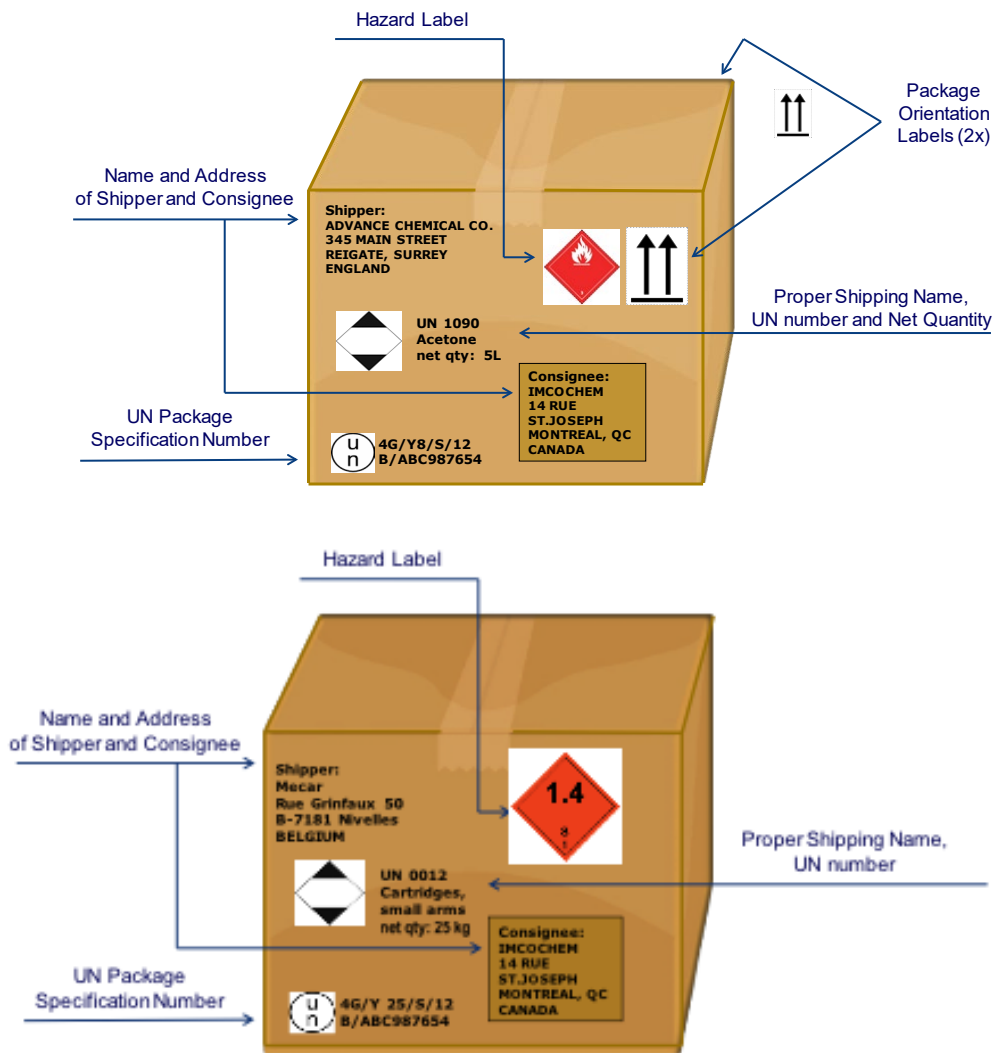


Figure 3.4.2: Limited quantity for transport modes other than air (not acceptable for air) in accordance with paragraph 3.4.7 of the Model Regulations



Figure 3.4.3: Limited quantity for transport modes other than air (fully regulated for air) in accordance with paragraph 3.4.10 of the Model Regulations



Chapter 3.5 - Excepted quantities

1. The rationale behind excepted quantity provisions is that selected dangerous goods packed in very small quantities, other than articles, with limitations on the quantity per inner packaging and outer packaging and in very robust, tested packaging pose a lesser risk in transport than do the same goods packed in larger volumes, and on this basis some relief from the requirements may be accepted. The substances permitted and the provisions applied are based on criteria established by the ICAO Dangerous Goods Panel. There is no requirement for such dangerous goods to be labelled or for transport document provisions to be met but a suitable mark, based on the established air transport mark, is used to aid identification of packages.
2. The excepted quantity provisions were first introduced in the International Civil Aviation Technical Instructions (ICAO TI) in 1987 to allow for the transport of small quantities of dangerous goods by air under relaxed conditions. This scheme was later introduced in the Model Regulations for the uninterrupted movement of dangerous goods across all modes.
3. These provisions reflect safety considerations pertaining to transport by air, and, as a result, the quantity limits and packaging requirements for selected dangerous goods are more stringent than those for limited quantities.
4. Given the lower level of measures applied, a threshold limit has been placed on the total quantity of such goods that may be carried on any one cargo transport unit. Given the difficulty of calculating whether the

threshold is reached based on the very small net mass of dangerous goods contained in each package, that threshold is set, uniquely, simply on the total number of packages of dangerous goods packed in excepted quantities. The limit is 1000 packages per cargo transport unit.

5. The following table describes the methodology for determining the “E” codes:

Table 3.5.1: Methodology for determining excepted quantities

| Class/Division | | Packing group | Maximum net quantity per inner packaging (in g (solids) and ml (liquids, gases)) | Maximum net quantity per outer packaging (in g (solids) and ml (liquids, gases) or sum of g and ml in the case of mixed packing) | E Code |
|--------------------------|---|---------------|--|--|--------|
| 1 | | | Not permitted | | E0 |
| 2.1 | | | Not permitted | | E0 |
| 2.2 | without subsidiary hazard ^a | | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| | with subsidiary hazard | | Not permitted | | E0 |
| 2.3 | | | Not permitted | | E0 |
| 3 | without subsidiary hazard ^b | I | 30 g / 30 ml | 300 g / 300 ml | E3 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| | with subsidiary hazard ^c | I | Not permitted | | E0 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 4.1^d | | I | Not permitted | | E0 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 4.2 | | I | Not permitted | | E0 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 4.3 | | I | Not permitted | | E0 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 5.1 | | I | Not permitted | | E0 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 5.2^e | | | Not permitted | | E0 |
| 6.1 | Toxic by inhalation (TIH) substances ^k | I | Not permitted | | E0 |
| 6.1^{f,g} | | I | 1 g / 1 ml | 300 g / 300 ml | E5 |
| | | II | 1 g / 1 ml | 500 g / 500 ml | E4 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 6.2 | | | Not permitted | | E0 |
| 7 | | | Not permitted | | E0 |
| 8^{h,i} | | I | Not permitted | | E0 |
| | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |
| 9^j | | II | 30 g / 30 ml | 500 g / 500 ml | E2 |
| | | III | 30 g / 30 ml | 1000 g / 1000 ml | E1 |

^a For gases, the volume indicated for inner packagings refers to the water capacity of the inner receptacle and the volume indicated for outer packagings refers to the combined water capacity of all inner packagings within a single outer package.

^b Desensitized explosives and UN 3256 shall not be transported as excepted quantities.

^c Chlorosilanes (UN Nos. 1162, 1196, 1250, 1298, 1305, 2985) shall not be transported as excepted quantities.

^d Self-reactive substances, polymerizing substances, desensitized explosives, UN Nos. 2304, 2448, 3176 (molten substances), 3360 and 3527 shall not be transported as excepted quantities.

- e *Division 5.2 dangerous goods shall ONLY be transported as excepted quantities if in UN 3316, chemical kit or first aid kit.*
- f *UN Nos. 1600, 2312 and 3250 (molten substances) shall not be transported as excepted quantities.*
- g *Chlorosilanes (UN Nos. 3361, 3362) shall not be transported as excepted quantities.*
- h *UN Nos. 2215 (molten), 2576, 2803 and 2809 shall not be transported as excepted quantities.*
- i *Chlorosilanes (UN Nos. 1724, 1728, 1747, 1753, 1762, 1763, 1766, 1767, 1769, 1771, 1781, 1784, 1799, 1800, 1801, 1804, 1816, 1818, 2434, 2435, 2437, 2986, 2987) shall not be transported as excepted quantities.*
- j *Code E1 applies for UN Nos. 3334 and 3335. UN Nos. 1845, 2807, 3245, 3257 and 3258 shall not be transported as excepted quantities.*
- k *These are substances which are assigned special provision 354 in column (6) of the Dangerous Goods List and "TOXIC BY INHALATION" N.O.S entries.*

6. The meaning of the codes in the table above is explained in section 3.5.1 of the Model Regulations.

“De minimis” quantities (sub-section 3.5.1.4)

7. Excepted quantities of dangerous goods assigned to codes E1, E2, E4, and E5 are not subject to the Model Regulations in quantities often referred to as "de minimis". The rationale behind "de minimis" quantity provisions is that selected dangerous goods packed in minute quantities, with limitations on the quantity per inner packaging and outer packaging and in good quality packaging pose a negligible risk in transport compared to those same goods packed in larger quantities. On this basis, relief from all other provisions of the Model Regulations is accepted. Subjecting minute quantities of certain goods to the full requirements of the Model Regulations is of questionable value and may also falsely communicate a risk in transport. This in turn can lead to unjustified precautions and unnecessary incident response actions which are unwarranted and have a negative effect on transport safety. To ensure consistency with the excepted quantity provisions, only dangerous goods assigned to excepted quantity codes E1, E2, E4, and E5 qualify for “de minimis” provisions:

| E-Code | Maximum quantity per inner receptacle | Maximum quantity per package |
|--------------------|--|-------------------------------------|
| E1, E2, E4, and E5 | 1 ml (liquids and gases) | 100 ml (liquids and gases) |
| | 1 g (solids) | 100 g (solids) |

PART 4

PACKING AND TANK PROVISIONS

A. Basic principles for developing packing instructions for the model regulations

A.1 General provisions

1. Packing instructions should be clear and provide as wide a choice of packagings as possible.
2. The packing instructions consist of a small number of general instructions supplemented by a limited number of more specific instructions for particularly hazardous or specialized dangerous goods.
3. Packing instructions should be developed with the objective of being suitable for multimodal transport. More severe packaging restrictions, in some instances, may be necessary for mode specific regulations.
4. A rationalized approach (based on similar properties or hazards presented) should be used for allocating packing instructions to specific substances.
5. The packing instructions are primarily intended for the person preparing the package for consignment. They should not address classification or operational provisions.

A.2 Packing instruction structure

6. There are packing instructions for:
 - (a) Packagings, prefixed by "P". Included are:
 - (i) Packagings in accordance with Chapter 6.1 (up to 450 L and/or 400 kg net, as appropriate).
 - (ii) Pressure receptacles in accordance with Chapter 6.2.
 - (iii) Packagings for Division 6.2 substances in accordance with Chapter 6.3.
 - (iv) Packagings or packing methods not subject to the provisions of chapters 6.1, 6.2, 6.3, 6.5 or 6.6.
 - (b) Intermediate bulk containers, prefixed by "IBC", up to 3 m³, in accordance with Chapter 6.5;
 - (c) Large packagings, prefixed by "LP", exceeding 400 kg net or 450 L, in accordance with Chapter 6.6).
7. The majority of substances and articles, excluding classes 1, 2 and 7, have been allocated to a packing instruction beginning "P00*". When considering new packing instructions, the use of one of these numbers should be considered first; class specific packing instructions should only be used when there is need for restricted packaging options or extensive special conditions. Exceptions to this rule are for instance, P004, P005 or P006 to which articles containing dangerous goods of different classes are assigned.
8. Where the "P00*" instructions cannot be used then there are series of class specific packing instructions all beginning with the class number. In some cases, it will be necessary to indicate in the packing instruction that in addition to the permitted design types packages and any quantity thresholds that are specified, there are some "Additional requirements" that apply for all substances or articles assigned to that packing instruction. An example is the requirement to protect cells and batteries against short circuit as may be found in packing instruction P903.

9. Some packing instructions may need to include provisions which are relevant only for a small number of substances or articles among many others that are assigned to a particular packing instruction. These are referred to as “special packing provisions”, are identified as “PPxx” and listed in Column 9 of the Dangerous Goods List. An example is PP28 which is specific to perchloric acid in packing instruction P502. Some, such as PP26 which requires packagings to be lead free, will appear in more than one packing instruction (e.g. P112, P114, P406) with the same number since the requirement is the same but the UN numbers to which it applies are different.

10. Where a solid or liquid substance can only be transported in a cylinder then allocation to table 3 of P200 shall be considered.

A.3 Packagings "P"

11. Some general principles of assignment of substances to packing instructions and examples of exceptions are given below.

Class 1: P100s

Given the intrinsic properties of explosive substances and articles and the variable effects that they display depending on the manner in which they are packaged, the classification process addresses issues of possible over-confinement, for example in metal packagings. Such packagings are often chosen for their robustness in handling rather than their appropriateness in transport.

However, given the desirability of uniformity in assessing packaging in relation to the classification process (as set out in the Manual of Tests and Criteria) it has been decided that packagings used to transport explosive substances and articles should meet the packing group II test performance level.

Similar principles apply to the assignment of packaging for organic peroxides and self-reactive substances.

Class 2: P200s

For gases, except some small articles containing gas such as UN 2037 or UN 3150 which are allocated to P003.

Class 3: P300s

Flammable liquids with explosive properties are assigned to P300 (UN 3064).

Substances that form part of chemical kits are assigned to P302.

Class 4: P400s

Many substances of Class 4 have been allocated to special P40x packing instructions.

Self-reactive substances of Division 4.1 are packaged in the same way as organic peroxides and are allocated to P520. This packing instruction provides packing method codes OP1 to OP8 which refer to the packing methods for the various types of self-reactive substances.

Class 5: P500s

Chemical oxygen generators are assigned to P500 and stabilized hydrogen peroxide is assigned to P501.

Substances of Division 5.2 are assigned to P520. This packing instruction provides packing method codes OP1 to OP8 which refer to the packing methods for the various types of organic peroxides.

Division 6.1: P600s

Toxic ammunition and tear gas candles are assigned to P600.

Uranium hexafluoride (UN 3507) is assigned to P603.

Division 6.2: P600s

Infectious substances are assigned to P620, P621 or P650.

Waste of UN 3549 transported for disposal is assigned to P622.

Class 7

No packing instructions have yet been allocated to radioactive materials as the packaging requirements have been set by IAEA and do not align easily to the system for the other classes. Instead radioactive material is assigned to special UN numbers which depend on a number of characteristics including packaging such as the activity level of radionuclides in the package, or the fissile or non-fissile properties.

Class 8

There are a number of specific packing instructions for Class 8 substances and articles. For instance, P800 applies to gallium (UN 2803) and mercury (UN 2809); P804 applies to bromine and bromine solutions.

Class 9

Substances and articles of this class each have a hazard not covered by other classes. When any substance or article is assigned to this class its unique properties will need to be considered in developing or assigning a packing instruction.

12. The following should form the template for any new proposal to the TDG Sub-Committee for new packing instructions (PXXX) for classes/divisions 3, 4, 5.1, 6, 8 or 9.

| PXXX | PACKING INSTRUCTION | PXXX |
|--|--|----------------------------------|
| <p>[For specific UN number(s) only (e.g see P301):] This instruction applies to UN Nos. XXXX... [Packing instructions for articles should consider the required packaging performance level.]</p> | | |
| <p>The following packagings are authorized, provided that the general packing provisions of 4.1.1, 4.1.3 and special packing provisions of 4.1.5 are met: [Sometimes additional paragraphs will need to be quoted or alternatives given e.g. P620]</p> | | |
| Combination packagings | | |
| Inner packagings | Outer packagings | Maximum net mass/capacity |
| [List permitted types and capacity/mass] | Drums [List permitted types] Boxes [List permitted types] Jerricans [List permitted types] | |
| Single packagings | | Maximum net mass/capacity |
| Drums [List permitted types] Jerricans [List permitted types] Boxes [List permitted types] Bags [List permitted types] Composite packagings [List permitted types] | | |
| <p>Pressure receptacles, provided that the general provisions of 4.1.3.6 are met. [If 4.1.3.6 is not sufficient then the use of cylinders should be addressed in detail. E.g.P602(4)]</p> | | |
| Additional requirements: | | |
| 1. [This section should contain additional packaging information which should be applicable to specific or all the packaging choices listed above] 2. ... | | |
| Special packing provision: | | |
| PPXX [These should address specific requirements for individual or groups of substances. The provision should only address packaging issues and not classification or operational provisions.] | | |

B. Rationalized approach for the assignment of IBC packing instructions to substances of classes 3, 4, 5, 6, 8, and 9

B.1 General provisions

1. The following are not allowed in IBCs:
 - (a) Explosives of Class 1 (other than UN Nos. 0082, 0222, 0241, 0331 and 0332)
 - (b) Desensitized explosives of Class 3 (other than UN Nos. 1204 and 2059, packing groups II and III)
 - (c) Desensitized explosives of Division 4.1
 - (d) Pyrophoric substances of Division 4.2
 - (e) Gases of Class 2
 - (f) Chlorosilanes
 - (g) Radioactive materials of Class 7 (except as provided in 6.4.5.4.5)
 - (h) Packing group I liquids of any Class or Division
 - (i) Liquids with a vapour pressure ≥ 110 kPa at 50 °C (other than substances specifically permitted, i.e. UN 2672)

B.2 Guidelines for the assignment of packing instructions for IBCs

2. The following table indicates the appropriate IBC packing instruction assignment for substances based on their class or division, special properties, subsidiary hazard, and packing group. A dash in the subsidiary hazard column indicates that the IBC packing instruction is assigned irrespective of the substance's subsidiary hazard unless otherwise stated in the special properties column. The unique physical and chemical properties of a substance must be considered when determining an appropriate IBC assignment.

Table 4.1: Packing instructions assignment for IBCs

| Class/ Division | Special properties | Subsidiary hazard | PG | IBC instruction |
|--------------------|---|-------------------|-----|-----------------|
| 1 | Explosive, blasting, type B or E in Division 1.1D (UN 0082, UN 0241) Ammonium nitrate in Division 1.1D (UN 0222) Explosive, blasting, type B or E in Division 1.5D (UN 0331, UN 0332) | - | - | IBC100 |
| 3 | Flammable liquids | - | II | IBC02 |
| | | - | III | IBC03 |
| 4.1 | Sulphides and Hydrides | - | II | IBC04 |
| | Wetted powders, n.o.s. substances with a subsidiary hazard, and solids containing a flammable liquid (UN 3175) | - | II | IBC06 |
| | 4.1 PG II substances other than those identified above | - | II | IBC08 |
| | Fused calcium resinate (UN 1314) and Metal hydrides, flammable, n.o.s. (UN 3182) | - | III | IBC04 |
| | Resinates and n.o.s. substances with a subsidiary hazard | - | III | IBC06 |
| | Polymerizing substances, solid | - | III | IBC07 |
| | Polymerizing substances, liquid | - | III | IBC03 |
| | 4.1 PG III substances other than those identified above | - | III | IBC08 |
| 4.2 | Liquids | - | II | IBC02 |
| | Solids with a subsidiary hazard | - | II | IBC05 |
| | Solids without a subsidiary hazard | None | II | IBC06 |
| | Fish meal, unstabilized (UN 1374) and Organic pigments, self-heating (UN 3313) | - | II | IBC08 |

| Class/ Division | Special properties | Subsidiary hazard | PG | IBC instruction |
|--|---|--|------|--------------------|
| | Liquids | - | III | IBC02 |
| | Maneb (UN 2210) | - | III | IBC06 |
| | Solids | - | III | IBC08 |
| 4.3 | Alkali metals, (Caesium, Lithium, Rubidium, Sodium, Potassium), Calcium carbide, and Lithium nitride | - | I | IBC04 |
| | Liquids | - | II | IBC01 |
| | Hydrides, Sulphides, and Organometallic substance, solid, water-reactive (UN 3395) | - | II | IBC04 |
| | Solids with a flammable subsidiary hazard | 4.1 | II | IBC04 |
| | Solids with a subsidiary hazard other than flammability | Other than 4.1 | II | IBC05 |
| | Solids without a subsidiary hazard | None | II | IBC07 |
| | Liquids | - | III | IBC02 |
| | Solids with a flammable subsidiary hazard | 4.1 | III | IBC06 |
| | Solids without a flammable subsidiary hazard | Other than 4.1 | III | IBC08 |
| 5.1 | Sodium peroxide (UN 1504) and Oxidizing solid, n.o.s. (UN 1479) | - | I | IBC05 |
| | Potassium peroxide (UN 1491), Potassium superoxide (UN 2466), and Sodium superoxide (UN 2547) | - | I | IBC06 |
| | Liquid: - n.o.s. substances with a subsidiary hazard - nitrites, inorganic, aqueous solution, n.o.s. (UN 3219) | - | II | IBC01 |
| | Liquid: - liquids other than those assigned to IBC01 | - | II | IBC02 |
| | Solid: - chlorates and chlorites (n.o.s. substances only) - permanganates - peroxides - n.o.s. substances with a subsidiary hazard | - | II | IBC06 |
| | Solid: -nitrates and nitrites -chlorates and chlorites (other than n.o.s substances) -solids other than those assigned to IBC06 | - | II | IBC08 |
| | Liquids | - | III | IBC02 |
| | Solids | - | III | IBC08 |
| | 6.1 | Solids without a subsidiary hazard other than those evolving vapours that are toxic (i.e. Cyanogen bromide) or irritating (i.e. Tear gas substance, solid, n.o.s.) | None | I |
| Liquids | | - | II | IBC02 |
| Solids | | - | II | IBC08 |
| Liquids | | - | III | IBC03 |
| Solids | | - | III | IBC08 |
| Cobalt dihydroxide powder (UN 3550) ^a | | None | I | IBC07 |
| 6.2 | Clinical waste, unspecified, n.o.s. (UN 3291) | - | II | IBC620 |
| 8 | Solids without a subsidiary hazard | None | I | IBC07 |
| | Liquids with a self-heating subsidiary hazard | 4.2 | II | Not allowed |
| | Liquids other than those with a self-heating subsidiary hazard | All except 4.2 | II | IBC02 |
| | Solids containing corrosive liquid, n.o.s. (UN 3244) | - | II | IBC05 |
| | Solids with a self-heating, water-reactive or oxidizing subsidiary hazard | 4.2, 4.3 or 5.1 | II | IBC06 |
| | Liquids | - | III | IBC03 |
| | Solids | - | III | IBC08 |
| 9^b | Elevated temperature liquid (UN 3257) | - | III | IBC01 |
| | Liquids | - | III | IBC03 |
| | Solids | - | III | IBC08 |

^a Acknowledging the unique properties of cobalt dihydroxide powder, which include that this material is: hygroscopic, heavy with a density of 3.6 g/cm³, has zero vapour pressure, tends to clump and not remain airborne, and that the airborne fraction has a low respirability value of only 0.8 % modelled to deposit in the deep lung, the Sub-Committee of Experts on the Transport of Dangerous Goods agreed to authorize UN 3550 to be packed in flexible intermediate bulk containers, provided these include a sift-proof liner (to prevent any egress of dust during transport), and are transported in closed cargo transport units

^b Class 9 IBC authorizations should be considered based on the specific properties of the substance.

3. The following substances are allowed in IBCs only on the basis of an approval by the competent authority. All of them except UN 3375 are assigned IBC99:

Table 4.2: Substances allowed for transport in IBCs subject to approval by the competent authority

| UN | Name | Class/Div. | PG | Subsidiary hazard(s) |
|------|--|------------|----|----------------------|
| 2359 | DIALLYLAMINE | 3 | II | 6.1 + 8 |
| 2588 | PESTICIDE, SOLID, TOXIC, N.O.S. | 6.1 | I | |
| 2811 | TOXIC SOLID, ORGANIC, N.O.S. | 6.1 | I | |
| 2813 | WATER-REACTIVE SOLID, N.O.S. | 4.3 | I | |
| 2921 | CORROSIVE SOLID, FLAMMABLE, N.O.S. | 8 | I | 4.1 |
| 2923 | CORROSIVE SOLID, TOXIC, N.O.S. | 8 | I | 6.1 |
| 2928 | TOXIC SOLID, CORROSIVE, ORGANIC, N.O.S. | 6.1 | I | 8 |
| 2930 | TOXIC SOLID, FLAMMABLE, ORGANIC, N.O.S. | 6.1 | I | 4.1 |
| 3132 | WATER-REACTIVE SOLID, FLAMMABLE, N.O.S. | 4.3 | I | 4.1 |
| 3208 | METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S. | 4.3 | I | |
| 3229 | SELF-REACTIVE LIQUID TYPE F | 4.1 | | |
| 3230 | SELF-REACTIVE SOLID TYPE F | 4.1 | | |
| 3245 | GENETICALLY MODIFIED MICROORGANISMS | 9 | | |
| 3286 | FLAMMABLE LIQUID, TOXIC, CORROSIVE, N.O.S. | 3 | II | 6.1 + 8 |
| 3288 | TOXIC SOLID, INORGANIC, N.O.S. | 6.1 | I | |
| 3290 | TOXIC SOLID, CORROSIVE, INORGANIC, N.O.S. | 6.1 | I | 8 |
| 3375 | AMMONIUM NITRATE EMULSION or SUSPENSION or GEL, intermediate for blasting explosives | 5.1 | II | |
| 3423 | TETRAMETHYLAMMONIUM HYDROXIDE, SOLID | 6.1 | I | 8 |
| 3535 | TOXIC SOLID, FLAMMABLE, INORGANIC, N.O.S. | 6.1 | II | 4.1 |

C. Guidelines for assigning portable tank requirements to substances listed in the Dangerous Goods List

1. These guidelines are provided as a reference to be used for assigning portable tank requirements to specific substances listed in the dangerous goods list. They were developed taking into consideration the hazards of dangerous goods and their physical and chemical characteristics.

2. For certain substances, the tank requirements recommended by these guidelines may not be appropriate owing to unique characteristics of the substance that are not addressed here. In these instances, expert judgement should be applied in assigning appropriate requirements. For example, bottom openings may not be appropriate for substances corrosive to ship structures.

3. The guidelines are provided in three parts. Section C.1 provides general guidance. Section C.2 provides specific guidance for groups of substances organized on the basis of the class or division, packing group and subsidiary hazard. Section C.3 provides guidance on the assignment of tank provisions.

C.1 General guidelines

4. In assigning tank requirements to a substance, the following should be taken into account:

- (a) **Prohibited substances:** Some substances are prohibited from transport in portable tanks. These substances are considered too dangerous for transport in bulk typically because of their instability or because they pose an unacceptably high level of risk when transported in bulk quantities under normal conditions of transport. These are:
 - (i) Substances of Class 1 (other than UN 0331 or UN 0332 - Explosive, blasting, type B or E (Agent, blasting, type B or E));
 - (ii) Desensitized explosives of Class 3;

- (iii) Desensitized explosives of Division 4.1;
- (iv) Self-reactive substances (other than type F);
- (v) Organic peroxides of Division 5.2 other than type F; and
- (vi) Radioactive materials other than low specific activity (LSA) non-fissile or fissile excepted materials.

Additional prohibited substances are specifically identified in the Model Regulations.

When no portable tank instruction (Tx) appears in column 10 of the Dangerous Goods List for a specific dangerous goods entry, then transport of the substance is not permitted unless a competent authority approval is granted as detailed in 6.7.1.3 of the Model Regulations.

- (b) **Minimum shell thicknesses:** The minimum shell thicknesses prescribed are provided in thicknesses relevant to reference steel with a guaranteed minimum tensile strength of 370 N/mm² and a guaranteed minimum elongation of 27%. When other materials are used equivalent thickness calculations should be performed. Minimum thicknesses range from 5 mm to 10 mm. Section C.2 of these guidelines provides guidance for assigning minimum thicknesses. Granular or powdered solid substances of packing groups II or III may be transported in tanks with minimum shell thicknesses of 5 mm in the reference steel regardless of the tank diameter when 6.7.2.4.2 of the Model Regulations is specified in the portable tank instructions in 4.2.5.2.6 relevant to a given substance. Regardless of the minimum thickness specified in Section C.2 of these guidelines, if the thickness determined in accordance with the provisions of section 6.7.2.4 is greater, the greater thickness shall be applied. A reduced thickness may also be authorized in accordance with 6.7.2.4.3 for substances assigned to portable tank instructions T1 and T2.
- (c) **Corrosive effects of substances on materials of construction:** The minimum thicknesses prescribed do not take a substance's corrosive effects into account. The consignor must ensure that the tank materials of construction are compatible with the lading.
- (d) **Minimum test pressures:** Irrespective of the pressure assigned in these guidelines, the minimum test pressure assigned to an individual substance should be the greater of the pressure determined on the basis of the definitions in 6.7.2.1 of the Model Regulations and the pressure assigned in these guidelines.
- (e) **Pressure-relief devices requirements:** Two pressure relief device requirements are possible:
 - (i) "Normal" (where the provisions of paragraph 6.7.2.8.1 apply); or
 - (ii) 6.7.2.8.3.

When paragraph 6.7.2.8.3 is referenced, a frangible disk must be provided in series preceding the pressure relief device. Paragraph 6.7.2.8.3 should be assigned to substances that have the potential to polymerize or to produce solid or highly viscous substances capable of preventing proper operation of the relief valve.

In addition, 6.7.2.8.3 is also specified for certain groups of substances as indicated in Section C.2 of these guidelines and for individual substances as indicated in the Dangerous Goods List of Chapter 3 of the Model Regulations based on the decisions of the TDG Sub-Committee having particular regard to inhalation toxicity.

- (f) **Bottom openings:** Three possible bottom opening arrangements are proposed, 6.7.2.6.3 (which indicates three serially mounted means of closure), 6.7.2.6.2 (two serially mounted means of closure) or "Not allowed". Bottom openings are not allowed for packing group I and certain packing group II substances which are highly corrosive to steel or aluminium.

- (g) **Filling limits:** Three different filling restrictions are possible. The filling limits are considered operational requirements. The filling limits do not have a direct relationship to the construction of the tank or the arrangement of the service equipment. On this basis, filling limits are not addressed in Section C.2 of these guidelines and will not be included in the tank type designations. The maximum filling limit for a substance should be consistent with the provisions under "Filling" in Chapter 4.2 of the Model Regulations. The consignor of the dangerous goods has the ultimate responsibility for assuring portable tanks are not filled in excess of the specified limits for each substance, solution or mixture transported.
- (h) **Molten substances:** Assignments for molten substances of all classes should be based on the requirements established for liquids of the same class, division, packing group and subsidiary hazard of the molten substance taking into account the hazards posed by the high temperature of the substance during loading, unloading and while in transport (see 4.2.1.19). Specific filling limits apply for molten and elevated temperature substances (see 4.2.1.9.5).

C.2 Guidance for the assignment of portable tank instructions to groups of substances based on class or division, packing group and subsidiary hazard(s)

5. Portable tank instructions apply to dangerous goods of Classes 1 to 9. They provide specific information relevant to portable tanks provisions applicable to specific substances. These tank provisions shall be met in addition to the general provisions of Chapter 4.2 and the general requirements of Chapter 6.7 of the Model Regulations.
6. Each portable tank instruction is identified by an alpha-numeric designation (Tx). Column 10 of the Dangerous Goods List in Chapter 3.2 indicates the portable tank instruction that shall be used for each substance permitted for transport in a portable tank. When no portable tank instruction appears in Column 10 for a specific dangerous goods entry then transport of the substance in portable tanks is not permitted unless a competent authority approval is granted.
7. When a specific portable tank instruction is specified in Column 10 for a specific dangerous goods entry, additional portable tanks with higher test pressures, greater shell thicknesses, more stringent bottom openings and pressure-relief device arrangements may be used, in accordance with the table in 4.2.5.2.5.
8. Some of the portable tank instructions in the T1 to T22 range are currently unused. In other words, there are no substances in the dangerous goods list which have these instructions assigned to them. These portable tank instructions are nevertheless kept in the regulations, as portable tanks can be constructed and marked according to any of these portable tank instructions and used to transport substances with other codes, in accordance with the table in 4.2.5.2.5.
9. For substances of Class 1 and classes 3 to 9, the portable tank instructions indicate the applicable minimum test pressure, the minimum shell thickness (in reference steel), bottom opening requirements and pressure relief requirements.
10. Gases authorized for transport in multiple element gas containers (MEGCs) are indicated in the column "MEGC" in tables 1 and 2 of packing instruction P200.
11. Self-reactive substances of Division 4.1 and Division 5.2 organic peroxides permitted to be transported in portable tanks are listed in T23, along with the applicable control and emergency temperatures.
12. Non-refrigerated liquefied gases are assigned to portable tank instruction T50. T50 provides the maximum allowable working pressures, bottom opening requirements, pressure relief requirements and degree of filling requirements for non-refrigerated liquefied gases permitted for transport in portable tanks.
13. Refrigerated liquefied gases are assigned to portable tank instruction T75.
14. The following guidelines apply to determining the appropriate portable tanks which may be used for transport of particular substances:

Table 4.3: Assignment of portable tank instructions based on class or division, packing group and subsidiary hazard(s)

| Class/ Division | PG | Subsidiary hazard | Tank instruction | Notes |
|------------------------|-----|----------------------|------------------------------------|---|
| 1 | | | T1 | Only UN 0331 or UN 0332 - Explosive, blasting, type B or E (Agent, blasting, type B or E) are authorized for transport in portable tanks. |
| 2.1 | | | T50/T75 | T50 applies to non-refrigerated liquefied flammable gases and to flammable chemicals under pressure (UN 3501, 3504 and 3505). T75 applies to refrigerated liquefied flammable gases. These are evaluated on a case by case basis. |
| 2.2 | | | T50/T75 | T50 applies to non-refrigerated liquefied gases and to chemicals under pressure (UN 3500, 3502 and 3503). T75 applies to refrigerated liquefied gases. These are evaluated on a case by case basis. |
| 2.3 | | | T50 | These are evaluated on a case by case basis. |
| 3 | I | Any other than 6.1/8 | T11 | |
| | II | Any other than 6.1/8 | T4 or T7 ^a | |
| | III | Any other than 6.1/8 | T2 or T4 ^a | |
| 3 | I | 6.1 or 8 | T14 | |
| | II | 6.1 or 8 | T7 or T11 ^a | T10 and T14 ^a apply to chlorosilanes |
| | III | 6.1 or 8 | T4 ^a or T7 ^b | |
| 4.1 | I | Any | | Desensitized explosives of Division 4.1 are not authorized for transport in portable tanks. Only Type F Self-reactive substances are authorized for transport in tanks. These substances are assigned T23. Polymerizing substances are assigned T7. |
| | II | Any | T3 | |
| | III | Any | T1 | |
| 4.2 Liquids | I | Any | T21 | Portable tank instructions are not currently assigned to any liquid self-heating substances |
| | II | Any | | |
| | III | Any | | |
| 4.2 Solids | I | Any | T21 | |
| | II | Any | T3 | |
| | III | Any | T1 | |
| 4.3 Liquids | I | Any other than 6.1/8 | T9 or T13 ^a | |
| | II | Any other than 6.1/8 | T7 | |
| | III | Any other than 6.1/8 | T7 | |
| 4.3 Liquids | I | 6.1 or 8 | T10 or T14 ^a | |
| | II | 6.1 or 8 | T7 or T11 ^a | |
| | III | 6.1 or 8 | T7 | |
| 4.3 Solids | I | Any | T9 | |
| | II | Any | T3 | |
| | III | Any | T1 | |
| 5.1 Liquids | I | Any other than 8 | T10 | |
| | II | Any other than 8 | T4 | |
| | III | Any other than 8 | T4 | |
| 5.1 Liquids | I | 8 | T10 or T14 ^a | Substances with both toxic <i>and</i> corrosive subsidiary hazards are assigned T22. |
| | II | 8 | T7 or T11 ^a | |

| Class/ Division | PG | Subsidiary hazard | Tank instruction | Notes |
|-------------------------|-----|-------------------|---|--|
| | III | 8 | T7 | |
| 5.1 Solids | I | Any | Not allowed | |
| | II | Any | T3 | |
| | III | Any | T1 | |
| 5.2 | | | | Only Type F organic peroxides are authorized for transport in tanks. These substances are assigned T23. |
| 6.1 Liquids (TIH) | I | Any | T20 | This instruction shall be assigned to substances with an LC ₅₀ less than or equal to 1000 ml/m ³ and saturated vapour concentration greater than or equal to 10 LC ₅₀ . |
| | | | T22 | This instruction shall be assigned to substances with an LC ₅₀ less than or equal to 200 ml/m ³ and a saturated vapour concentration greater than or equal to 500 LC ₅₀ . |
| 6.1 Liquids | I | Any | T14 | |
| | II | Any | T7 or T8 ^c or T11 ^a | T14 ^a applies to chlorosilanes |
| | III | Any | T4 or T7 ^a | |
| 6.1 Solids | I | Any | T6 | |
| | II | Any | T3 | |
| | III | Any | T1 | |
| 8 Liquids | I | Any | T10 or T14 ^a or T20 ^d or T22 ^d | |
| | II | Any | T7 or T8 ^c or T11 ^a | T10 and T14 ^a apply to chlorosilanes |
| | III | Any | T4 or T7 ^a | |
| 8 Solids | I | Any | T6 | |
| | II | Any | T3 | |
| | III | Any | T1 | |
| 9 Liquids | II | Any | T4 | Special consideration may need to be given to Class 9 substances based on the substances' properties. |
| | III | Any | T4 | |
| 9 Solids | II | Any | T3 | |
| | III | Any | T1 | |

^a This portable tank instruction shall be assigned to n.o.s. substances and may also be assigned based on the absolute vapour pressure of the substance.

^b This portable tank instruction shall be assigned to n.o.s. substances with a Division 6.1 subsidiary hazard.

^c This portable tank instruction shall be assigned to n.o.s. substances with a Division 6.1 subsidiary hazard.

^d T20 shall be assigned to substances with an LC₅₀ less than or equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC₅₀. T22 shall be assigned to substances with an LC₅₀ less than or equal to 200 ml/m³ and a saturated vapour concentration greater than or equal to 500 LC₅₀.

C.3 Guidelines for assigning portable tank special provisions (TP) to individual substances

14. Portable tank special provisions are assigned to specific dangerous goods in Column 11 of the Dangerous Goods List in Chapter 3.2. They indicate provisions which are in addition or in lieu of those provided by the portable tank instructions or the requirements in Chapter 6.7.

15. Each portable tank special provision is identified by an alpha-numeric designation (TPx). Their assignment should be considered on an individual basis depending on the characteristics of the substances to be transported. A listing of the portable tank special provisions is provided in 4.2.5.3 of the Model Regulations. The following guidance applies:

- TP1:** Applies to liquid substances with a vapour pressure of not more than 175 kPa (1.75 bar) at 65 °C other than substances of Division 6.1 or Class 8 in PG I or II.
- TP2:** Applies to liquid substances with a vapour pressure greater than 175 kPa (1.75 bar) at 65 °C and also to substances of Division 6.1 or Class 8 in PG I or II.
- TP3:** Applies to solids transported above their melting point and to elevated temperature liquids.
- TP4:** Applies to low specific activity and surface contaminated objects radioactive materials authorized for transport in portable tanks, to polymerizing substances (UN Nos. 3531 to 3534), to chemicals under pressure (UN Nos. 3500 to 3505) and to sulphur trioxide, stabilized.
- TP5:** Applies to refrigerated liquefied gases.
- TP6:** Applies to Hydrogen peroxides (UN Nos. 2014, 2015, 2984 and 3149), to polymerizing substances (UN Nos. 3531 to 3534) and to Chloroprene, UN 1991).
- TP7:** Applies to pyrophoric, water reactive and other substances that are reactive with air, water or moisture.
- TP8:** Applies to certain flammable liquids with a flash point greater than 0 °C.
- TP9:** Assigned to substances for which transport in portable tanks is only authorized under an approval granted by the competent authority. It is currently assigned only to UN 3375.
- TP10:** Applies to bromine or bromine solutions.
- TP11:** *[Deleted]*
- TP12:** *[Deleted]*
- TP13:** Applies to substances which are toxic by inhalation.
- TP14:** *[Deleted]*
- TP15:** *[Deleted]*
- TP16:** Applies to ammonium nitrate, liquid (hot concentrated solution).
- TP17:** Applies to blasting explosives and blasting agents of types B or E, ammonium nitrate, liquid (hot concentrated solution), and to ammonium nitrate emulsions, suspensions, or gels.
- TP18:** Applies to stabilized methacrylic acid.
- TP19:** Applies to sulphur dioxide and chlorine.
- TP20:** Applies to ethylene oxide, or ethylene oxide with nitrogen, up to a total pressure of 1 MPa (10 bar) at 50 °C.
- TP21:** Applies to dinitrogen tetroxide and trifluoroacetyl chloride.
- TP22:** Applies to oxidizing refrigerated liquefied gases.
- TP23:** *[Deleted]*
- TP24:** Applies to substances liable to build up excess pressure due to decomposition.
- TP25:** Applies to stabilized sulphur trioxide.

- TP26:** Applies to substances transported in a molten state which react dangerously with water.
- TP27:** Applies when a higher test pressure has been assigned to a substance on the basis of its generic nomenclature, but it can be shown that a test pressure of 4 bar or less is acceptable according to the test pressure definition in 6.7.2.1 for the particular substance transported.
- TP28:** Applies when a higher test pressure has been assigned to a substance on the basis of its generic nomenclature, but it can be shown that a test pressure of 2.65 bar or less is acceptable according to the test pressure definition in 6.7.2.1 for the particular substance transported.
- TP29:** Applies when a higher test pressure has been assigned to a substance on the basis of its generic nomenclature, but it can be shown that a test pressure of 1.5 bar or less is acceptable according to the test pressure definition in 6.7.2.1 for the particular substance transported.
- TP30:** Applies to stabilized methacrylic acid.
- TP31:** Applies to certain substances whose proper shipping name authorizes a solid and a liquid state but whose portable tank instruction and special provisions only apply to the solid state.
- TP32:** Applies to blasting explosives and blasting agents of Division 1.5 of types B or E, and to ammonium nitrate emulsions, suspensions, or gels.
- TP33:** Applies to certain granular and powdered solids, to certain solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass and to solid polymerizing substances.
- TP34:** Applies to hydrogen, refrigerated liquid and helium, refrigerated liquid.
- TP35:** *[Deleted]*
- TP36:** Applies to organometallic substances of Divisions 4.2 and 4.3.
- TP37:** *[Deleted]*
- TP38:** *[Deleted]*
- TP39:** *[Deleted]*
- TP40:** Applies to chemicals under pressure.
- TP41:** Applies to organometallic substances of UN Nos. 3393 to 3399.

D. Use of bulk containers for the transport of solid substances

1. Chapter 4.3 of the Model Regulations contains the provisions addressing the transport of solid substances in bulk containers.
2. Substances allowed to be transported in bulk containers are assigned a bulk container instruction, identified by the alphanumerical code “BKx” in Column 10 of the Dangerous Goods List, with the following meaning:
 - BK1: for transport in sheeted bulk containers
 - BK2: for transport in closed bulk containers
 - BK3: for transport in flexible bulk containers
3. When a substance is not assigned a bulk container code in Column 10 of the Dangerous Goods List, interim approval for transport may be issued by the competent authority of the country of origin. Appropriate

measures should be initiated by the competent authority to include the assignment in the Dangerous Goods List.

4. Substances which may become liquid at temperatures likely to be encountered during transport, are not permitted in bulk containers

5. The following guidance on the assignment of bulk container codes applies:

Table 4.5: Assignment of bulk containers for the transport of solids

| Class or Division | PG | Bulk container type(s) |
|--------------------------|-----------|--|
| 4.1 | II | BK1, BK2 |
| | III | BK1, BK2, BK3 |
| 4.2 | - | Only BK2 are authorized |
| 4.3 | - | Only waterproof BK2 or BK3 containers are authorized |
| 5.1 | II | BK1, BK2 |
| | III | BK1, BK2, BK3 (except for UN 1438 for which BK3 is not authorized) |
| 6.2 | - | BK1, BK2: for animal material containing infectious substances (UN Nos. 2814, 2900 and 3373) |
| | | Only BK2 are authorized for bulk wastes of Division 6.2 (UN 3291) |
| 7 | | Refer to 4.1.9.2.4 of the Model Regulations |
| 8 | | Only BK2 are authorized. An exception to this rule is UN 3244 which is allowed to be transported in leakproof BK1 and BK2 containers. |
| 9 | | Assignment of BK1, BK2 or BK3 containers is determined on an individual basis |

6. Bulk containers for the transport of solid substances and freight containers used as BK1 or BK2 bulk containers shall conform to the design, construction, inspection and testing requirements of Chapter 6.8.

PART 5

CONSIGNMENT PROCEDURES

1. Whenever dangerous goods are offered for transport certain measures should be taken to ensure that the hazards of the dangerous goods being transported are correctly communicated. This has traditionally been accomplished through marking and labelling of packages and by placarding of cargo transport units to indicate the hazards of the dangerous goods and through the inclusion of relevant information in the dangerous goods transport documents. Requirements are in chapters 5.1, 5.2, 5.3, 5.4 and 5.5 of the Model Regulations.
2. The labels illustrated in 5.2.2.2.2 of the Model Regulations should be affixed on dangerous goods or packages containing dangerous goods. The labelling system is based on the classification of dangerous goods and was established with the following aims in mind:
 - (a) To make dangerous goods easily recognizable by the general appearance (symbol, colour and shape) of the labels they bear;
 - (b) To provide a useful first guide for handling, stowage and segregation.
3. In certain cases, where the hazard posed by dangerous goods is considered low, or the dangerous goods are in a limited quantity, exemptions from labelling may be provided (see chapters 3.4 and 3.5 of the Model Regulations). In such cases, marking of packages with the class or division and the packing group number may be required.
4. One of the primary requirements of the dangerous goods transport document is to convey basic hazard information about the dangerous goods being offered for transport. It is recognized that individual national authorities or international organizations may consider it necessary to require additional information. However, the basic items of information considered necessary for each of the dangerous goods offered for transport by any mode are identified in Chapter 5.4 of the Model Regulations.
5. Many consignments of goods are treated for disinfection, cooling or conditioning purposes, with substances that may pose a poisoning or asphyxiation risk during transport, in particular to workers who may be exposed unknowingly when they open cargo transport units. These consignments are subject to special documentation and warning sign requirements that are addressed in the consignment procedures of Part 5 of the Model Regulations.

PART 6

CONSTRUCTION AND TESTING OF PACKAGINGS, INTERMEDIATE BULK CONTAINERS (IBCs), LARGE PACKAGINGS, PORTABLE TANKS, MULTIPLE-ELEMENT GAS CONTAINERS (MEGCs) AND BULK CONTAINERS

Chapter 6.2 - Establishment of transitional periods for standards for UN pressure receptacles, their service equipment and periodic inspection and test

1. When new standards replace existing referenced standards for UN pressure receptacles, their service equipment and periodic inspection and test, the following general principles apply for the establishment of transitional periods:

- (a) When an existing standard is replaced by either a revised version or another standard having the same scope, there shall be a period during which either the new or old standard may be used. This will allow for the issue of new type approvals, the adjustment of procedures and where necessary, the acquisition of new equipment.
- (b) The period shall be expressed by setting a limiting date after which the old standard can no longer be used. The new standard can be used from the date at which the regulations in which they are listed come into force.
- (c) For standards covering the design and manufacture of pressure receptacles and their closures, the limiting date shall normally be set at six years from the close of the biennium in which the new standard was agreed for referencing in the Model Regulations. For example, if a standard is adopted in the 2019/2020 biennium, the standard which it replaces shall have a limiting date of 31 December 2026.

NOTE: Given the time taken to transfer new provisions from the Model Regulations into the international provisions for the air, sea and land modes, it is expected that this will result in an actual transition period of four years.

- (d) For standards covering periodic inspection a limiting date of four years from the end of the biennium of adoption of the new standard shall be set. When the transition period is completed, the old standard shall be deleted.
- (e) If the TDG Sub-Committee believes that the new standard provides a significant improvement in public safety, it may set shorter transition periods.
- (f) A transition period is not envisaged for standards in sub-section 6.2.2.2 concerning materials (ISO 11114, parts 1 and 2 concerning the compatibility of materials with gases) since these provide information and guidance only.
- (g) A transition period shall not be set when a new standard is introduced having a scope not previously covered in section 6.2.2.
- (h) The regulations shall include a statement that UN pressure receptacles constructed according to standards applicable at the date of manufacture may continue in use subject to periodic inspection provisions of the Model Regulations.

Presentation of the transitional periods in the Model Regulations

2. Each table of standards shall have a column at the right showing the date after which the standard shall not be used. In the case of standards for design and manufacture this column shall be headed “Applicable for manufacture”. In the table in the sub-section for Periodic inspection and test, the column shall be headed “Applicable”.

3. Alongside each standard for which a limit date has been set shall appear “Until 31 December 2XYZ”. If no date has been set the words “Until further notice” shall appear.

4. Examples of how the standards shall be listed:

- (a) Example for sub-section 6.2.2.3 Service equipment showing a revised standard adopted in the biennium 2017/2018 (for the 21st revised edition).

| Reference | Title | Applicable for manufacture |
|--------------------------|---|----------------------------|
| ISO 10297:2014 | Gas cylinders – Cylinder valves – Specification and type testing | Until 31 December 2022 |
| ISO 10297:2014 + A1:2017 | Gas cylinders – Cylinder valves – Specification and type testing; | Until further notice |

- (b) Example for sub-section 6.2.2.4 Periodic inspection and test showing a revised standard adopted in the biennium 2017/2018 (for the 21st revised edition).

| Reference | Title | Applicable |
|----------------|--|------------------------|
| ISO 11623:2002 | Transportable gas cylinders – Periodic inspection and testing of composite gas cylinders | Until 31 December 2020 |
| ISO 11623:2015 | Gas cylinders – Composite construction – Periodic inspection and testing | Until further notice |

PART 7

PROVISIONS CONCERNING TRANSPORT OPERATIONS

1. Part 7 is divided into two chapters (7.1 and 7.2)
2. The provisions in Chapter 7.1 are applicable to all modes of transport and include:
 - (a) Requirements for loading and segregation;
 - (b) Special provisions for explosives, gases, self-reactive substances, organic peroxides, for substances stabilized by temperature control other than self-reactive substances and organic peroxides, for Class 6 and for Class 7;
 - (c) Requirements for reporting of accidents or incidents; and
 - (d) Requirements for the retention of dangerous goods transport information.
3. The provisions in Chapter 7.2 are generally mode specific and are in addition to the provisions for all modes in Chapter 7.1. They include:
 - (a) Special provisions for the transport of portable tanks on vehicles;
 - (b) Special provisions for transport of radioactive material by road, rail, vessels and air; and
 - (c) Security provisions for transport by road, rail and inland waterway.
4. It must be emphasized that the provisions in Part 7 are additional requirements to those in other parts of the Model Regulations so that Part 7 cannot be read in isolation nor can it be deemed to contain all the requirements necessary for transporting dangerous goods.