

PART 1

GENERAL PROVISIONS, DEFINITIONS AND TRAINING

CHAPTER 1.1

GENERAL PROVISIONS

Introductory notes

NOTE 1: *Recommendations on Tests and Criteria, which are incorporated by reference into certain provisions of these Regulations are published as a separate Manual (ARecommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria®) (ST/SG/AC.10/11/Rev.3), the contents of which are:*

Part I: Classification procedures, test methods and criteria relating to explosives of Class 1

Part II: Classification procedures, test methods and criteria relating to self-reactive substances of Division 4.1 and organic peroxides of Division 5.2

Part III: Classification procedures, test methods and criteria relating to substances or articles of Class 3, Class 4, Division 5.1 and Class 9.

Appendices: Information common to a number of different types of tests and national contacts for test details.

NOTE 2: *Part III of the Manual of Tests and Criteria contains some classification procedures, test methods and criteria which are also given in these Regulations.*

1.1.1 Scope and application

1.1.1.1 These Regulations prescribe detailed requirements applicable to the transport of dangerous goods. Except as otherwise provided in these Regulations, no person may offer or accept dangerous goods for transport unless those goods are properly classified, packaged, marked, labelled, placarded, described and certified on a transport document, and otherwise in a condition for transport as required by these Regulations.

1.1.1.2 These Regulations do not apply to the transport of:

- (a) Dangerous goods in bulk (except LSA-I and SCO-I material) which, in most countries, are subject to special regulations;
- (b) Dangerous goods that are required for the propulsion of the means of transport or the operation of its specialised equipment during transport (e.g. refrigeration units) or that are required in accordance with the operating regulations (e.g. fire extinguishers); and
- (c) Dangerous goods, packaged for retail sale, that are carried by individuals for their own use.

NOTE 1: *Specific modal provisions for the transport of dangerous goods as well as derogations from these general requirements can be found in the modal regulations.*

NOTE 2: *Certain special provisions of Chapter 3.3 also indicate substances and articles which are not subject to these Regulations.*

1.1.1.3 In certain parts of these Regulations, a particular action is prescribed, but the responsibility for carrying out the action is not specifically assigned to any particular person. Such responsibility may vary according to the laws and customs of different countries and the international conventions into which these countries have entered. For the purposes of these Regulations, it is not necessary to make this assignment, but only to identify the action itself. It remains the prerogative of each government to assign this responsibility.

1.1.1.4 In the transport of dangerous goods, the safety of persons and protection of property and the environment is assured when these Regulations are complied with. Confidence in this regard is achieved through quality assurance and compliance assurance programmes.

1.1.1.5 *Exceptions for dangerous goods packed in limited quantities*

Certain dangerous goods packed in limited quantities are exempted from certain requirements of these regulations subject to the conditions laid down in Chapter 3.4.

1.1.1.6 In accordance with the Universal Postal Union Convention, dangerous goods as defined in these Regulations, with the exception of those listed below, are not permitted in the mail. National postal authorities should ensure that provisions are complied with in relation to the transport of dangerous goods. The following dangerous goods may be acceptable in mail subject to the provisions of the national postal authorities:

- (a) Infectious substances and solid carbon dioxide (dry ice) when used as a refrigerant for infectious substances; and
- (b) Radioactive material in an excepted package conforming to the requirements of 2.7.9.1, the activity of which does not exceed one tenth of that listed in Table 2.7.7.1.2.1.

For international movement by post additional requirements as prescribed by the Acts of the Universal Postal Union apply.

1.1.2 Transport of radioactive material

1.1.2.1 *General*

1.1.2.1.1 These Regulations establish standards of safety which provide an acceptable level of control of the radiation, criticality and thermal hazards to persons, property and the environment that are associated with the transport of radioactive material. These regulations are based on the IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1 (ST-1, Revised)), IAEA, Vienna (2000). Explanatory material on TS-R-1 can be found in Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (1996 Edition)⁹, Safety Standard Series No. ST-2, IAEA, Vienna (to be published).

1.1.2.1.2 The objective of these Regulations is to protect persons, property and the environment from the effects of radiation during the transport of radioactive material. This protection is achieved by requiring:

- (a) Containment of the radioactive contents;
- (b) Control of external radiation levels;
- (c) Prevention of criticality; and
- (d) Prevention of damage caused by heat.

These requirements are satisfied firstly by applying a graded approach to contents limits for packages and conveyances and to performance standards applied to package designs depending upon the hazard of the radioactive contents. Secondly, they are satisfied by imposing requirements on the design and operation of packages and on the maintenance of packagings, including a consideration of the nature of the radioactive

contents. Finally, they are satisfied by requiring administrative controls including, where appropriate, approval by competent authorities.

1.1.2.1.3 These Regulations apply to the transport of radioactive material by all modes on land, water or in the air, including transport which is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with and involved in the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, transport including in-transit storage, unloading and receipt at the final destination of loads of radioactive material and packages. A graded approach is applied to the performance standards in these Regulations that is characterized by three general severity levels:

- (a) Routine conditions of transport (incident free);
- (b) Normal conditions of transport (minor mishaps);
- (c) Accident conditions of transport.

1.1.2.2 *Radiation protection programme*

1.1.2.2.1 The transport of radioactive material shall be subject to a radiation protection programme which shall consist of systematic arrangements aimed at providing adequate consideration of radiation protection measures.

1.1.2.2.2 The nature and extent of the measures to be employed in the programme shall be related to the magnitude and likelihood of radiation exposures. The programme shall incorporate the requirements in 1.1.2.2.3 to 1.1.2.2.5., 7.1.7.1.1, 7.1.7.1.3 and applicable emergency response procedures. Programme documents shall be available, on request, for inspection by the relevant competent authority.

1.1.2.2.3 Protection and safety shall be optimized in order that the magnitude of individual doses, the number of persons exposed, and the likelihood of incurring exposure shall be kept as low as reasonably achievable, economic and social factors being taken into account, and doses to persons shall be below the relevant dose limits. A structured and systematic approach shall be adopted and shall include consideration of the interfaces between transport and other activities.

1.1.2.2.4 Workers shall receive appropriate training concerning the radiation hazards involved and the precautions to be observed in order to ensure restriction of their exposure and that of other persons who might be affected by their actions.

1.1.2.2.5 For occupational exposures arising from transport activities, where it is assessed that the effective dose:

- (a) Is most unlikely to exceed 1 mSv in a year, no special work patterns, detailed monitoring, dose assessment programmes or individual record keeping shall be required;
- (b) Is likely to be between 1 and 6 mSv in a year, a dose assessment programme via workplace monitoring or individual monitoring shall be conducted;
- (c) Is likely to exceed 6 mSv in a year, individual monitoring shall be conducted.

When individual monitoring or workplace monitoring is conducted, appropriate records shall be kept.

1.1.2.3 *Quality assurance*

1.1.2.3.1 Quality assurance programmes based on international, national or other standards acceptable to the competent authority shall be established and implemented for the design, manufacture, testing, documentation, use, maintenance and inspection of all special form radioactive material, low dispersible radioactive material

and packages and for transport and in-transit storage operations to ensure compliance with the relevant provisions of these Regulations. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared to provide facilities for competent authority inspection during manufacture and use and to demonstrate to any cognizant competent authority that:

- (a) The manufacturing methods and materials used are in accordance with the approved design specifications; and
- (b) All packagings are periodically inspected and, as necessary, repaired and maintained in good condition so that they continue to comply with all relevant requirements and specifications, even after repeated use.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the quality assurance programme.

1.1.2.4 *Special arrangement*

1.1.2.4.1 Special arrangement shall mean those provisions, approved by the competent authority, under which consignments which do not satisfy all the requirements of these Regulations applicable to radioactive material may be transported.

1.1.2.4.2 Consignments for which conformity with any provision applicable to Class 7 is impracticable shall not be transported except under special arrangement. Provided the competent authority is satisfied that conformity with the Class 7 provisions of these Regulations is impracticable and that the requisite standards of safety established by these Regulations have been demonstrated through alternative means the competent authority may approve special arrangement transport operations for single or a planned series of multiple consignments. The overall level of safety in transport shall be at least equivalent to that which would be provided if all the applicable requirements had been met. For international consignments of this type, multilateral approval shall be required.

1.1.2.5 *Radioactive material possessing other dangerous properties*

1.1.2.5.1 In addition to the radioactive and fissile properties, any subsidiary risk of the contents of a package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall also be taken into account in the documentation, packing, labelling, marking, placarding, stowage, segregation and transport, in order to be in compliance with all relevant provisions for dangerous goods of these regulations.

1.1.3 *Dangerous goods forbidden from transport*

1.1.3.1 Unless provided otherwise by these Regulations, the following are forbidden from transport:

Any substance or article which, as presented for transport, is liable to explode, dangerously react, produce a flame or dangerous evolution of heat or dangerous emission of toxic, corrosive or flammable gases or vapours under normal conditions normally encountered in transport.

CHAPTER 1.2

DEFINITIONS AND UNITS OF MEASUREMENT

Introductory note

NOTE: Scope of definitions

This Chapter provides definitions of general applicability that are used throughout these Regulations. Additional definitions of a highly specific nature (e.g., terms relating to construction of intermediate bulk containers or portable tanks) are presented in the relevant chapters.

1.2.1 Definitions

For the purposes of these Regulations:

Aerosols or aerosol dispensers are non-refillable receptacles meeting the requirements of 6.2.4, made of metal, glass or plastics and containing a gas, compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid state or in a gaseous state;

Aircraft

Cargo aircraft means any aircraft, other than a passenger aircraft, which is carrying goods or property;

Passenger aircraft means an aircraft that carries any person other than a crew member, a carrier's employee in an official capacity, an authorized representative of an appropriate national authority, or a person accompanying a consignment or other cargo;

Alternative arrangement means an approval granted by the competent authority for a portable tank or MEGC that has been designed, constructed or tested to technical requirements or testing methods other than those specified in these regulations (see, for instance, 6.7.5.11.1);

Bags are flexible packagings made of paper, plastics film, textiles, woven material or other suitable materials;

Boxes are packagings with complete rectangular or polygonal faces, made of metal, wood, plywood, reconstituted wood, fibreboard, plastics or other suitable material. Small holes for purposes such as ease of handling or opening, or to meet classification requirements, are permitted as long as they do not compromise the integrity of the packaging during transport;

Bundles of cylinders are assemblies of cylinders that are fastened together and which are interconnected by a manifold and transported as a unit. The total water capacity shall not exceed 3000 litres except that bundles intended for the transport of gases of Division 2.3 shall be limited to 1000 litres water capacity;

Carrier means any person, organization or government undertaking the transport of dangerous goods by any means of transport. The term includes both carriers for hire or reward (known as common or contract carriers in some countries) and carriers on own account (known as private carriers in some countries);

Closures are devices which close an opening in a receptacle;

Combination packagings are a combination of packagings for transport purposes, consisting of one or more inner packagings secured in an outer packaging in accordance with 4.1.1.5;

Competent authority means any national body or authority designated or otherwise recognized as such for any purpose in connection with these Regulations;

Compliance assurance means a systematic programme of measures applied by a competent authority which is aimed at ensuring that the provisions of these Regulations are met in practice;

Composite packagings are packagings consisting of an outer packaging and an inner receptacle so constructed that the inner receptacle and the outer packaging form an integral packaging. Once assembled it remains thereafter an integrated single unit; it is filled, stored, transported and emptied as such;

Consignee means any person, organization or government which is entitled to take delivery of a consignment;

Consignment means any package or packages, or load of dangerous goods, presented by a consignor for transport;

Consignor means any person, organization or government which prepares a consignment for transport;

Conveyance means

- (a) For transport by road or rail: any vehicle;
- (b) For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel; and
- (c) For transport by air: any aircraft;

Crates are outer packagings with incomplete surfaces;

Critical temperature is the temperature above which the substance cannot exist in the liquid state;

Cryogenic receptacles are transportable thermally insulated receptacles for refrigerated liquefied gases, of a water capacity of not more than 1000 litres;

Cylinders are transportable pressure receptacles of a water capacity not exceeding 150 litres;

Defined deck area means the area of the weather deck of a vessel, or of a vehicle deck of a roll-on/roll-off ship or a ferry, which is allocated for the stowage of dangerous goods;

Drums are flat-ended or convex-ended cylindrical packagings made of metal, fibreboard, plastics, plywood or other suitable materials. This definition also includes packagings of other shapes e.g. round taper-necked packagings, or pail-shaped packagings. Wooden barrels or jerricans are not covered by this definition;

Filling ratio is the ratio of the mass of gas to the mass of water at 15°C that would fill completely a pressure receptacle fitted ready for use;

Inspection body is an independent inspection and testing body approved by the competent authority;

Intermediate Bulk Containers (IBCs)

IBCs are rigid or flexible portable packagings, other than those specified in Chapter 6.1, that:

- (a) Have a capacity of:
 - (i) not more than 3.0 m³ (3,000 litres) for solids and liquids of packing groups II and III;
 - (ii) not more than 1.5 m³ for solids of packing group I when packed in flexible, rigid plastics, composite, fibreboard and wooden IBCs;
 - (iii) not more than 3.0 m³ for solids of packing group I when packed in metal IBCs;
 - (iv) not more than 3.0 m³ for radioactive material of Class 7;
- (b) Are designed for mechanical handling;
- (c) Are resistant to the stresses produced in handling and transport, as determined by tests;

Remanufactured IBCs are metal, rigid plastics or composite IBCs that:

- (a) are produced as a UN type from a non-UN type; or
- (b) are converted from one UN design type to another UN design type.

Remanufactured IBCs are subject to the same requirements of these Regulations that apply to new IBCs of the same type (see also design type definition in 6.5.4.1.1).

Repaired IBCs are metal, rigid plastics or composite IBCs that, as a result of impact or for any other cause (e.g. corrosion, embrittlement or other evidence of reduced strength as compared to the design type) are restored so as to conform to the design type and to be able to withstand the design type tests. For the purposes of these Regulations, the replacement of the rigid inner receptacle of a composite IBC with a receptacle conforming to the original manufacturer's specification is considered repair. However, routine maintenance of IBCs (see definition below) is not considered repair. The bodies of rigid plastics IBCs and the inner receptacles of composite IBCs are not repairable.

Routine maintenance of IBCs is the routine performance on metal, rigid plastics or composite IBCs of operations such as:

- (a) Cleaning;
- (b) Removal and reinstallation or replacement of body closures (including associated gaskets), or of service equipment, conforming to the original manufacturer's specifications, provided that the leaktightness of the IBC is verified; or
- (c) Restoration of structural equipment not directly performing a dangerous goods containment or discharge pressure retention function so as to conform to the design type (e.g. the straightening of legs or lifting attachments) provided that the containment function of the IBC is not affected.

Inner packagings are packagings for which an outer packaging is required for transport;

Inner receptacles are receptacles which require an outer packaging in order to perform their containment function;

Intermediate packagings are packagings placed between inner packagings, or articles, and an outer packaging;

Jerricans are metal or plastics packagings of rectangular or polygonal cross-section;

Large packagings are packagings consisting of an outer packaging which contains articles or inner packagings and which

- (a) Are designed for mechanical handling; and
- (b) Exceed 400 kg net mass or 450 litres capacity but have a volume of not more than 3 m³;

Liner means a separate tube or bag inserted into a packaging, (including IBCs and large packagings) but not forming an integral part of it, including the closures of its openings;

Liquids are dangerous goods which at 50 °C have a vapour pressure of not more than 300 kPa (3 bar), which are not completely gaseous at 20 °C and at a pressure of 101.3 kPa, and which have a melting point or initial melting point of 20 °C or less at a pressure of 101.3 kPa. A viscous substance for which a specific melting point cannot be determined shall be subjected to the ASTM D 4359-90 test; or to the test for determining fluidity (penetrometer test) prescribed in section 2.3.4 of Annex A of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)¹.

Manual of Tests and Criteria is the third revised edition of the United Nations publication entitled "*Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*" (ST/SG/AC.10/11/Rev.3);

Maximum capacity as used in 6.1.4 is the maximum inner volume of receptacles or packagings expressed in litres;

Maximum net mass is the maximum net mass of contents in a single packaging or maximum combined mass of inner packagings and the contents thereof and is expressed in kg;

Multiple-element gas containers (MEGCs) are multimodal assemblies of cylinders, tubes and bundles of cylinders which are interconnected by a manifold and which are assembled within a framework. The MEGC includes service equipment and structural equipment necessary for the transport of gases;

Outer packaging is the outer protection of a composite or combination packaging together with any absorbent materials, cushioning and any other components necessary to contain and protect inner receptacles or inner packagings;

Overpack means an enclosure used by a single consignor to contain one or more packages and to form one unit for convenience of handling and stowage during transport. Examples of overpacks are a number of packages either:

- (a) Placed or stacked on to a load board such as a pallet and secured by strapping, shrink wrapping, stretch wrapping, or other suitable means; or
- (b) Placed in a protective outer packaging such as a box or crate;

Packages are the complete product of the packing operation, consisting of the packaging and its contents prepared for transport;

NOTE: For radioactive material, see 2.7.2.

¹ United Nations publication: [ECE/TRANS/140].

Packagings are receptacles and any other components or materials necessary for the receptacle to perform its containment function;

NOTE: For radioactive material, see 2.7.2.

Portable tank means:

- (a) For the purposes of the transport of substances of Classes 3 to 9, a multimodal portable tank having a capacity of more than 450 litres. It includes a shell fitted with service equipment and structural equipment necessary for the transport of dangerous substances;
- (b) For the purposes of transport of non-refrigerated, liquefied gases of Class 2, a multimodal tank having a capacity of more than 450 litres. It includes a shell fitted with service equipment and structural equipment necessary for the transport of gases;
- (c) For the purposes of transport of refrigerated liquefied gases, a thermally insulated tank having a capacity of more than 450 litres fitted with service equipment and structural equipment necessary for the transport of refrigerated liquefied gases;

The portable tank shall be capable of being loaded and discharged without the need of removal of its structural equipment. It shall possess stabilizing members external to the shell, and shall be capable of being lifted when full. It shall be designed primarily to be loaded on to a transport vehicle or ship and is equipped with skids, mountings or accessories to facilitate mechanical handling. Road tank-vehicles, rail tank-wagons, non-metallic tanks, gas cylinders, large receptacles, and intermediate bulk containers (IBCs) are not considered to fall within this definition;

Pressure drums are welded transportable pressure receptacles of a water capacity exceeding 150 litres and of not more than 1000 litres, (e.g. cylindrical receptacles equipped with rolling hoops, spheres on skids);

Pressure receptacles is a collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles and bundles of cylinders;

Quality assurance means a systematic programme of controls and inspections applied by any organization or body which is aimed at providing adequate confidence that the standard of safety prescribed in these Regulations is achieved in practice;

Receptacles are containment vessels for receiving and holding substances or articles, including any means of closing;

Reconditioned packagings include:

- (a) Metal drums that:
 - (i) are cleaned to original materials of construction, with all former contents, internal and external corrosion, and external coatings and labels removed;
 - (ii) are restored to original shape and contour, with chimes (if any) straightened and sealed, and all non-integral gaskets replaced; and
 - (iii) are inspected after cleaning but before painting, with rejection of packagings with visible pitting, significant reduction in material thickness, metal fatigue, damage threads or closures, or other significant defects; or

- (b) Plastics drums and jerricans that:
 - (i) are cleaned to original materials of construction, with all former contents, external coatings and labels removed;
 - (ii) have all non-integral gaskets replaced; and
 - (iii) are inspected after cleaning with rejection of packagings with visible damage such as tears, creases or cracks, or damaged threads, or closures, or other significant defects;

Recycled plastics material means material recovered from used industrial packagings that has been cleaned and prepared for processing into new packagings. The specific properties of the recycled material used for production of new packagings shall be assured and documented regularly as part of a quality assurance programme recognized by the competent authority. The quality assurance programme shall include a record of proper pre-sorting and verification that each batch of recycled plastics material has the proper melt flow rate, density, and tensile yield strength, consistent with that of the design type manufactured from such recycled material. This necessarily includes knowledge about the packaging material from which the recycled plastics have been derived, as well as awareness of the prior contents of those packagings if those prior contents might reduce the capability of new packagings produced using that material. In addition, the packaging manufacturer's quality assurance programme under 6.1.1.4 shall include performance of the mechanical design type test in 6.1.5 on packagings manufactured from each batch of recycled plastics material. In this testing, stacking performance may be verified by appropriate dynamic compression testing rather than static load testing;

Remanufactured IBCs (see "*Intermediate Bulk Containers (IBCs)*")

Remanufactured packagings include:

- (a) Metal drums that:
 - (i) are produced as a UN type from a non-UN type;
 - (ii) are converted from one UN type to another UN type; or
 - (iii) undergo the replacement of integral structural components (such as non-removable heads); or
- (b) Plastics drums that:
 - (i) are converted from one UN type to another UN type (e.g. 1H1 to 1H2); or
 - (ii) undergo the replacement of integral structural components;

Remanufactured drums are subject to the same requirements of these Regulations that apply to a new drum of the same type;

Repaired IBCs (see "*Intermediate Bulk Containers (IBCs)*")

Reused packagings are packagings to be refilled which have been examined and found free of defects affecting the ability to withstand the performance tests: the term includes those which are refilled with the same or similar compatible contents and are transported within distribution chains controlled by the consignor of the product;

Routine Maintenance of IBCs (see "*Intermediate Bulk Containers (IBCs)*")

Salvage packagings are special packagings into which damaged, defective, leaking or non-conforming dangerous goods packages, or dangerous goods that have spilled or leaked, are placed for purposes of transport for recovery or disposal;

Settled pressure is the pressure of the contents of a pressure receptacle in thermal and diffusive equilibrium;

Shipment means the specific movement of a consignment from origin to destination;

Siftproof packagings are packagings impermeable to dry contents including fine solid material produced during transport;

Solids are dangerous goods, other than gases, that do not meet the definition of *liquids* in this paragraph;

Tank means a portable tank (see 6.7.2.1) including a tank container, a road tank vehicle, a rail tank wagon or a receptacle with a capacity of not less than 450 litres to contain solids, liquids, or gases;

Test pressure is the required pressure applied during a pressure test for qualification or requalification;

Tubes are seamless transportable pressure receptacles of a water capacity exceeding 150 litres but not more than 3000 litres;

Vehicle means a road vehicle (including an articulated vehicle, i.e. a tractor and semi-trailer combination), railroad car or railway wagon. Each trailer shall be considered as a separate vehicle;

Vessel means any seagoing vessel or inland waterway craft used for carrying cargo;

Wooden barrels are packagings made of natural wood, of round cross-section, having convex walls, consisting of staves and heads and fitted with hoops.

Working pressure is the settled pressure of a compressed gas at a reference temperature of 15 °C in a full pressure receptacle;

Clarifying examples for certain defined terms

The following explanations and examples are meant to assist in clarifying the use of the some of the packaging terms defined in this section.

The definitions in this section are consistent with the use of the defined terms throughout the Regulations. However, some of the defined terms are commonly used in other ways. This is particularly evident in respect of the term "inner receptacle" which has often been used to describe the "inners" of a combination packaging.

The "inners" of "combination packagings" are always termed "inner packagings" not "inner receptacles". A glass bottle is an example of such an "inner packaging".

The "inners" of "composite packagings" are normally termed "inner receptacles". For example, the "inner" of a 6HA1 composite packaging (plastics material) is such an "inner receptacle" since it is normally not designed to perform a containment function without its "outer packaging" and is not therefore an "inner packaging".

1.2.2 Units of measurement

1.2.2.1 The following units of measurement a/ are applicable in these Regulations:

Measurement of	SI Unit <u>b/</u>	Acceptable alternative unit	Relationship between units
Length	m (metre)	--	--
Area	m ² (square metre)	--	--
Volume	m ³ (cubic metre)	l <u>c/</u> (litre)	1 l = 10 ⁻³ m ³
Time	s (second)	min (minute)	1 min = 60 s
		h (hour)	1 h = 3 600 s
		d (day)	1 d = 86 400 s
		g (gramme)	1 g = 10 ⁻³ kg
Mass	kg (kilogramme)	t (ton)	1 t = 10 ³ kg
		kg/m ³	1 kg/l = 10 ³ kg/m ³
Mass density		kg/l	
Temperature	K (kelvin)	°C (degree Celsius)	0 °C = 273.15 K
Difference of temperature	K (kelvin)	°C "	1 °C = 1 K
Force	N (newton)	--	1 N = 1 kg · m/s ²
Pressure	Pa (pascal)	bar (bar)	1 bar = 10 ⁵ Pa
			1 Pa = 1 N/m ²
			1 N/mm ² = 1 MPa
Stress	N/m ²	N/mm ²	1 N/mm ² = 1 MPa
Work)	kWh (kilowatt hour)	1 kWh = 3.6 MJ
Energy)		
)		
Quantity of heat)		
)		
Power	J (joule)		1 J = 1 N · m = 1 W · s
		eV (electronvolt)	1 eV = 0.1602 × 10 ⁻¹⁸ J
Power	W (watt)	--	1 W = 1 J/s = 1 N · m/s
Kinematic viscosity	m ² /s	mm ² /s	1 mm ² /s = 10 ⁻⁶ m ² /s
Dynamic viscosity	Pa · s	mPa · s	1 mPa · s = 10 ⁻³ Pa · s
Activity	Bq (becquerel)		
Dose equivalent	Sv (sievert)		

Notes to 1.2.2.1:

a/ The following round figures are applicable for the conversion of the units hitherto used into SI Units.

Force

$$1 \text{ kg} = 9.807 \text{ N}$$

$$1 \text{ N} = 0.102 \text{ kg}$$

Stress

$$1 \text{ kg/mm}^2 = 9.807 \text{ N/mm}^2$$

$$1 \text{ N/mm}^2 = 0.102 \text{ kg/mm}^2$$

Pressure

$$1 \text{ Pa} = 1 \text{ N/m}^2 = 10^{-5} \text{ bar} = 1.02 \times 10^{-5} \text{ kg/cm}^2 = 0.75 \times 10^{-2} \text{ torr}$$

$$1 \text{ bar} = 10^5 \text{ Pa} = 1.02 \text{ kg/cm}^2 = 750 \text{ torr}$$

$$1 \text{ kg/cm}^2 = 9.807 \times 10^4 \text{ Pa} = 0.9807 \text{ bar} = 736 \text{ torr}$$

$$1 \text{ torr} = 1.33 \times 10^2 \text{ Pa} = 1.33 \times 10^{-3} \text{ bar} = 1.36 \times 10^{-3} \text{ kg/cm}^2$$

Energy, Work, Quantity of heat

$$1 \text{ J} = 1 \text{ Nm} = 0.278 \times 10^{-6} \text{ kWh} = 0.102 \text{ kgm} = 0.239 \times 10^{-3} \text{ kcal}$$

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J} = 367 \times 10^3 \text{ kgm} = 860 \text{ kcal}$$

$$1 \text{ kgm} = 9.807 \text{ J} = 2.72 \times 10^{-6} \text{ kWh} = 2.34 \times 10^{-3} \text{ kcal}$$

$$1 \text{ kcal} = 4.19 \times 10^3 \text{ J} = 1.16 \times 10^{-3} \text{ kWh} = 427 \text{ kgm}$$

Power

Kinematic viscosity

$$1 \text{ W} = 0.102 \text{ kgm/s} = 0.86 \text{ kcal/h} \quad 1 \text{ m}^2/\text{s} = 10^4 \text{ St (Stokes)}$$

$$1 \text{ kgm/s} = 9.807 \text{ W} = 8.43 \text{ kcal/h} \quad 1 \text{ St} = 10^{-4} \text{ m}^2/\text{s}$$

$$1 \text{ kcal/h} = 1.16 \text{ W} = 0.119 \text{ kgm/s}$$

Dynamic viscosity

$$1 \text{ Pa} \cdot \text{s} = 1 \text{ Ns/m}^2 = 10 \text{ P (poise)} = 0.102 \text{ kgs/m}^2$$

$$1 \text{ P} = 0.1 \text{ Pa} \cdot \text{s} = 0.1 \text{ Ns/m}^2 = 1.02 \times 10^{-2} \text{ kgs/m}^2$$

$$1 \text{ kgs/m}^2 = 9.807 \text{ Pa} \cdot \text{s} = 9.807 \text{ Ns/m}^2 = 98.07 \text{ P}$$

b/ The International System of Units (SI) is the result of decisions taken at the General Conference on Weights and Measures (Address: Pavillon de Breteuil, Parc de St-Cloud, F-92 310 Sèvres).

c/ The abbreviation "L" for litre may also be used in place of the abbreviation "l" when a typewriter cannot distinguish between figure "1" and letter "l".

The decimal multiples and sub-multiples of a unit may be formed by prefixes or symbols, having the following meanings, placed before the name or symbol of the unit:

<u>Factor</u>			<u>Prefix</u>	<u>Symbol</u>
1 000 000 000 000 000 000	= 10^{18}	quintillion	exa	E
1 000 000 000 000 000	= 10^{15}	quadrillion	peta	P
1 000 000 000 000	= 10^{12}	trillion	tera	T
1 000 000 000	= 10^9	billion	giga	G
1 000 000	= 10^6	million	mega	M
1 000	= 10^3	thousand	kilo	k
100	= 10^2	hundred	hecto	h
10	= 10^1	ten	deca	da
0.1	= 10^{-1}	tenth	deci	d
0.01	= 10^{-2}	hundredth	centi	c
0.001	= 10^{-3}	thousandth	milli	m
0.000 001	= 10^{-6}	millionth	micro	μ
0.000 000 001	= 10^{-9}	billionth	nano	n
0.000 000 000 001	= 10^{-12}	trillionth	pico	p
0.000 000 000 000 001	= 10^{-15}	quadrillionth	femto	f
0.000 000 000 000 000 001	= 10^{-18}	quintillionth	atto	a

NOTE: $10^9 = 1$ billion is United Nations usage in English. By analogy, so is $10^9 = 1$ billionth.

1.2.2.2 Whenever the word "weight" is used, it means "mass".

1.2.2.3 Whenever the weight of a package is mentioned, the gross mass is meant unless otherwise stated. The mass of containers or tanks used for the transport of goods is not included in the gross mass.

1.2.2.4 Unless expressly stated otherwise, the sign "%" 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 mass based on the total mass of the mixture, the solution or the wetted solid;
- (b) In the case of mixtures of compressed gases: when filled by pressure, the proportion of the volume indicated as a percentage of the total volume of the gaseous mixture, or, when filled by mass, the proportion of the mass indicated as a percentage of the total mass of the mixture.

In the case of mixtures of liquefied gases and gases dissolved under pressure: the proportion of the mass indicated as a percentage of the total mass of the mixture.

1.2.2.5 Pressures of all kinds relating to receptacles (such as test pressure, internal pressure, safety-valve opening pressure) are always indicated in gauge pressure (pressure in excess of atmospheric pressure); however, the vapour pressure of substances is always expressed in absolute pressure.

CHAPTER 1.3

TRAINING

1.3.1 Persons engaged in the transport of dangerous goods shall receive training in the contents of dangerous goods requirements commensurate with their responsibilities.

1.3.2 Individuals such as those who classify dangerous goods; pack dangerous goods; mark and label dangerous goods; prepare transport documents for dangerous goods; offer or accept dangerous goods for transport; carry or handle dangerous goods in transport; mark or placard or load or unload packages of dangerous goods into or from transport vehicles, bulk packagings or freight containers; or are otherwise directly involved in the transport of dangerous goods as determined by the competent authority; shall receive the following training:

- (a) *General awareness/familiarization training:*
 - (i) Each person shall receive training designed to provide familiarity with the general provisions of dangerous goods transport requirements;
 - (ii) Such training shall include a description of the classes of dangerous goods; labelling, marking, placarding and packaging, segregation and compatibility requirements; a description of the purpose and content of the dangerous goods transport document; and a description of available emergency response documents;
- (b) *Function-specific training:* Each person shall receive detailed training concerning specific dangerous goods transport requirements which are applicable to the function that person performs;
- (c) *Safety training:* Commensurate with the risk of exposure in the event of a release and the functions performed, each person shall receive training on:
 - (i) Methods and procedures for accident avoidance, such as proper use of package-handling equipment and appropriate methods of stowage of dangerous goods;
 - (ii) Available emergency response information and how to use it;
 - (iii) General dangers presented by the various classes of dangerous goods and how to prevent exposure to those hazards, including if appropriate the use of personal protective clothing and equipment; and
 - (iv) Immediate procedures to be followed in the event of an unintentional release of dangerous goods, including any emergency response procedures for which the person is responsible and personal protection procedures to be followed.

1.3.3 The training required by 1.3.2 shall be provided or verified upon employment in a position involving dangerous goods transport and shall be periodically supplemented with retraining as deemed appropriate by the competent authority.

