DEAS 951: 2019

ICS 67.160.10

DRAFT EAST AFRICAN STANDARD

Transport of dangerous goods — Packaging for road and rail transport

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EAST AFRICAN COMMUNITY

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Foreword

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

In order to achieve this objective, the Community established an East African Standards Committee mandated to develop and issue East African Standards.

The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

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

EAS was prepared by Technical Committee EASC/TC

Transport of dangerous goods — Packaging for road and rail transport

1 Scope

1.1 This draft East African Standard identifies various methods of packaging that are suitable for prescribed maximum quantities of dangerous goods that may be offered for transport by road or by rail.

1.2 It specifies minimum performance requirements for the packaging,

1.3 It prescribes procedures to be followed to obtain packaging approval

1.4 it specifies marks, labels and placards to be displayed on the packaging

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies..

2.1 Standards

ASTM D 4359, *Standard test method for determining whether a material is a liquid or a solid*

ISO 535, *Paper and board – Determination of water absorptiveness – Cobb method*

ISO 2919, *Radiation protection – Sealed radioactive sources – General requirements and classification*

ISO 3573, *Hot-rolled carbon steel sheet of commercial and drawing qualities*

ISO 3574, *Cold-reduced carbon steel sheet of commercial and drawing qualities*

ISO 3807-1, *Cylinders for acetylene – Basic requirements – Part 1: Cylinders without fusible plugs*

ISO 3807-2, *Cylinders for acetylene – Basic requirements – Part 2: Cylinders with fusible plugs*

ISO 6406, *Periodic inspection and testing of seamless steel gas cylinders*

ISO 7195, *Packaging of uranium hexafluoride (UF6) for transport*

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ISO 7866, *Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing*

ISO 9978, *Radiation protection – Sealed radioactive sources – Leakage test methods*

ISO 10297, *Gas cylinders – Refillable gas cylinder valves – Specification and type testing*

ISO 10461, *Seamless aluminium-alloy gas cylinders – Periodic inspection and testing*

ISO 10462, *Cylinders for dissolved acetylene – Periodic inspection and maintenance*

ISO 11114-1, *Transportable gas cylinders – Compatibility of cylinder and valve material with gas contents – Part 1: Metallic materials*

ISO 11114-2, *Transportable gas cylinders – Compatibility of cylinder and valve material with gas contents – Part 2: Non-metallic materials*

ISO 11621, *Gas cylinders – Procedures for change of gas service*

ISO 11623, *Transportable gas cylinders – Periodic inspection and testing of composite gas cylinders*

ISO 11949, *Cold-reduced electrolytic tinplate*

ISO 11950, *Cold-reduced electrolytic chromium/chromium oxide-coated steel*

ISO 11951, *Cold-reduced blackplate in coil form for the production of tinplate or electrolytic chromium/chromium oxide-coated steel*
DEAS 949:2019, *The identification and classification of dangerous goods for transport*

DEAS 952-1:2019, *Transport of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transport*

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards; General Safety Requirements Part 3; No. GSR Part 3

NOTE Explanatory material on the 2005 edition of TS-R-1 can be found in the *Advisory material for the IAEA Regulations for the safe transport of radioactive material, Safety standards series No. TS-G-1.1 (ST-2) IAEA.* Vienna, 2007

Regulations for the Safe Transport of Radioactive MateriaL, Specific Safety Requirements; No. SSR-6 , 2018 Edition

Recommendations on the transport of dangerous goods, Manual of Tests and Criteria, Sixth revised edition

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

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3 Terms and definitions

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

3.1 Definitions

3.1.1
accredited laboratory
laboratory accredited by the national laboratory accreditation authority

3.1.2
activity
amount of a radionuclide in a particular energy state at a given time
NOTE Activity is quantified as the excepted number of spontaneous nuclear transitions from that energy state in a unit time.

3.1.3
ambient temperature
air temperature of an environment or object

3.1.4
bag
flexible packaging made of paper, plastics film, textiles, woven material or other similar material

3.1.5
box
packaging that has complete rectangular or polygonal faces made of metal, wood, plywood, reconstituted wood, fibreboard, plastics or other similar material

3.1.6
bulk container
containment system (including any liner or coating) intended for the transport of solid substances which is in direct contact with the containment system and is

a) of a permanent character and strong enough to be suitable for repeated use,

b) specially designed to facilitate the transport of goods by one or more means of transport without intermediate reloading,

c) fitted with devices permitting its ready handling, and

d) of capacity of not less than 1.0 m^3

NOTE 1 Packagings, intermediate bulk containers (IBCs), large packagings and portable tanks are not included.

NOTE 2 Examples of bulk containers are freight containers, off-shore bulk containers, skips, bulk bins, swap bodies, trough-shaped containers, roller containers and load compartments of vehicles.

3.1.7
bundle of cylinders
assembly of cylinders that are fastened together and which are interconnected by a manifold and transported as one unit

NOTE 1 The total water capacity of a bundle of cylinders intended for the transport of toxic gases of division 2.3 should not exceed 1 000 L.

NOTE 2 The total water capacity of a bundle of cylinders intended for the transport of flammable gases of division 2.1 and of non-flammable, non-toxic gases of division 2.2 should not exceed 3 000 L.

3.1.8
closure
device that closes an opening in a receptacle

3.1.9
combination packaging

packaging that consists of one or more inner packaging secured in an outer packaging

3.1.10
competent authority
national body or authority designated or otherwise recognized for the control or regulation of a particular aspect of the transport of dangerous goods

3.1.11
composite packaging
packaging that consists of outer packaging and at least one inner receptacle and that is so constructed that the component parts form an integral unit

NOTE Once assembled, composite packaging remains as a single unit and is filled, stored, transported and emptied as such.

3.1.12
consignee
any person, organization or government that accepts dangerous goods that have been transported in a vehicle in accordance with the relevant national legislation, provisions and requirements, or any other regulatory requirements of the relevant regional governments

3.1.13
consignment
any package or packages, or load of dangerous goods, presented by a consignor for transport

3.1.14
consignor
any person, organization or government that prepares or offers dangerous goods for transport in a vehicle in accordance with the relevant national legislation, or any other regulatory requirements of the relevant provincial and local governments

3.1.15
crate
outer packaging with incomplete sides

3.1.16
cryogenic receptacle
thermally insulated receptacle for refrigerated liquefied gas of a water capacity not exceeding 1 000 L

3.1.17
cylinder
pressure receptacle of a water capacity not exceeding 150 L

3.1.18
dangerous goods
goods that are capable of posing a significant risk to health and safety or to property and the environment and that are listed in B.2 and annex C DEAS 949:2019

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

3.1.19
design type packaging
packaging design type (samples of which are presented for testing) as defined by its design, size, material(s), thickness, mass and surface treatment(s), and the method(s) by which it is produced

3.1.20
drum
flat-ended or convex-ended cylindrical packaging made of metal, fibreboard, plastics, plywood or other similar material

NOTE The term "drum" also includes packaging of other shapes, for example round, taper-necked packaging or round, pail-shaped packaging. Wooden barrels or jerricans are not covered by this term.

3.1.21
exclusive use (radioactive material)
transport of radioactive material in respect of which all initial, intermediate, and final loading and unloading is carried out in accordance with the directions of the consignor or consignee

3.1.22
filling ratio
ratio of the mass of gas to the mass of water at 15 °C that would completely fill a pressure receptacle fitted ready for use

3.1.23
gas
state of matter that is characterized by very low density and viscosity (relative to liquids and solids), comparatively great expansion and contraction with changes in pressure and temperature, the ability to diffuse readily into other gases, and the ability to occupy with almost complete uniformity the whole of any container

3.1.24
hermetically sealed
closed with a gas-tight and vapour-tight closure

3.1.25
inner packaging
packaging that requires outer packaging for transport purposes

NOTE The term applies to packaging intended for use in combination packaging.

3.1.26
inner receptacle
receptacle that requires an outer packaging in order to perform its containment function

NOTE The term applies to packaging intended for use in composite packaging.

3.1.27
jerrican
metal or plastics packaging of rectangular or polygonal cross-section

3.1.28
liquid
substance that has a vapour pressure of not more than 300 kPa at 50 °C and which is not completely gaseous at 20 °C or less at a pressure of 101.3 kPa

3.1.29
maximum capacity
maximum inner volume of a receptacle or a packaging, expressed in litres

3.1.30
maximum net mass
maximum net mass of contents in a single packaging or the combined mass of inner packaging and the contents thereof, expressed in kilograms

3.1.31
multiple-element gas containers (MEGCs)
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

3.1.32
outer packaging
outer protection of composite or combination packaging, together with any absorbent material, cushioning and other components necessary to contain and protect inner receptacles or inner packaging

3.1.33
over pack
enclosure used by a single consignor to contain one or more packages to form one unit for convenience of handling and stowage during transport

NOTE 1 Examples of over packs are a number of packages that are

a) placed or stacked on to 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

NOTE 2 See 15.3.5 and 15.9.3.2 for the over packs for radioactive material.

3.1.34
package
complete product of the packing operation, consisting of the packaging and its contents prepared for transport

3.1.35
packaging
receptacles and any other components or material necessary for a receptacle to perform its containment and other safety functions

3.1.36
packing group
group symbol that indicates the degree of danger or hazard presented by the primary property of a specific substance in accordance with internationally recognized classifications

NOTE The packing groups referred to in this standard are synonymous with the danger groups given in previous editions of DEAS 949:2019

3.1.37
paste
soft, viscous mass of solids dispersed in a liquid

NOTE A paste can be classified either as a liquid or as a solid, depending on the results obtained when it is tested in accordance with ASTM D 4359.

3.1.38
phlegmatizer
substance added to an explosive to enhance its safety in handling and transport and renders the explosive insensitive, or less sensitive to heat, shock, impact, percussion or friction

NOTE Typical phlegmatizers include, but are not limited to, wax, paper, water, polymers (such as chlorofluoro polymers), alcohol and oils (such as petroleum jelly and paraffin).

3.1.39
pressure drum
welded pressure receptacle of a water capacity of more than 150 L but not more than 1 000 L, for example, a cylindrical receptacle equipped with rolling hoops or spheres on skids

3.1.40
pressure receptacle
collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles and bundles of cylinders

3.1.41
primary receptacle
component part of composite packaging that is in contact with an infectious substance

3.1.42
proper shipping name
that part of an entry that most accurately describes the dangerous goods listed in DEAS 949:2019and that appears in capital letters

NOTE 1 If more than one distinct entry is given under a UN number (see 3.1.53), as indicated by the conjunction "or" or by punctuation, the more appropriate of the names should be used.

NOTE 2 If several names are in use for the same substance, one or more of these names can be used as proper shipping names; the rest, being synonyms, are given in lower case for reference purposes only DEAS 949:2019

NOTE 3 Technical names and trade names can be used on documents and packages in addition to the proper shipping name.

3.1.43
receptacle
container that is used to receive and hold dangerous goods, and that can be fitted with a means of closure

3.1.44
reprocessed packaging
packaging that is

a) converted from one UN type to another UN type or to a non-UN type,

b) cleaned to the original material of construction, with all former contents, internal and external corrosion, and external coatings and labels removed,

c) restored to its original shape and contour, with chimes (if any) straightened and sealed, and all integral structural components and all non-integral gaskets replaced, and

d) inspected after cleaning but before painting

NOTE 1 The term “reprocessed packaging” includes re-conditioned packaging and remanufactured packaging.

NOTE 2 A steel drum that shows visible pitting, significant reduction in material thickness, metal fatigue, damaged threads or closures or any other significant defect upon inspection, should be rejected.

NOTE 3 A plastics drum and jerrican that show visible damage such as tears, creases or cracks, or damaged threads, or closures, or any other defects should be rejected.

3.1.45
recycled plastics material
plastics material recovered from used industrial packaging that has been cleaned and prepared for processing into new packaging (see also 10.6)

3.1.46
re-used packaging
packaging that is refilled and that has been examined and found to be free of defects that would affect its ability to withstand performance tests (see 12.3)

NOTE The term includes packaging that is refilled with the same or similar compatible contents and that is transported within various distribution chains that are controlled by the consignor of the product.

3.1.47
salvage packaging
special packaging 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

3.1.48
secondary packaging
intermediate form of packaging that encloses a primary receptacle that contains an infectious substance, together with any absorbent material necessary to contain and protect the primary receptacle

3.1.49
sift-proof packaging
packaging that is impermeable to dry contents, including the fine, solid material that is produced during transport

3.1.50
solid
powders, flakes, granules and kibbles, and also pastes and viscous substances that conform to the test for solids in accordance with ASTM D 4359

3.1.51
test pressure
required pressure applied during a pressure test for certification qualification or re-certification (see 10.1.3)

3.1.52
ullage
difference between the brimful capacity and the net volume of contents of a container

3.1.53
United Nations (UN) number

Serial number assigned to dangerous goods by the United Nations' Committee of Experts on the Transport of Dangerous Goods

3.1.54
unit load
number of packages secured to form a unit that is suitable for mechanical handling and is stacked on a pallet or slip sheet and secured by, for example, strapping, shrink wrapping or stretch wrapping, placed in a pallet box, or secured together by means of a sling or a net

3.1.55
working pressure
settled pressure of a compressed gas at a reference temperature of 15 °C in a full pressure receptacle

3.2 Abbreviations

ADR European Agreement Concerning the International Carriage of Dangerous Goods by Road

CSC Convention for Safe Containers (ISO freight containers)

IATA International Air Transport Association

IBC Intermediate Bulk Container

ICAO International Civil Aviation Organization

IMDG International Maritime Dangerous Goods

IMO International Maritime Organization

ISO International Organization for Standardization

NACE National Association of Corrosion Engineers

NOS Not Otherwise Specified

OECD Organization for Economic Cooperation and Development

RID Regulations concerning the International carriage of Dangerous goods by rail

SADT Self-Accelerating Decomposition Temperature

SAE Society for Automotive Engineering

UN United Nations

4 Test laboratories and certification authorities

4.1 Test laboratories

For the purposes of this standard, the authorities responsible for the testing of the packaging of specific classes and divisions of dangerous goods that can be offered for transport are designated or

accredited test laboratories approved by the national authorities. Information regarding these facilities can be obtained from the relevant national authority and the national/international laboratory accreditation authority.

4.2 Certification authorities

A certification authority, approved by statutory regulations, shall be responsible for the certification of the packaging of specific classes and divisions of dangerous goods that can be offered for transport by road and rail.

5 Dangerous goods identification for packaging

The official identification and classification of dangerous goods are as specified in DEAS 949:2019, Annex B and Annex C.

6 Classification system and packing group allocation

6.1 General

Classification system, packing group allocation and subsidiary risk shall be as stipulated in DEAS 949:2019.

6.2 Packing group allocation

6.2.1 General

For packing purposes, certain substances listed in DEAS 949:2019 are assigned to three packing groups in accordance with their degree of danger.

NOTE Dangerous goods of classes 1, 2 and 7, and divisions 5.2 and 6.2 are excluded from the packing group allocation.

6.2.2 Packing groups

The packing groups have the following meaning:

a) **Packing group I:** High-strength packaging, that offers a high degree of protection for a substance that presents a high danger;

b) **Packing group II:** Medium-strength packaging, that offers adequate protection for a substance that presents a medium danger; and

c) **Packing group III:** Low-strength packaging, that offers adequate protection for a substance that presents a low danger.

7 Packaging not covered by this standard

7.1 Dangerous goods in bulk

Dangerous goods in bulk (see 3.1.6), with the exception of low specific activity (LSA) radioactive material and radioactive surface contaminated objects (SCO), which, in most countries, are subject to special regulations.

7.2 Specialized equipment

Dangerous goods required for the propulsion of means of transport, or the operation of its specialized equipment during transport, for example, refrigeration units, or equipment that are required in accordance with the operating regulations, for example, fire extinguishers.

7.3 Goods sold in the retail trade

Subject to the statutory regulations that apply to certain classes and divisions of dangerous goods,the requirements of this standard do not apply to dangerous goods that are transported, as packed for retail sale, by private individuals who purchased such goods for their private use.

8 General packaging requirements

8.1 General

8.1.1 All new, re-used (see 3.1.47) or reconditioned (reprocessed) (see 3.1.44) or remanufactured (see 3.1.46) packaging shall be well manufactured and shall be so constructed and so closed as to prevent deformation, leakage or sifting of the contents as a result of vibration, stacking, impact or changes in environmental conditions such as temperature, pressure or humidity that might be encountered during transport. This includes trans-shipment between transport units and between transport units and warehouses, as well as any removal from a pallet or an overpack for subsequent manual or mechanical handling.

8.1.2 Dangerous goods presented for transport shall be packed in packaging that has successfully passed the performance tests carried out by an designated or accredited test laboratory (see 12.3 and 3.1.1 respectively), and that has been approved by the designated certification authority and marked as set out in clause 10.

8.1.3 The packing instructions given in clause 13 have been used successfully for the packaging of dangerous goods. However, there is no objection to the use of packaging manufactured to requirements that differ from those in clause 13, provided that the packaging is equally effective, acceptable to the relevant competent authority and can successfully withstand the tests described in clause 12.3.

8.1.4 Variations in the maximum quantities specified are permitted, provided that the overall limitations for each type of packaging, given in 13.4 are observed.

8.1.5 New, remanufactured, re-used or reconditioned packaging shall be capable of passing the tests given in clause 12). Before being filled and handed over for transport, all packaging shall be inspected by the manufacturers or users to ensure that it is free from corrosion, contamination or other damage. Packaging that shows signs of reduced strength when compared with the approved design type shall either not be used or shall be so reconditioned that it is able to withstand the design type testing (see 12.1).

8.1.6 No dangerous residue shall adhere to the outside of a dangerous goods packaging during transport.

8.1.7 The packaging shall be manufactured and tested under a quality assurance programme that satisfies the relevant competent authority in order to ensure that each manufactured item of packaging meets the requirements of this standard.

8.1.8 Manufacturers and subsequent distributors of packaging shall provide information regarding procedures to be followed and a description of the types and dimensions of closures (including required gaskets) and any other components needed to ensure that the packages as presented for transport are capable of passing the applicable performance tests given in 12.3.

8.2 Compatibility

8.2.1 Packaging and parts of packaging that are in direct contact with dangerous substances shall be resistant to the contents. Packaging shall not incorporate materials that can react dangerously with its contents, form hazardous compounds or lead to softening, weakening or failure of the packaging or its closure. If necessary, packaging shall be provided with a suitable inner coating or treatment to make it resistant to its contents.

8.2.2 Dangerous goods shall not be packed in the same outer packaging as another type of dangerous or non-dangerous goods if they react dangerously with one another and give rise to any (or a combination) of the following:

a) the combustion or evolution (or both) of considerable heat;

b) the evolution of flammable, toxic or asphyxiant gases;

c) the formation of corrosive substances; and

d) the formation of unstable substances.

8.3 Packaging for liquids

8.3.1 Packaging for liquid substances shall have provision for adequate ullage and shall not completely fill a packaging at a temperature of 55 °C. This is to ensure that neither leakage nor permanent distortion of the package will occur as a result of an expansion of the liquid caused by temperatures likely to occur under normal conditions of transport.

8.3.2 Packaging intended for liquids shall have an adequate resistance to the internal pressure that can develop under normal conditions of transport. Packaging marked with the hydraulic test pressure as prescribed in 10.2.4.1(d) shall be filled only with a liquid that has a vapour pressure that is

a) such that the total gauge pressure in the packaging (namely the vapour pressure of the liquid substance plus the partial pressure of air or other inert gases, minus 100 kPa) at 55 °C (determined on the basis of a maximum degree of filling in accordance with 8.3.1 and an assumed filling temperature of 15 °C) does not exceed two-thirds of the marked test pressure, or

b) less than four-sevenths of the sum of the marked test pressure plus 100 kPa at 50 °C, or

c) less than two-thirds of the sum of the marked test pressure plus 100 kPa at 55 °C.

8.3.3 All packaging intended to contain liquids shall comply with the requirements of the leakproofness test for liquids (see 12.3.2)

a) before it is first used for transport, and

b) after remanufacturing or reconditioning and before it is re-used for transport.

For the leakproofness test the packaging need not have its closures fitted. The inner receptacle of a composite packaging can be tested without the outer packaging, provided the test results are not affected. The leakproofness test is not necessary for inner packaging of combination packaging.

8.3.4 Packaging that is used for solids that can become liquid at temperatures likely to be encountered during transport, shall be capable of containing the substance in the liquid state (see also 13.1.4).

8.3.5 Packaging that contains liquids and intended to be transported by air, shall be capable of withstanding a pressure differential without leakage in accordance with the international regulations for air transport.

8.4 Packaging for solids

Packaging used for powdery or granular substances shall be sift-proof or shall be provided with a liner.

8.5 Inner packaging

8.5.1 Inner packaging shall be packed in an outer packaging in such a way that, under normal conditions of transport, it is protected from breakage, puncture or leakage. Inner packaging that is liable to break or to be punctured easily, such as that made of glass, porcelain, stoneware or certain plastics materials, shall be secured in the outer packaging by means of suitable cushioning material. Any leakage of the contents shall not substantially impair the protective properties of the cushioning material or of the outer packaging.

8.5.2 Inner packaging that contains different substances that can react dangerously with one another, shall not be packed together in an outer packaging without the approval of the competent authority.

8.5.3 Liquids shall only be filled into inner packaging which has appropriate resistance to internal pressure that might develop under normal conditions of transport.

8.5.4 Packaging that contains liquids shall be packed with their closures upward and placed within an outer packaging consistent with the orientation marking described in 16.2.4.

8.6 Packaging for wetted or diluted substances

Packaging intended for the transport of wetted or diluted substances shall be such that the percentage of wetting agent or diluting agent, for example water or solvent or phlegmatizer, is prevented from falling below the prescribed limits during transport.

8.7 Packaging fitted with vented closures

Where pressure can develop in a package as a result of the emission of gas from the contents, the packaging can be fitted with a vent, provided that the gas emitted will not cause danger on account of its toxicity, flammability or the quantity released. The vent shall be so designed that, when the package is put in the position in which it is intended to be transported, leakage of liquid from the vent and the entry of foreign substances through the vent does not occur under normal conditions of transport.

8.8 Empty packaging

8.8.1 Empty packaging that has contained a dangerous substance shall, for transport purposes, be treated as if it were filled with the dangerous substance until such time that it has been purged of the residue of that dangerous substance.

8.8.2 Where the nature of the former contents of a container permits, the competent authority may grant authorization for the transport, without restriction, of empty packaging that previously contained dangerous goods.

8.9 Combination packaging

8.9.1 It is permissible to subdivide the contents of combination packaging for secondary distribution by public road, provided that the requirements given in 8.9.2 and 8.9.3, the requirements applicable to the relevant class of the goods and the quantity limitations as prescribed in P001,P002 and P403 of 13.4 for inner packages, as appropriate, are observed.

8.9.2 Repacked inner packaging shall be placed in, and rendered safe by, adequate outer packaging that satisfies the performance requirements for packing group III commodities. The gross mass of the reconstituted combination packaging shall not exceed 30 kg.

8.9.3 Reconstituted combination packaging shall be clearly marked with the name and class or division of the commodity that it contains.

NOTE Reconstituted combination packaging is exempted from the labelling and performance test requirements of this standard.

8.10 Packaging for explosives, self-reactive substances and organic peroxides

Packaging used for explosives of class 1, self-reactive substances of division 4.1 and organic peroxides of division 5.2 shall comply with the performance testing for packing group II (see 12.3).

8.11 Salvage packaging

Damaged, defective, leaking or non-conforming, or dangerous goods that have spilled or leaked can be transported in salvage packaging (see 3.1.47). This does not prevent the use of a bigger size packaging of appropriate type and performance level, provided that measures shall be taken to prevent excessive movement of the damaged or leaking packaging within the salvage packaging.

Sufficient inert absorbent material shall be added to absorb all free liquid when liquid salvage packaging is transported (see also 12.1.2).

8.12 Overpacks

8.12.1 An overpack (see 3.1.33) shall be marked with the word “OVERPACK”, the proper shipping name (see clause 17) and the UN number of the contents. It shall be marked and labelled in accordance with clause 16 for each item of dangerous goods contained in the overpack, unless markings and labels representative of all dangerous goods in the overpack are visible.

8.12.2 Each package of dangerous goods contained in an overpack shall comply with all applicable provisions of this standard. The “overpack” marking is an indication of compliance with this requirement. The intended function of each package shall not be impaired by the overpack.

8.12.3 An overpack shall not contain dangerous goods that can interact dangerously in the event of leakage.

Each package bearing package orientation markings as prescribed in 16.2.4.4 and which is in an “over packed” or placed in a large packaging shall be oriented in accordance with such markings.

9 Packaging type codes

9.1 General

9.1.1 A packaging type code consists of a sequence of letters and digits that serves the purpose of identifying the type of packaging, the nature of the material(s) from which the packaging has been manufactured and special features of the packaging. (See table 1 for a list of packaging and the assigned type codes.)

The code consists of:

a) an Arabic numeral indicating the type of packaging, for example drum, a fibreboard box, followed by;

b) a capital letter(s) indicating the type of material from which the packaging has been manufactured, for example steel and wood, followed, where necessary, by;

c) an Arabic numeral indicating the category of packaging within the type to which the packaging belongs.

9.1.2 In the case of composite packaging (see 3.1.11), two capital letters are used in sequence in the second position of the code to identify the material of construction. The first letter indicates the Inner material that is in contact with the contents, and the second letter indicates the outer material.

9.1.3 In the case of combination packaging, only one capital letter is used and it identifies the material of the outer packaging.

9.2 Codes for types of packaging

The first element of the type code is an Arabic numeral (digit) and it indicates the type of packaging:

Type code	Package
1	Drum
2	(reserved)
3	Jerrican
4	Box
5	Bag
6	composite packaging

9.3 Codes for types of material

9.3.1 The second element of the type code is a capital letter and indicates the material from which the packaging has been manufactured:

type code	Material
A	steel (all types and surface treatments)
B	Aluminium
C	natural wood
D	plywood, wickerwork
F	reconstituted wood
G	fibreboard
H	plastics material
L	textile

M	paper, multiwall
N	metal (other than steel and aluminium)
P	glass, porcelain or stoneware.

NOTE Plastics materials is taken to include other polymeric materials such as rubber.

9.4 Special types of packaging

9.4.1 The letters "T" or "V" or "W" can follow the packaging type code. The letter "T" signifies a salvage packaging (see 3.1.47 and 8.11). The letter "V" signifies a special type of packaging (see 12.1.1.9(h)). The letter "W" signifies that the packaging, although of the same type as that indicated by the packaging type code, has been manufactured to a standard different from that given in clause 11, but is considered to meet the requirements of 8.1.3.

9.4.2 If the use of a particular type of outer packaging, for example 4G, is authorized in a combination packaging, packaging bearing the same packaging type code followed by the letter "V" can also be used under the conditions and limitations applicable to the use of this particular type of Outer packaging, in accordance with the relevant packing requirements. For example, combination packaging that bears the code 4GV can be used whenever combination packaging of code 4G is authorized, provided that the relevant packing provisions in regard to the types of inner packaging that is allowed, for example glass or metal, and quantity limitations, are respected.

Table 1 — Packaging and assigned type codes

1	2	3	4
Type of packaging	**Material**	**Special features**	**Type code**
1. Drums	A. Steel	Non-removable head	1A1
		Removable head	1A2
	B. Aluminium	Non-removable head	1B1
		Removable head	1B2
	D. Plywood	–	1D
	G. Fibre	–	1G
	H. Plastics	Non-removable head	1H1
		Removable head	1H2
	N: Metal, other than steel and aluminium	Non-removable head	1N1
		Removable head	1N2
2. Reserved			
3. Jerricans	A. Steel	Non-removable head	3A1
		Removable head	3A2
	B. Aluminium	Non-removable head	3B1
		Removable head	3B2
	H. Plastics	Non-removable head	3H1
		Removable head	3H2
4. Boxes	A. Steel	–	4A
	B. Aluminium	–	4B
	C. Natural wood	Ordinary	4C1
		With sift-proof walls	4C2
	D. Plywood	–	4D
	F. Reconstituted wood	–	4F
	G. Fibreboard	–	4G
	H. Plastics	Expanded	4H1
		Solid	4H2
5. Bags	H. Plastics (woven)	Without liner or coating	5H1
		Sift-proof	5H2
		Water resistant	5H3
	H. Plastics film	–	5H4
	L. Textiles	Without liner or coating	5L1
		Sift-proof	5L2
		Water resistant	5L3
	M. Paper	Multiwall	5M1
		Multiwall, water resistant	5M2
6. Composite packaging	H. Plastics receptacle	In steel drum	6HA1
		In steel crate or box	6HA2
		In aluminium drum	6HB1
		In aluminium crate or box	6HB2
		In natural-wood box	6HC
		In plywood drum	6HD1
		In plywood box	6HD2
		In fibre drum	6HG1
		In fibreboard box	6HG2
		In plastics drum	6HH1
		In solid-plastics box	6HH2
	P. Glass, porcelain or stoneware receptacle	In steel drum	6PA1
		In steel crate or box	6PA2
		In aluminium drum	6PB1
		In aluminium crate or box	6PB2
		In natural-wood box	6PC
		In plywood drum	6PD1
		In wickerwork hamper	6PD2
		In fibre drum	6PG1
		In fibreboard box	6PG2
		In expanded-plastics packaging	6PH1
		In solid-plastics packaging	6PH2

10 Marking of packaging for compliance

10.1 General

10.1.1 Design type packaging can be marked in accordance with this clause only after it has passed the required performance type tests carried out by an accredited tests laboratory.

10.1.2 The marking is intended to be of assistance to manufacturers, reconditioners, users and transporters of packaging and also to competent authorities in that it indicates the packaging type and that the performance test requirements have been met.

10.1.3 The certification authority issues a certificate of compliance that shall be valid for a period of time as determined by the certification authority. During this time, the manufacturer may not in any way alter manufacturing procedures or the design criteria recorded on the manufacturer's design drawings and specifications.

The certification authority shall maintain a register of approved packaging, that indicates the following:

a) the marking, in accordance with the requirements of this standard, that is to be displayed on approved packaging (see 10.2 to 10.7);

b) the name of the certificate holder or of the manufacturer;

c) the date of approval;

d) a description of the packaging; and

e) the test report reference number.

10.2 Marking requirements

10.2.1 General

10.2.1.1 On satisfactory completion of design type testing (see 12.1) and issue of a certificate of compliance (see 10.1.3), each outer or sole packaging for dangerous goods shall bear marking that is durable, legible and of such a size relative to the packaging that it is readily visible.

10.2.1.2 In the case of a package with a gross mass exceeding 30 kg, the marking, or a duplicate thereof, shall appear on the top or on a side of the packaging. Letters, digits and symbols shall be of height at least 12 mm, except for a package of capacity equal to or less than 30 L or 30 kg, when the marking shall be of height at least 6 mm. For a package of capacity equal to or less than 5 L or 5 kg, the marking shall be of an appropriate size that is readily visible and legible.

10.2.2 Inner packaging

Inner packaging shall be marked in a satisfactory manner that will permit its origin to be traced. The relevant marking shall be recorded on the test report or design drawings and specifications.

NOTE The UN packaging symbol (see 10.2.4.1(a)) is not required for inner packaging.

10.2.3 Portable gas containers

Portable gas containers shall be marked in accordance with applicable regulations.

10.2.4 Outer packaging

10.2.4.1 Each outer packaging approved in terms of this standard shall bear the following compliance markings:

a) The United Nations packaging symbol:

NOTE For marking embossed on metal, this symbol may be replaced by the capital letters UN. The symbol shall not be used for any other purpose than to certify that a packaging complies with the relevant requirements of clause 12.

b) The relevant packaging type codes given in clause 9.

c) A two-part code that consists of

1) a letter code that indicates the packaging group, namely
X: packing groups I, II and III,
Y: packing group II and III, and
Z: packing group III only,

2) in the case of self-supporting outer packaging intended for liquids, the relative density of the liquid, rounded off to the first decimal place; this may be omitted if the relative density does not exceed 1,2, and

3) in the case of outer packaging intended for solids or for inner packaging, the maximum gross mass, in kilograms.

d) Either a capital S to denote that the packaging is intended for the transport of solids or inner packaging, or, for outer packaging (other than combination packaging) that is intended for a liquid commodity, the hydraulic test pressure in kilopascals, rounded off to the nearest 10 kPa,that was applied at the time of design type testing.

e) The date of manufacture, indicated by the last two digits of the year, for example 08. Plastics drums (1H1 and 1H2) and plastics jerricans (3H1) shall also show the month of manufacture;this may be displayed on the packaging at a different location from the rest of the marking. An appropriate method is the familiar clock face symbol that indicates the month of manufacture as used on plastics containers.

f) A code to identify the country that authorized the use of the UN packaging symbol.

g) The approval reference number issued by the certification authority, for example CT298.

10.2.4.2 The marking shall be applied in the sequence as given in (a) to (g) above, and each element of the marking shall be clearly separated, for example, by a slash or a space, so as to be easily identifiable. The layout of the marking shall follow the examples given in table 2, table 3 or 10.7, as applicable. The marking may be applied in a single line or in multiple lines.

Table 2 — Examples of markings for new packaging

1	2
Marking	**Description**
 4G/Y140/S/08 ZA/CT7	Fibreboard box/tested for packing group II solid of maximum gross mass 140 kg/solid substance/ packaging manufactured 2002. Approved South Africa/approval reference number.
 1A1/X1,3/125/06 ZA/CT10	Non-removable-head steel drum/tested for packing group I liquid of relative density 1,3/hydraulic test pressure 125 kPa/packaging manufactured 1999. Approved South Africa/approval reference number.
 1A2/Z150/S/00 ZA/CT361	Removable-head steel drum/tested for packing group III solids of maximum gross mass 150 kg/solid substance/packaging manufactured 2000. Approved South Africa/approval reference number.
 4HIW/Y136/S/02 ZA/CT21	Removable expanded plastics box of equivalent specification/packing group II solid of max gross mass 136 kg/solid substance/packaging manufactured 1998/approved South Africa/approval reference number

10.3 Marking for new metal drums of capacity exceeding 100 L

10.3.1 Supplementary to the marking prescribed in 10.2, every new metal drum of capacity exceeding 100 L shall bear the marks described in 10.2.4.1(a) to (e) on the bottom of the drum. In addition, the nominal thickness of the metal used for the body shall be indicated to the nearest 0,1 mm in permanent marking, for example embossing.

10.3.2 If the nominal thickness of either head of a metal drum is thinner than that of the body, the nominal thicknesses of the top head, body and bottom head shall be permanently marked on the bottom of the drum, for example 1,0-1,2-1,0 or 0,9-1,0-1,0.

NOTE The nominal thickness of metal can be determined in accordance with an appropriate standard, for example ISO 3574 for steel drums.

10.3.3 Metal drums manufactured from, for example, stainless steel and designed to be re-used repeatedly may bear the marking indicated in 10.2.4.1(f) and (g) in permanent form.

10.4 Marking for remanufactured metal drums

10.4.1 If there is no change to the packaging type and no replacement or removal of integral structural components, the required marking on remanufactured metal drums need not be permanent.

10.4.2 Remanufactured metal drums other than those described in 10.4.1 shall bear marking in accordance with 10.2.4.1(a) to (e) in permanent form, for example embossing, on the top head or on the side of the drum.

10.5 Marking for reconditioned packaging

10.5.1 Certain packaging, for example metal drums and plastics drums, can be reconditioned, in which case the appropriate marking shall identify them as having been reconditioned.

10.5.2 The following durable marking (see also 10.5.5) shall be applied by the reconditioner on each item of dangerous goods packaging after it has been reconditioned:

a) the code of the country in which the reconditioning was carried out,

b) the name of the reconditioner or other identification of the packaging as specified by the competent authority;

c) the year of reconditioning;

d) a capital letter R, to indicate that the packaging has been reconditioned; and

e) a capital letter L, to indicate that the reconditioned packaging was subjected to and passed the leakproofness test (see 12.3.2).

10.5.3 Marking required for reconditioned packaging shall be applied near the original compliance marking and shall follow the layout given in table 3.

10.5.4 The original compliance marking shall not be removed and care shall be taken not to damage it during the reconditioning process. However, if the original markings required by 10.2.4.1(a) to (d) no longer appear on the head or the side of a metal drum after reconditioning, the reconditioner shall apply them in a durable form followed by 10.5.2(a) to (e). These markings shall not identify a greater performance capability than for which the original design type had been tested and marked.

10.5.5 Additional marking shall be stencilled on reconditioned packaging intended for export. Packaging reconditioned in Kenya and intended for national distribution can be marked with a waterproof, non-removable, pressure-sensitive adhesive label.

10.5.6 Every packaging liable to undergo a reconditioning process shall bear the marks indicated in 10.2.4.1(a) to (e) in a permanent form. Marks are permanent if they are able to withstand the reconditioning process, for example, embossed. For packaging other than metal drums of capacity greater than 100 L, these permanent marks may replace the corresponding durable markings prescribed in 10.2.4.

Table 3 — Examples of marking after reconditioning

1	2
Marking	**Description**
 1A1/Y1,4/150/01 ZA/DFA/01RL	Non-removable head steel drum/tested for packing group II liquid of relative density 1,4/hydraulic test pressure 150 kPa/packaging manufactured 0997. Approved South Africa/name or symbol of reconditioner/reconditioned 2001, reconditioned (R) and leakproofness test passed (L).
 1A2/Z150/S/07 ZA/RB/00R	Removable-head steel drum/tested for packing group III solids of maximum gross mass 150 kg/solid substance/ packaging manufactured 1999. Approved South Africa/name or symbol of reconditioner/reconditioned 2000 and reconditioned (R).

10.6 Marking for packaging manufactured with recycled plastics material

Packaging manufactured with recycled plastics material (see 3.1.45) shall be marked "REC". This mark shall be placed near the mark prescribed in 10.2.4.1.

10.7 Marking for salvage packaging

The marking for salvage packaging shall have the following layout:

	1A2T/Y300/S/01 ZA/CR33	Removable head steel drum salvage packaging/tested for packing group II solids of maximum gross mass 300 kg/solid substance/ packaging manufactured 2001/manufactured South Africa/approval reference number

11 Specific types of packaging

11.1 Steel drums (1A1 and 1A2)

11.1.1 The body and heads of a steel drum shall be constructed of steel sheet of a type and thickness appropriate to the capacity and the intended use of the drum.

Carbon steel drums shall comply with ISO 3573 or ISO 3574. Carbon steel sheets in compliance with ISO 11949, ISO 11950 or ISO 11951 can also be used for the manufacture of carbon steel drums of capacity less than 100 L.

11.1.2 A drum of capacity exceeding 40 L, that is intended for liquids, shall have its body seams welded. A drum that is intended for solids and a drum of capacity 40 L and less that is intended for liquids shall have welded or mechanically rolled body seams.

11.1.3 Chimes shall be mechanically seamed or welded. Separate reinforcing rings may be applied.

11.1.4 The body of a drum of a capacity exceeding 60 L shall have at least two expanded rolling hoops or, alternatively, at least two separate rolling hoops. Separate rolling hoops shall be fitted tightly onto the body and so secured that they cannot shift. Rolling hoops shall not be spot welded.

11.1.5 The diameter of openings that are used for filling, emptying and venting and that are situated in the body or head of a non-removable-head (1A1) drum shall not exceed 70 mm. A drum that has larger openings shall be considered to be of the removable-head type (1A2). Closures for openings in the bodies and heads of drums shall be so designed and so applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges shall be mechanically seamed or welded in place. Gaskets or other sealing elements shall be used in conjunction with closures, unless the closure is inherently leakproof.

11.1.6 A closure for a removable-head drum shall be so designed and so applied that the closure will remain secure and the drum will remain leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used in the case of all removable-head drums.

11.1.7 If the materials used for bodies, heads, closures and fittings are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments shall be applied.

These coatings or treatments shall retain their protective properties under normal conditions of transport.

11.1.8 The maximum capacity of a steel drum shall not exceed 450 L.

11.1.9 The maximum net mass of the contents of a steel drum shall not exceed 400 kg.

11.1.10 A steel drum of capacity greater than 100 L that was manufactured and marked in accordance with the requirements of this standard, can be reconditioned (see 3.1.44) and re-used for the transport of dangerous goods of packaging group II and packaging group III, provided that

a) the drum has been cleaned down to its original metal surface, and that all former contents, internal and external corrosion, coatings and labels were removed chemically or mechanically or thermally or by abrasive blasting,

b) the drum has been restored to its original shape and contour, that chimes were straightened and sealed and all integral gaskets replaced,

c) the drum has been inspected after cleaning but before repainting, and that any drum with defects such as visible pitting, a significant reduction in wall thickness, metal fatigue, damaged closure threads or other significant defects was rejected,

d) each drum was tested for leakage (see 12.3.2),

e) the mass of each drum was determined and recorded, and

f) each drum is durably marked in accordance with 10.5.

11.2 Aluminium drums (1B1 and 1B2)

11.2.1 The body and heads of an aluminium drum shall be constructed either of aluminium of at least 99 % purity or of an aluminium base alloy. The material shall be of a type and thickness appropriate to the capacity and the intended use of the drum.

11.2.2 All seams shall be welded. Chime seams, if any, shall be reinforced by the application of separate reinforcing rings.

11.2.3 The body of an aluminium drum of a capacity exceeding 60 L shall have at least two expanded rolling hoops or, alternatively, at least two separate rolling hoops. Separate rolling hoops shall be fitted tightly onto the body and so secured that they cannot shift. Rolling hoops shall not be spot welded.

11.2.4 The diameter of openings that are used for filling, emptying and venting and that are situated in the body or head of a non-removable-head drum (1B1) shall not exceed 70 mm. A drum that has larger openings is considered to be of the removable-head type (1B2). Closures for openings in the bodies and heads of drums shall be so designed and so applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges shall be so welded in place that the weld provides a leakproof seam. Gaskets or other sealing elements shall be used in conjunction with closures, unless the closure is inherently leakproof.

11.2.5 A closure for a removable-head drum shall be so designed and so applied that the closure will remain secure and the drum remain leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used in the case of any removable head drum.

11.2.6 The maximum capacity of an aluminium drum shall not exceed 450 L.

11.2.7 The maximum net mass of an aluminium drum shall not exceed 400 kg.

11.3 Drums of metal other than steel or aluminium (1N1 and 1N2)

11.3.1 The body and heads of a metal drum, other than steel or aluminium, shall be constructed of metal sheet of a type and thickness appropriate to the capacity and the intended use of the drum.

11.3.2 Chime seams, if any, shall be reinforced by the application of separate reinforcing rings. All seams shall be welded or soldered in accordance with the technical state of the art for the metal or metal alloy used.

11.3.3 The body of a metal drum of a capacity exceeding 60 L shall have at least two expanded rolling hoops or, alternatively, at least two separate rolling hoops. Separate rolling hoops shall be fitted tightly onto the body and so secured that they cannot shift. Rolling hoops shall not be spot welded.

11.3.4 The diameter of openings that are used for filling, emptying and venting and that are situated in the body or head of a non-removable-head drum (1N1) shall not exceed 70 mm. A drum that has larger openings shall be considered to be of the removable-head type (1N2).

Closures for openings in the bodies and heads shall be so designed and so applied that they will remain secure and leakproof under normal conditions of transport.

Closure flanges shall be welded or soldered in place in accordance with the technical state of the art for the metal or metal alloy used. Gaskets or other sealing elements shall be used in conjunction with closures, unless the closure is inherently leakproof.

11.3.5 A closure for a removable-head drum shall be so designed and so applied that the closure will remain secure and the drum will remain leakproof under normal conditions of transport.

11.3.6 The maximum capacity of a metal drum, other than steel or aluminium, shall not exceed 450 L.

11.3.7 The maximum net mass of a metal drum, other than steel or aluminium, shall not exceed 400 kg.

11.4 Steel jerricans (3A1 and 3A2) or aluminium jerricans (3B1 and 3B2)

11.4.1 The body and heads of a jerrican shall be constructed of steel sheet or of aluminium of at least 99 % purity or of an aluminium base alloy. The metal shall be of a type and thickness appropriate to the capacity and the intended use of the jerrican.

11.4.2 The chimes of a jerrican shall be mechanically seamed or welded. The body seams of a jerrican intended to contain more than 40 L of liquid shall be welded. The body seams of a jerrican intended to carry 40 L or less shall be mechanically seamed or welded.

11.4.3 In a non-removable-head jerrican (3A1 and 3B1), the diameter of openings that are used for filling, emptying and venting shall not exceed 70 mm. A jerrican that has larger openings is considered to be of the removable-head type (3A2 and 3B2). Any closure shall be so designed that the closure will remain secure and leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used in conjunction with closures, unless the closure is inherently leakproof.

11.4.4 If materials used for the body, heads, closures and fittings of a jerrican are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments shall

be applied. These coatings or treatments shall retain their protective properties under normal conditions of transport.

11.4.5 The maximum capacity of a jerrican is 60 L.

11.4.6 The maximum net mass of a jerrican is 120 kg.

11.5 Plywood drums (1D)

11.5.1 The plywood used for a plywood drum shall be well seasoned, commercially dry and free from any defect likely to lessen the effectiveness of the drum for its intended purpose. If a material other than plywood is used for the heads, it shall be suitable for the intended purpose of the drum.

11.5.2 At least two-ply plywood shall be used for the body and at least three-ply plywood for the heads. The plies shall be firmly glued together by a water resistant adhesive, with their grains crosswise. The body and heads of a plywood drum and the method of joining them together shall be appropriate to the capacity and the intended use of the drum.

11.5.3 In order to prevent sifting of the contents, the lid shall be lined with kraft paper or an equivalent material that is securely fastened to the lid and extends beyond its circumference.

11.5.4 The maximum capacity of a plywood drum shall not exceed 250 L.

11.5.5 The maximum net mass of a plywood drum shall not exceed 400 kg.

11.6 Fibre drums (1G)

11.6.1 The body of a fibre drum shall consist of multiple plies of heavy paper or fibreboard (without corrugations), firmly glued or laminated together, and may include one or more protective layers of bitumen, waxed kraft paper, metal foil, plastics material, etc.

11.6.2 The heads of a fibre drum shall be of natural wood, fibreboard, metal, plywood, plastics or other suitable material and may include one or more protective layers of bitumen, waxed Kraft paper, metal foil, plastics material, etc.

11.6.3 The body and heads of a fibre drum and the method of joining them shall be appropriate to the capacity and the intended use of the drum.

11.6.4 The assembled components shall be sufficiently water resistant to prevent delamination under normal conditions of transport.

11.6.5 The maximum capacity of a fibre drum shall not exceed 450 L.

11.6.6 The maximum net mass of a fibre drum shall not exceed 400 kg.

11.7 Plastics drums (1H1 and 1H2) and plastics jerricans (3H1 and 3H2)

11.7.1 A plastics drum and a plastics jerrican shall be manufactured from plastics material of adequate strength in relation to the capacity of the drum or jerrican and the intended use of each.Except for recycled plastics material as defined in 3.1.44, no used material other than production residues or regrind from the same manufacturing process shall be used.

11.7.2 A plastics drum and a plastics jerrican shall be resistant to ageing and degradation caused either by their contents or by ultraviolet radiation. Any permeation of the plastics drum or plastics jerrican by their contents shall not constitute a danger under normal conditions of transport.

11.7.3 Depending on the nature of the substance intended for transport, the competent authority may authorize the re-use of a plastics drum or a plastics jerrican, provided that the consignor can provide a report that states that a representative sample taken from a lot of plastics drums or jerricans has been retested and found to comply with the requirements for similar new drums and jerricans.

11.7.4 Notwithstanding the requirements of 11.7.3, plastics drums and plastics jerricans are permitted to be used for the transport of dangerous goods for a period of five years from the date of manufacture, except where the competent authority prescribes a shorter period because of the nature of the substance to be transported.

11.7.5 Protection against ultraviolet radiation shall be provided by the addition of carbon black or other similar pigments or inhibitors. These additives shall be compatible with the intended contents of the plastics drum or jerrican and shall remain effective throughout the life of the packaging. If carbon black, pigments or inhibitors, other than those used in the manufacture of the tested design type, are added, retesting may be waived if

a) the carbon black content does not exceed 2 % by mass, or

b) the pigment content does not exceed 3 % by mass.

NOTE The content of inhibitors of ultraviolet radiation is not limited.

11.7.6 Additives for purposes other than protection against ultraviolet radiation may be included in the composition of the plastics material, provided that they do not adversely affect the chemical and physical properties of the material used in the manufacture of the packaging. Under these circumstances, the need for retesting the packaging may be waived.

11.7.7 The wall thickness of a plastics drum or a plastics jerrican at every point of the packaging shall be appropriate to its capacity and intended use, taking into account the stresses to which each point in the walls is liable to be exposed.

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11.7.8 The diameter of openings that are used for filling, emptying and venting and that are situated in the heads of a non-removable-head plastics drum (1H1) or jerrican (3H1) shall not exceed 70 mm. A plastics drum or jerrican that has larger openings is considered to be of the removable-head type (1H2 and 3H2). Closures for openings in the bodies and heads of non removable- head plastics drums (1H1) and jerricans (3H1) shall be so designed and so applied that the closures will remain secure and leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used in conjunction with closures, unless the closure is inherently leakproof.

11.7.9 Closures for openings in the bodies and heads of removable-head plastics drums (1H2) and plastics jerricans (3H2) shall be so designed and so applied that the closures will remain secure and leakproof under normal conditions of transport. Gaskets shall be used with all removable heads unless the design of the plastics drum or plastics jerrican is such that, where the removable head is properly secured, the drum or jerrican is inherently leakproof.

11.7.10 Steps shall be taken to ensure that the plastics material used in the manufacture of plastics drums and plastics jerricans complies with the requirements of 8.2. This can be done, for example by subjecting samples of the packaging to a preliminary test over a long period, such as six months, during which the samples are filled with the substances they are intended to contain, and after which the samples are submitted to the applicable tests given in clause 12. For substances that can cause stress cracking or weakening in a plastics drum or a plastics jerrican, the sample, filled with the substance or with another substance that is known to have at least as severe a stress-cracking influence on the plastics material in question, shall be subjected to a Superimposed load equivalent to

the total mass of identical packages that might be stacked on it during transport. The minimum height of the stack, including the test sample, shall be 3 m.

11.7.11 The maximum capacity of a plastics drum shall not exceed 450 L and that of a plastics jerrican shall not exceed 60 L.

11.7.12 The maximum net mass of a plastics drum shall not exceed 400 kg and that of plastics jerrican shall not exceed 120 kg.

11.8 Natural-wood boxes (4C1 and 4C2)

11.8.1 The wood used in the manufacture of natural-wood boxes shall be well seasoned, commercially dry and free from any defects that could reduce the strength of any part of the box.

The strength of the material used and the method of construction shall be appropriate to the capacity and the intended use of the box. The tops and bottoms can be made of water resistant reconstituted wood such as hardboard, particle board or another similar material.

11.8.2 Fastenings shall be resistant to the vibration experienced under normal conditions of transport. Nailing into the end grains shall be avoided whenever practicable. Clenched or annular ring nails or equivalent fastenings shall be used for joints that are likely to be subjected to high stress.

11.8.3 Each part of a sift-proof walled box (4C2) shall consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when one of the following methods of glue assembly is used: Linderman joint, tongue-and-groove joint, ship lap, rabbet joint or butt joint, with at least two corrugated metal fasteners at each joint.

11.8.4 The maximum net mass of a natural-wood box shall not exceed 400 kg.

11.9 Plywood boxes (4D)

11.9.1 The plywood used in the manufacture of a plywood box shall be at least three ply. It shall be made from well-seasoned, rotary cut, either sliced or sawn veneer, commercially dry and free from defects that could reduce the strength of any part of the box. The strength of the material used and the method of construction shall be appropriate to the capacity and the intended use of the box.

All adjacent plies shall be glued with water-resistant adhesive. Other suitable materials may be used in combination with plywood in the construction of a plywood box. A plywood box shall be firmly nailed, or shall be secured by corner posts or ends, or shall be assembled by means of equally suitable devices.

11.9.2 The maximum net mass of a plywood box shall not exceed 400 kg.

11.10 Reconstituted-wood boxes (4F)

11.10.1 The walls of a reconstituted-wood box shall be made of water-resistant reconstituted wood such as hardboard, particle board or other similar board. The strength of the material used and the method of construction shall be appropriate to the capacity and the intended use of the box.

11.10.2 Other parts of a reconstituted-wood box can be made of other suitable material.

11.10.3 A reconstituted-wood box shall be securely assembled by means of suitable devices.

11.10.4 The maximum net mass of a reconstituted-wood box shall not exceed 400 kg.

11.11 Fibreboard boxes (4G)

11.11.1 Strong, good quality solid or double-faced corrugated fibreboard (single or multiwall) shall be used in the manufacture of a fibreboard box. The material used shall be appropriate to the capacity and the intended use of the box. The water resistance of the outer surface of the outer facing of the combined board shall be such that the increase in mass over a period of 30 min, does not exceed 155 g/m2 in accordance with ISO 535. Fibreboard shall be cut, creased without scoring,and so slotted as to permit assembly without cracking, surface breaks or undue bending. The fluting of corrugated fibreboard shall be firmly glued to the facings.

11.11.2 The ends of a fibreboard box may have wooden frames or be entirely of wood or other suitable material. Reinforcements of wooden battens or other suitable material may be used.

11.11.3 Manufacturing joins in the body of a fibreboard box shall be taped, lapped and glued, or lapped and stitched with metal staples. Lapped joins shall have an appropriate overlap. Where closing is effected by gluing or taping, a water-resistant adhesive shall be used.

11.11.4 A fibreboard box shall be so designed as to provide a good fit to the contents.

11.11.5 The maximum net mass of a fibreboard box shall not exceed 400 kg.

11.12 Plastics boxes (4H1 and 4H2)

11.12.1 A plastics box shall be manufactured from a plastics material of adequate strength in relation to the capacity and the intended use of the box. A plastics box shall be resistant to ageing and to degradation that is caused either by the contents or by ultraviolet radiation.

11.12.2 An expanded-plastics box shall comprise two parts made of a moulded, expanded-plastics material, namely a bottom section that contains cavities for the inner packaging and a top section that covers and interlocks with the bottom section. The top and bottom sections shall be so designed that the inner packaging fits snugly. The closure of any inner packaging shall not be in contact with the inside of the top section of the box.

11.12.3 An expanded-plastics box shall be closed with a self-adhesive tape that has sufficient tensile strength to prevent the box from opening under normal conditions of transport. The adhesive tape shall be weather resistant and its adhesive shall be compatible with the expanded-plastics material of the box. Other closing devices may be used, provided that they are at least equally effective.

11.12.4 For a solid-plastics box, protection against ultraviolet radiation shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the intended contents of the box and shall remain effective throughout the life of the box. If carbon black, pigments or inhibitors, other than those used in the manufacture of the tested design type, are added, retesting may be waived if

a) the carbon black content does not exceed 2 % by mass, or

b) the pigment content does not exceed 3 % by mass.

NOTE The content of inhibitors of ultraviolet radiation is not limited.

11.12.5 Additives for purposes other than protection against ultraviolet radiation may be included in the composition of the plastics material, provided that they do not adversely affect the chemical and physical properties of the material used in the manufacture of the box. Under these Circumstances, the need for retesting the packaging may be waived.

11.12.6 A solid-plastics box shall have closures made of material of a suitable strength and the closures shall be so designed that the box is prevented from opening under normal conditions of transport.

11.12.7 The maximum net mass of an expanded-plastics box (4H1) shall not exceed 60 kg, and that of a solid- plastics box (4H2) shall not exceed 400 kg.

11.13 Steel (4A) and aluminium (4B) boxes

11.13.1 The strength of the metal and the construction of a steel or an aluminium box shall be appropriate to the capacity and the intended use of the box.

11.13.2 A box shall be lined with fibreboard or felt packing pieces, or shall have an inner liner or Coating of suitable material. If a double-seam metal liner is used, steps shall be taken to prevent the ingress of any substance, particularly of an explosive substance, into the recesses of the seams.

11.13.3 Closures may be of any suitable type and shall remain secured under normal conditions of transport.

11.13.4 The maximum net mass of a steel or an aluminium box shall not exceed 400 kg.

11.14 Textile bags (5L1, 5L2 and 5L3)

11.14.1 The textiles used in the manufacture of a bag without a liner or coating (5L1), or a siftproof bag (5L2), or a water resistant bag (5L3), shall be of good quality. The strength of the fabric and the construction of the bag shall be appropriate to the capacity and the intended use of the bag.

11.14.2 A sift-proof bag (5L2) shall be lined with

a) paper bonded to the inner surface of the bag by means of a water resistant adhesive such as bitumen, or

b) plastics film bonded to the inner surface of the bag, or

c) one or more inner liners made of paper or a plastics material.

11.14.3 Water resistant textile bags (5L3) shall be made waterproof by the use of

a) separate inner liners of water-resistant paper, for example waxed Kraft paper, double-tarred Kraft paper or plastics-coated Kraft paper,

b) plastics film bonded to the inner surface of the bag, or

c) one or more inner liners made of a plastics material.

11.14.4 The maximum net mass of a textile bag shall not exceed 50 kg.

11.15 Woven plastics bags (5H1, 5H2 and 5H3)

11.15.1 The woven plastics used in the manufacture of a bag without a liner (5H1), or a sift-proof bag (5H2), or a water-resistant bag (5H3), shall be made from stretched tapes or monofilaments of a suitable plastics material. The strength of the material used and the construction of the bag shall be appropriate to the capacity and the intended use of the bag.

11.15.2 If the fabric is woven flat, the bag shall be made by sewing or by some other method that ensures closure of the bottom and one side. If the fabric is tubular, the bag shall be closed by sewing or weaving or another equally strong method of closure.

11.15.3 Sift-proof bags (5H2) shall be lined with

a) paper or a plastics film bonded to the inner surface of the bag, or

b) one or more separate inner liners made of paper or a plastics material.

11.15.4 Water resistant bags (5H3) shall be made waterproof by means of

a) separate inner liners of water-resistant paper, for example waxed Kraft paper, double-tarred Kraft paper or plastics-coated Kraft paper,

b) plastics film bonded to the inner or outer surface of the bag, or

c) one or more inner liners made of a plastics material.

11.15.5 The maximum net mass of a woven plastics bag shall not exceed 50 kg.

11.16 Plastics film bags (5H4)

11.16.1 A plastics film bag shall be made of a suitable plastics material. The strength of the material and the construction of the bag shall be appropriate to the capacity and intended use of the bag. Joints and closures shall withstand any pressure and impact liable to occur under normal conditions of transport.

11.17 Paper bags (5M1 and 5M2)

11.17.1 The paper used in the manufacture of a multiwall bag (5M1), or a water-resistant multiwall bag (5M2), shall be of a suitable kraft paper or of an equivalent paper that has at least three plies.

The middle ply may be net-cloth with adhesive bonding to the outer ply. The strength of the paper and the construction of the bag shall be appropriate to the capacity and the intended use of the bag.Joints and closures shall be sift-proof.

11.17.2 A water-resistant paper bag (5M2), that consists of four or more plies, shall have either a Water-resistant ply as one of the two outermost plies, or a water- resistant barrier made of a suitable protective material between the two outermost plies. A 5M2 bag of three plies shall be made waterproof by the use of a water-resistant ply as the outermost ply. Where there is danger of the contents reacting with moisture, or where the contents are packed damp, a water-resistant ply or barrier, such as double-tarred kraft paper, or plastics-coated kraft paper, plastics film bonded to then inner surface of the bag, or one or more inner liners made of a plastics material, shall in addition be placed next to the contents of the bag. Joins and closures shall be waterproof.

11.17.3 The maximum net mass of a paper bag shall not exceed 50 kg.

11.18 Composite packaging with plastics inner receptacles

11.18.1 For the purposes of this standard, composite packaging that has a plastics inner receptacle comprises the following:

a) 6HA1 plastics receptacle with outer steel drum;

b) 6HA2 plastics receptacle with outer steel crate or box;

c) 6HB1 plastics receptacle with outer aluminium drum;

d) 6HB2 plastics receptacle with outer aluminium crate or box;

e) 6HC plastics receptacle with outer natural-wood box;

f) 6HD1 plastics receptacle with outer plywood drum;

g) 6HD2 plastics receptacle with outer plywood box;

h) 6HG1 plastics receptacle with outer fibre drum;

i) 6HG2 plastics receptacle with outer fibreboard box;

j) 6HH1 plastics receptacle with outer plastics drum; and

k) 6HH2 plastics receptacle with outer solid-plastics box.

11.18.2 A plastics inner receptacle shall comply with the relevant requirements given in 11.7.1, 11.7.2 and 11.7.5 to 11.7.8 (inclusive).

11.18.3 A plastics inner receptacle shall fit snugly inside the outer packaging, which shall be free from any projection that might abrade or pierce the plastics material.

11.18.4 The nominal capacity of a plastics inner receptacle shall not exceed

a) 250 L for 6HA1, 6HB1, 6HD1, 6HG1 and 6HH1, and

b) 60 L for 6HA2, 6HB2, 6HC, 6HD2, 6HG2 and 6HH2.

11.18.5 The maximum net mass of a plastics inner receptacle shall not exceed

a) 400 kg for 6HA1, 6HB1, 6HD1, 6HG1 and 6HH1, and

b) 75 kg for 6HA2, 6HB2, 6HC, 6HD2, 6HG2 and 6HH2.

11.18.6 The following subclauses are applicable to the construction of outer packaging for plastics inner receptacles:

a) outer steel or aluminum drum (6HA1 or 6HB1) – See 11.1 or 11.2;

b) outer steel or aluminum crate or box (6HA2 or 6HB2) – See 11.13;

c) outer natural-wooden box (6HC) – See 11.8;

d) outer plywood drum (6HD1) – See 11.5;

e) outer plywood box (6HD2) – See 11.9;

f) outer fibre drum (6HG1) – See 11.6;

g) outer fibreboard box (6HG2) – See 11.11;

h) outer plastics drum (6HH1) – See 11.7; and

i) outer solid-plastics box, including corrugated plastics material (6HH2) – See 11.12.

11.19 Composite packaging with glass, porcelain or stoneware inner receptacles

11.19.1 For the purposes of this standard, composite packaging that has glass, porcelain or stoneware inner receptacles comprises the following:

a) 6PA1 receptacle with outer steel drum;

b) 6PA2 receptacle with outer steel crate or box;

c) 6PB1 receptacle with outer aluminium drum;

d) 6PB2 receptacle with outer aluminium crate or box;

e) 6PC receptacle with outer natural-wood box;

f) 6PD1 receptacle with outer plywood drum;

g) 6PD2 receptacle with outer wickerwork hamper;

h) 6PG1 receptacle with outer fibre drum;

i) 6PG2 receptacle with outer fibreboard box;

j) 6PH1 receptacle with outer expanded-plastics packaging; and

k) 6PH2 receptacle with outer solid-plastics packaging.

11.19.2 An inner receptacle shall be of a suitable shape (cylindrical or pear-shaped) and shall be made of good quality material that is free from any defect that could impair its strength. The walls shall be of thickness appropriate to the capacity and the intended use of the inner receptacle.

11.19.3 A screw-threaded plastics closure, a ground-glass stopper or a closure that is at least equally effective shall be used as a closure for an inner receptacle. Any part of the closure that is likely to come into contact with the contents of the inner receptacle shall be resistant to the contents. Care shall be taken to ensure that the closure is so fitted that it is leakproof and suitably secured to prevent any loosening during transport. If a vented closure is necessary, it shall comply with 8.7.

11.19.4 The inner receptacle shall be firmly secured in the outer packaging by means of cushioning or absorbent materials, or both.

11.19.5 The maximum capacity of an inner receptacle shall not exceed 60 L.

11.19.6 The maximum net mass of an inner receptacle shall not exceed 75 kg.

11.19.7 The following sub clauses are applicable to the outer packaging for glass, porcelain or stoneware inner receptacles:

a) outer steel drum (6PA1) – See 11.1 and a removable lid that may be in the form of a cap;

b) outer steel crate or box (6PA2) – See 11.13. For a cylindrical inner receptacle, the outer packaging shall, when upright, extend above the inner receptacle and its closure. If the outer packaging surrounds a pear-shaped inner receptacle and is of matching shape, it shall be fitted with a protective cover (cap);

c) outer aluminium drum (6PB1) – See 11.2;

d) outer steel or aluminium crate or box (6PB2) – See 11.13;

e) outer natural-wood box (6PC) – See 11.8;

f) outer plywood drum (6PD1) – See 11.5;

g) outer wickerwork hamper (6PD2) – The wickerwork hamper shall be made of material of good quality and shall be so fitted with a protective cover or cap to prevent damage to the inner receptacle;

h) outer fibre drum (6PG1) – See 11.6;

i) outer fibreboard box (6PG2) – See 11.11; and

j) outer expanded-plastics packaging (6PH1) or solid-plastics packaging (6PH2) (see 11.12).

Solid-plastics packaging shall be manufactured from high-density polyethylene or some other comparable plastics material. The removable lid for this type of packaging may be in the form of a cap.

11.20 Pressure receptacles (cylinders)

11.20.1 General

11.20.1.1 A pressure receptacle (cylinder) used for the transport of a compressed gas shall be manufactured, stamped, colour-coded, inspected, tested, maintained and filled in accordance with the requirements of the competent authority.

11.20.1.2 A non-refillable pressure receptacle used for the transport of compressed gases shall be manufactured, stamped, colour-coded, inspected, tested, maintained and filled in accordance with the requirements of the competent authority (see also 13.6.11).

11.20.2 Cryogenic receptacles

11.20.2.1 In addition to the requirements of 11.20.1, the mechanical properties of the metal used for the construction of cryogenic receptacles for refrigerated liquefied gases shall be established for each pressure receptacle, including the impact strength and the bending coefficient.

11.20.2.2 The pressure receptacles shall be thermally insulated. The thermal insulation shall be protected against impact by means of a jacket. If the space between the pressure receptacle and the jacket is evacuated of air (vacuum-insulation), the jacket shall be designed to withstand, without permanent deformation, an external pressure of at least 100 kPa, calculated in accordance with a recognized technical code or a calculated critical collapsing pressure of not less than 200 kPa gauge pressure. If the jacket is so closed as to be gas-tight, for example by vacuum insulation, a device shall be provided to prevent dangerous pressure build-up in the insulating layer in the event of inadequate gas-tightness of the pressure receptacle and its fittings. Such a device shall prevent moisture from penetrating into the insulation.

11.20.2.3 Closed cryogenic receptacles intended for the transport of refrigerated liquefied gases with a boiling point below −182 °C at atmospheric pressure shall not include materials that might react with oxygen or oxygen enriched atmospheres in a dangerous manner when located in parts of the thermal insulation and where there is a risk of contact with oxygen or with oxygen enriched liquid.

11.20.2.4 Closed cryogenic receptacles shall be designed and constructed with a suitable lifting and securing arrangement.

11.21 Aerosol dispensers

11.21.1 An aerosol dispenser is a non-refillable receptacle made of metal, glass or a plastics material, or of a combination of these materials. The capacity of an aerosol dispenser made of metal shall not exceed 1 000 mL and the capacity of an aerosol dispenser made of glass or of a plastics material shall not exceed 500 mL. Aerosol dispensers of volume less than 60 mL are exempt from the requirements of this standard.

11.21.2 An aerosol dispenser shall have a means of valve protection that will prevent accidental discharge during transport. A fully charged aerosol dispenser shall be able to withstand, without loss of contents, to being dropped (on the valve protector or any body seam) from a height of 1m onto a hardwood surface.

11.21.3 A full aerosol dispenser shall show no sign of distortion or leakage when heated to a uniform temperature of 55 °C (see 12.3.3).

11.21.4 The pressure in an aerosol dispenser shall comply with the values given in table 4, appropriate to the class of the dispenser.

Table 4 — Pressure in aerosol dispensers

1	2	3	4
Pressures	**Class of dispenser**		
	Low Pressure	**Medium pressure**	**High pressure**
Service pressure at 55 °C, kPa, max.	$P^a \leq 760$	$760 < P^a \leq 970$	$970 < P^a \leq 1\,275$
Hydraulic test pressure, kPa, max.	860	1 070	1 375
Bursting pressure, kPa, min.	1 140	1 450	1 860
[a] P is the pressure in the dispenser.			

11.22 Inner packaging

11.22.1 General

The inner packaging covered by this sub clause shall also comply with the relevant provisions of clause 8.

11.22.2 Tin-plate cans with friction or threaded closures

A tin-plate can with a friction or threaded closure that is used as inner packaging shall be of wall thickness appropriate to the capacity and the intended use of the tin-plate can. When tested as part of a combination packaging, the closure shall not become detached and shall not leak.

11.22.3 Glass containers

11.22.3.1 A glass container that is used as inner packaging shall be free from faults of a nature liable to impair its strength. In particular, internal strains shall have been relieved.

11.22.3.2 The walls of a glass container shall be of thickness at least

a) 3 mm for a gross mass exceeding 35 kg, and

b) 2 mm for a gross mass equal to or less than 35 kg.

11.22.4 Plastics bottles for liquids

A plastics bottle for liquids that is used as inner packaging shall be of wall thickness appropriate to the capacity and the intended use of the plastics container. When tested as part of a combination packaging, the closure shall not become detached or leak.

11.23 Unit loads

11.23.1 Packaging that comprises a unit load (see 3.1.55) shall comply with the relevant requirements of this standard and shall be suitable for safe handling and transport.

11.23.2 A unit load shall be secured in a way that is unlikely to damage the individual packages that comprise the unit load. A unit load that is intended to support over stowage shall be suitably shaped for the purpose.

11.23.3 A unit load shall be sufficiently strong to withstand repeated handling. A unit load intended to support over stowage shall be sufficiently strong to support unit loads of similar mass stacked to the height usually used during transport.

11.23.4 The materials used to bond the unit load together shall retain their efficiency when exposed to moisture, temperature extremes, sunlight and minor leakages of substances.

11.23.5 A unit load shall be suitable for lifting by fork lift truck or other similar apparatus. Where they are not apparent, the safe lifting points shall be marked on the unit load.

11.23.6 Unless otherwise approved by the competent authority, a unit load shall not contain packages of substances that can react dangerously with one another.

12 Test requirements for packaging

12.1 Design type testing

12.1.1 General

NOTE 1 The test requirements for the packaging of infectious substances of division 6.2 are given in 14.3.

NOTE 2 The test requirements for the packaging of radioactive material of class 7 are given in 15.8.

12.1.1.1 Tests shall be successfully performed on each packaging design type and a compliance certificate issued (see 4.2) before such packaging can be used for the transport of dangerous goods.

A packaging design type is defined by the design, size, material and thickness of the packaging and the manner of construction and packing. Packaging subjected to various surface treatments, for example painting and galvanization, and also packaging of a height less than that of the design type, are included in the definition of design type.

12.1.1.2 The test design type of each packaging shall be tested by an accredited test laboratory approved by the competent authority in order to establish whether or not it complies with the performance requirements of this standard.

12.1.1.3 Tests shall be repeated on production specimens at intervals established by the competent authority (see 4.1). For such tests on paper or fiberboard packaging, preparation at ambient conditions may be deemed equivalent to the requirements of 12.2.6.

12.1.1.4 Tests shall be repeated after each modification that alters the design, material or manner of construction of the packaging.

12.1.1.5 The competent authority may permit the selective testing of packaging that differs only in minor respects from a tested type, for example:

a) smaller sizes of inner packaging;

b) inner packaging of lower net mass; and

c) packaging such as drums, bags and boxes that are produced with small reductions in one or more of the external dimensions.

12.1.1.6 Where an outer packaging of combination packaging has been successfully tested with different types of inner packaging, a variety of such different inner packaging may be assembled in this outer packaging. In addition, where an equivalent level of performance is maintained, variations in inner packaging is allowed without further testing of the package (see 12.1.1.7 to 12.1.1.9).

12.1.1.7 Inner packaging of equivalent or smaller size than that tested may be used, provided that:

a) the inner packaging is of similar design to the tested inner packaging, for example of round or rectangular shape;
b) the material of construction of the inner packaging, for example glass, plastics or metal, offers resistance to impact and stacking forces equal to or exceeding that of the originally tested inner packaging;

c) the inner packaging has openings of the same size or smaller size, and the closures are of similar design, for example a screw cap or friction lid;

d) sufficient additional cushioning material is used to fill void spaces and to prevent significant movement of the inner packaging; and

e) inner packaging is oriented within the outer packaging in the same way as in the tested package.

12.1.1.8 A lesser number of inner packages than that used for the performance tests, or the alternative inner packaging given in 12.1.1.7, may be used, provided that sufficient cushioning material is added to fill any void spaces and to prevent significant movement of the inner packaging.

12.1.1.9 An article or inner packaging of any type intended for a solid or a liquid may be assembled and transported in an outer packaging without testing, provided that:

a) the outer packaging has been successfully tested in accordance with 12.3.1, using fragile inner packaging, for example glass, that contains a liquid, and a drop height suitable to packing group I;

b) the total combined gross mass of the inner packaging does not exceed one-half of the gross mass of the inner packaging used for the drop test as described in (a) above;

c) the thickness of the cushioning material between the inner packaging's and between the inner packaging and the outer packaging is not reduced to less than that of the corresponding thicknesses in the originally tested packaging. If a single inner packaging was used in the original test, the thickness of the cushioning material shall not be less than the thickness of cushioning material between the outer packaging and the inner packaging in the original test.

When the number of inner packages is fewer, or the size of the inner packaging is smaller than that used in the original drop test, sufficient additional cushioning material shall be used to fill any void space(s);

d) the outer packaging has successfully passed the stacking test (see 12.3.5) while empty. The total mass of identical packages shall be based on the combined mass of the inner packaging for the drop test as described in (a) above;

e) the inner packaging that contains liquids is completely surrounded with a sufficient quantity of absorbent material to absorb the entire liquid contents of the inner packaging;

f) if the outer packaging is not leak-proof and is intended to contain inner packaging for a liquid, or if the outer packaging is not sift-proof and is intended to contain inner packaging for a solid, an efficient means of containment for the liquid or the solid in the event of leakage has been provided, for example a leak-proof liner or a plastics bag;

g) in the case of air transport, packaging intended to contain a liquid is able to withstand a pressure differential without leakage, as specified in the international regulations for air transport; and

h) packaging is marked in accordance with clause 10 as having been tested to packing group I performance for combination packaging. The marked gross mass in kilograms shall be the sum of the mass of the outer packaging plus one-half of the mass of the inner packaging as used for the drop test referred to in (a) above. A package so marked shall also display the letter V (see 9.4).

12.1.1.10 Performance tests for all combination packaging shall be carried out on a combination package in accordance with tests prescribed for the outer packaging. Inner packaging need not be tested separately, but shall be incorporated in the combination packaging and tested in conjunction with the outer packaging.

12.1.1.11 The competent authority may at any time require proof, by tests in accordance with this clause, that serially produced packaging satisfies the requirements of the design type tests.

12.1.1.12 If an inner treatment or coating is required for safety reasons, it shall retain its protective properties even after completion of the tests.

12.1.1.13 Several tests may be carried out on one sample, provided that the validity of the tests results is not affected and that the competent authority has granted approval.

12.1.2 Design type testing for salvage packaging

12.1.2.1 Salvage packaging (see 3.1.47) shall be tested and marked in accordance with the requirements applicable to packing group II intended for the transport of solids or inner packaging. When water is used as the test substance:

a) the packaging shall be filled to at least 98 % of its maximum capacity. Bags of lead shot may be used to achieve the requisite total package mass, provided that these are positioned in such away that the test results are not affected. In performing the drop test (see 12.3.1), the drop height may be varied in accordance with 12.3.1.4.5; and

b) the packaging shall comply with the requirements of the leakproofness test at 30 kPa (see 12.3.2). The results of this test shall be reflected in the test report (see 12.3.7).

12.1.2.2 Salvage packaging shall be marked with the letter "T" (see also 8.11).

12.2 Preparation of packaging for testing

12.2.1 Performance tests shall be carried out on packaging prepared as for transport. Combination packaging shall be fitted with its inner packaging.

12.2.2 Receptacles or packaging shall be filled to at least 98 % of their maximum capacity for liquids or 95 % for solids. Bags shall be filled to the maximum mass at which they are intended to be used.

12.2.3 Combination packaging that contains inner packaging designed for the containment of liquids or of solids, shall be tested separately for both liquids and solids.

12.2.4 For testing purposes, the substances or articles to be transported in the packaging may be replaced by other substances or articles, provided that this would not invalidate the test results. If another substance is used in place of a solid, it shall have the same physical characteristics, for example mass and grain size, as the substance offered for transport. Additives, such as bags of lead shot, may be used to achieve the requisite total package mass, provided that these are positioned in such a way that the results are not affected.

12.2.5 An alternative substance may be used in the drop test for liquids, provided that the substance is of similar relative density and viscosity as the liquid offered for transport. Water may be used for the liquid drop test, under certain conditions (see 12.3.1.4.4 and 12.3.1.4.5).

12.2.6 Paper or fiberboard packaging shall be conditioned for at least 24 h at a controlled temperature and relative humidity. One of the following three options shall be chosen:

a) a temperature of 23 °C ± 2 °C and a relative humidity of (50 ± 2) % (preferred);

b) a temperature of 20 °C ± 2 °C and a relative humidity of (65 ± 2) %; or

c) a temperature of 27 °C ± 2 °C and a relative humidity of (65 ± 2) %.

NOTE 1 Average values should fall within these limits. Short-term fluctuations and measurement limitations can cause individual measurements of the relative humidity to vary up to approximately 5 % without significant impairment of test reproducibility.

NOTE 2 See 12.1.1.3 for the preparation of paper and fiberboard packaging on production specimens.

12.2.7 The following steps shall be taken to ascertain that the plastics material used in the manufacture of plastics drums, plastics jerricans and composite packaging complies with the requirements of 8.2 and 11.18:

a) submit the specimen receptacles or packaging to a preliminary test extending over a long period, for example six months, during which time the specimens shall remain filled with the substances intended for transport. For the first and last 24 h of storage, the specimen receptacles shall be placed with the closure downwards. However, packaging with a vent shall be so placed only for 5 min on each occasion. After this time has elapsed, submit the specimens to the appropriate tests given in 12.3.1, 12.3.2, 12.3.4 to 12.3.6; or

b) fill the specimens with substances that are known to cause stress cracking or weakening in the plastics material in question. Subject the specimens to a superimposed load equivalent to the total mass of identical packages that might be stacked on top of the packaging during transport. The minimum height of the stack, including the test specimen, shall be 3 m.

12.3 Performance testing

12.3.1 Drop test

12.3.1.1 Applicability

The drop test is applicable to all types of packaging.

12.3.1.2 Apparatus

Target, shall be non-resilient and horizontal surface and shall be:

a) integral and massive enough to be immovable;

b) flat with a surface kept free from local defects capable of influencing the test results;

c) rigid enough to be non-deformable under test conditions and not liable to become damaged by the tests; and

d) sufficiently large to ensure that the test package falls entirely upon the surface.

12.3.1.3 Preparation

12.3.1.3.1 In addition to the preparation of packaging for testing as given in 12.2, the temperature of the test specimen and its contents when tested shall not be below −18 °C for the following types of packaging:

a) plastics drums and plastics jerricans (see 11.7);

b) plastics boxes other than expanded-plastics boxes (see 11.12);

c) composite packaging with plastics inner receptacles (see 11.18); and

d) combination packaging with plastics inner packaging, other than plastics bags intended to contain solids or articles.

12.3.1.3.2 Test liquids shall be kept in the liquid state by the addition of anti-freeze if necessary.

12.3.1.3.3 Test specimens that have been prepared as described in 12.3.1.3.1 and 12.3.1.3.2 need not be conditioned as described in 12.2.6.

12.3.1.3.4 A removable-head type packaging intended for the transport of liquid shall be allowed to stand for at least 24 h after filling and closing. This is to allow for any possible gasket relaxation before the drop test is carried out.

12.3.1.4 Procedure

12.3.1.4.1 See table 5 for the number of test specimens (per design type and manufacturer) and the points of impact.

Table 5 — Number of test specimens (per design type and manufacturer) and points of impact for the drop test

1	2	3
Packaging	**Number of test specimens**	**Drop orientation**
Steel drums Aluminium drums Metal drums, other than steel or aluminium drums Steel jerricans Aluminium jerricans Plywood drums Wooden barrels Fibre drums Plastics drums and jerricans Composite packaging that is in the shape of a drum	Six (three for each drop)	**First drop** (using three specimens): the packaging shall strike the target diagonally on the chime or, if the packaging has no chime, on a circumferential seam or an edge. **Second drop** (using the other three specimens): the packaging shall strike the target on the weakest part not tested by the first drop, e.g. a closure or, for some cylindrical drums, the welded longitudinal seam of the drum body
Natural-wood boxes Plywood boxes Reconstituted-wood boxes Fibreboard boxes Plastics boxes Steel or aluminium boxes Composite packaging that is in the shape of a box	Five (one for each drop)	**First drop:** flat on the bottom **Second drop:** flat on the top **Third drop:** flat on the long side **Fourth drop:** flat on the short side **Fifth drop:** on a corner
Bags, single-ply with a side seam	Three (three drops per bag)	**First drop:** flat on a wide face **Second drop:** flat on a narrow face **Third drop:** on an end of the bag
Bags, single-ply without a side seam, or multi-ply	Three (two drops per bag)	**First drop:** flat on a wide face **Second drop:** on an end of the bag

12.3.1.4.2 Drop the packaging in such a way that the centre of gravity is vertically above the point or the area of impact.

12.3.1.4.3 Drop the packaging that contains the solid or the liquid to be transported, or another substance that has essentially the same characteristics, from the following heights:

– Packing group I: 1.8 m;

– Packing group II: 1.2 m; and

– Packing group III: 0.8 m.

12.3.1.4.4 Perform the test using water if the liquid substances to be transported have a relative density *d* equal to or less than 1,2. Drop the packaging from the appropriate height given in 12.3.1.4.3.

12.3.1.4.5 Perform the test using water if the liquid substances to be transported have a relative density *d* exceeding 1,2. Increase the drop height on the basis of the relative density of the substance to be transported, rounded off to the first decimal place as follows:

– Packing group I: *d* × 1.5 m;

– Packing group II: *d* × 1.0 m; and

– Packing group III: *d* × 0.67 m.

12.3.1.5 Acceptance criteria

12.3.1.5.1 Packaging for liquids

Packaging for liquids shall be leak proof when equilibrium is reached between the internal and external pressures. However, in the case of the inner packaging of combination packaging, it is unnecessary for the pressures to be equalized.

12.3.1.5.2 Packaging for solids

The entire contents of the packaging shall be retained by the inner packaging or the inner receptacle, for example a plastics bag, even if the closure while retaining its containment function, is no longer sift-proof.

12.3.1.5.3 Outer packaging of composite or combination packaging

The outer packaging of composite or combination packaging shall not exhibit any damage liable to affect safety during subsequent handling or transport. There shall be no leakage of the filling substance from the inner receptacle or the inner packaging, and all inner packaging shall be so retained within the outer packaging that it is not possible to remove the inner packaging by hand without further damage to the outer packaging.

12.3.1.5.4 Bags

In the case of a bag, neither the outermost ply of the bag, nor an outer packaging, shall exhibit any damage liable to affect safety during subsequent handling or transport.

12.3.1.5.5 Leakage from closures

A slight discharge from the closure(s) upon impact shall not be considered to be a failure of the packaging, provided that no further leakage occurs when the packaging is subsequently handled.

12.3.1.5.6 Packaging for goods of class 1

There shall be no rupture of packaging for goods of class 1, which would permit the spillage of loose explosive substances or articles from the outer packaging.

12.3.2 Leakproofness test for packaging intended for liquids

12.3.2.1 Applicability

The leakproofness test shall be performed on all design types of packaging intended to contain liquids (see also 8.3.3).

NOTE This test is not required for the inner packaging of combination packaging.

12.3.2.2 Procedure

12.3.2.2.1 Use three test specimens per design type and manufacturer.

12.3.2.2.2 Replace vented closures with similar, non-vented closures, or seal the vent.

12.3.2.2.3 Keep the entire packaging under water for 5 min while an internal air pressure (see Table 6) is applied. The method of restraint shall not affect the results of the test.

NOTE Other equally effective methods may be used to check for leaks, for example a soap solution may be applied externally to all surfaces, seams and closures.

Table 6 — Air pressure (gauge) applied for leakproofness test

1	2
Packing group	**Air pressure (gauge)** kPa
I	≥ 30
II	≥ 20
III	≥ 20

12.3.2.3 Acceptance criteria

There shall be no leakage of air from the packaging.

12.3.3 Leakproofness test for aerosol dispensers and small receptacles for gas

12.3.3.1 Applicability

Each aerosol dispenser and small receptacle for gas shall be subjected to a hot waterbath test.

12.3.3.1.1 Test conditions

The temperature of the water bath and the duration of the immersion of a receptacle shall be such that the internal pressure reaches 90 % of what the internal pressure would be at 55 °C (95 % of the capacity of the receptacle at 50 °C).

12.3.3.2 Procedure

12.3.3.2.1 Keep each receptacle under water in a hot water bath.

12.3.3.2.2 If the contents of the receptacle are sensitive to heat, or if the receptacle is made of plastics that softens at the temperature given in 12.3.3.2.3 or 12.3.3.2.4, maintain the water bath at a

temperature of between 20 °C and 30 °C. In addition, test one receptacle in 2000 in accordance with 12.3.3.2.3 or 12.3.3.2.4, as applicable.

12.3.3.2.3 In the case of tinplate or aluminum receptacles, maintain the water bath at a temperature of 50 °C.

12.3.3.2.4 In the case of glass receptacles, maintain the water bath at a temperature of between 38 °C and 43 °C.

12.3.3.3 Acceptance criteria

No leakage or permanent deformation of the receptacle shall occur, except that a plastics receptacle may be deformed through softening, provided that it does not leak.

12.3.4 Internal pressure (hydraulic) test

12.3.4.1 Applicability

This test is applicable to all design types of metal, plastics and composite packaging intended to contain liquids.
NOTE With the exception of aerosol dispensers, this test is not required for the inner packaging of combination packaging.

12.3.4.2 Procedure

NOTE Ensure that the packaging that is filled with the relevant liquid commodity is not liquid-full (brimful) when heated to 55 °C (see 8.3.1).

12.3.4.2.1 Use three test specimens per design type and manufacturer.

12.3.4.2.2 Replace vented closures with similar, non-vented closures, or seal the vent.

12.3.4.2.3 Subject metal packaging and composite packaging (glass, porcelain or stoneware), including the closures, to the appropriate hydraulic test pressure (see 12.3.4.3 and 12.3.4.4) for 5 min.

12.3.4.2.4 Subject plastics packaging and composite packaging manufactured of plastics material, including the closures, to the appropriate hydraulic test pressure (see 12.3.4.3 and 12.3.4.4) for 30 min. NOTE This pressure has to be included in the marking required by 10.2.4.

12.3.4.2.5 Support the packaging as not to invalidate the test.

12.3.4.2.6 Apply the test pressure continuously and evenly, and keep it constant throughout the test period.

12.3.4.2.7 Apply the appropriate test pressure to the packaging (see 12.3.4.3 and 12.3.4.4).

12.3.4.3 Hydraulic test pressure of packaging for packing group I liquids

12.3.4.3.1 Determine the appropriate pressure (gauge) to be applied to the packaging at 55 °C in accordance with 12.3.4.3.2(a) or (b), whichever gives the higher pressure.

12.3.4.3.2 The hydraulic pressure (gauge) applied shall not be less than

a) the total gauge pressure measured in the packaging, namely the vapour pressure of the liquid substance plus the partial pressure of air or other inert gases, minus 100 kPa at 55 °C and multiplied by a safety factor of 1,5, as represented by the following formula:

Ph = (Vg (55) –100) × 1,5

where

Ph is the hydraulic test pressure (gauge), in kilopascals; and

Vg (55) is the vapour pressure of the filling substance and the partial pressure of air or other inert gases, in kilopascals;

b) 1.75 times the vapour pressure at 50 °C of the liquid to be transported, minus 100 kPa but with a minimum test pressure of 100 kPa, as represented by the following formula:

Ph = (Va (50) –100) × 1,75

where

Ph is the hydraulic test pressure (gauge), in kilopascals; and

Va (50) is the vapour pressure of the liquid substance at a temperature of 50 °C, in kilopascals.

c) 1.5 times the vapour pressure of the liquid substance intended for transport at a temperature of 55 °C, minus 100 kPa, as represented by the following formula:

Ph = (Va (55) × 1,5) –100

where

Ph is the hydraulic test pressure (gauge), in kilopascals; and

Va (55) is the vapour pressure of the liquid substance at a temperature of 55 °C, in kilopascals.

12.3.4.3.3 In addition, subject the packaging to a test pressure of at least 250 kPa (gauge) for a period of 5 min or 30 min, depending upon the material of construction of the packaging (see 12.3.4.2.3 and 1.2.3.4.2.4).

12.3.4.4 Hydraulic test pressure of packaging for packing group II and packaging group III liquids

The test pressure shall be equal to an internal pressure that produces a pressure differential of 100 kPa, or a pressure that is related to the vapour pressure of the liquid to be transported, whichever is the greater. The pressure related to the vapour pressure shall be determined in accordance with 12.3.4.3.2(a) or (b).

12.3.4.5 Acceptance criteria

No leakage shall occur.

12.3.5 Stacking test

12.3.5.1 Applicability

This test is applicable to all design types of packaging other than bags.

12.3.5.2 Procedure

12.3.5.2.1 Use three test specimens per design type and manufacturer.

12.3.5.2.2 Subject the top surface of the test specimen to a force equivalent to the total mass of identical packages that are likely to be stacked on top of the packaging during transport.

12.3.5.2.3 If the contents of the test specimen are non-dangerous liquids of a relative density that differs from that of the liquid to be transported, calculate the appropriate stack force to be applied.

12.3.5.2.4 Stack the specimens, including the test specimen, to a height of at least 3 m.

12.3.5.2.5 Subject the test specimen to the stack force for at least 24 h, but subject plastics drums, plastics jerricans, and composite packaging 6HH1 and 6HH2 intended for liquids, to the stacking test for a period of 28 d at a temperature of at least 40 °C.

12.3.5.2.6 After completion of this test, carry out the stacking stability test (see 12.3.6).

12.3.5.3 Acceptance criteria

12.3.5.3.1 No leakage of a test specimen shall occur.

12.3.5.3.2 No leakage of the contents of an inner receptacle or inner packaging of composite packaging or combination packaging shall occur.

12.3.5.3.3 No test specimen shall show any distortion that

a) could adversely affect safety during subsequent handling or transport, or

b) is liable to reduce the test specimen's strength or cause instability in stacks of packages.

12.3.6 Stacking stability test

12.3.6.1 Applicability

This test is applicable to all design types of packaging, other than bags, that have been subjected to the stacking test (see 12.3.5).

12.3.6.2 Procedure

12.3.6.2.1 Allow the three tested specimens (see 12.3.5.2.1) to cool down to ambient temperature.

12.3.6.2.2 On top of each test specimen, stack two packages of the same type as the test specimen.

12.3.6.3 Acceptance criteria

The two packages stacked on top of the test specimen shall maintain their position for at least 1 h.

12.3.7 Test report

12.3.7.1 A test report shall be drawn up by the test laboratory (see 4.1). The test report is the property of the applicant who commissioned the test. Users of the packaging can obtain the test report only from the applicant who commissioned the test.

12.3.7.2 A test report shall contain at least the following information:

a) name and address of the test laboratory;

b) name and address of the applicant;

c) a unique test report identification;

d) date of the test report;

e) manufacturer of the packaging;

f) description of the packaging, for example dimensions, materials, closures, wall thickness, etc., including the method of manufacture, for example blow moulding, and which can include drawings or photographs, or both;

g) maximum capacity;

h) characteristics of test contents, for example viscosity, and relative density for liquids and particle size for solids;

i) test description and results; and

j) the signature, name and status of the signatory.

12.3.7.3 The test report shall contain a statement that the packaging, as prepared for transport, was tested in accordance with the appropriate requirements of this standard and that the use of other packaging methods or components can render it invalid (see also 10.1.3).

12.3.7.4 A copy of the test report shall be available to the competent authority.

13 Provisions concerning packing instructions

13.1 General

13.1.1 Packing instructions applicable to the packaging for dangerous goods of classes 1 to 9 are given in B.2 of k and are designated by the alphanumerical code comprising the letter "P".

13.1.2 A packing instruction may specify a special packing provision for an individual substance or article. Such a special provision is designated by an alphanumerical code comprising the letters "PP".

13.1.3 Generally, a packing instruction does not provide guidance on compatibility and the user shall check that the substance is compatible with the packaging selected, for example, most fluorides are unsuitable to be packed in glass receptacles.

NOTE Where glass receptacles are permitted in the packing instructions porcelain, earthenware and stoneware are also allowed.

13.1.4 The following packaging shall not be used when the substance to be transported is liable to become liquid during transport:

Drums: 1D and 1G

Boxes: 4C1, 4C2, 4D, 4F, 4G and 4H1

Bags: 5L1, 5L2, 5L3, 5H1, 5H2, 5H3, 5H4, 5M1 and 5M2

Composite packaging: 6HC, 6HD2, 6HG1, 6HG2, 6HD1, 6PC, 6PD1, 6PD2, 6PG1, 6PG2 and 6PH1.

13.1.5 All cylinders, tubes, pressure drums and bundles of cylinders conforming to the construction requirements of packing instruction P200 are authorized for the transport of any liquid or solid substance assigned to packing instruction P001 or P002, unless otherwise indicated in the packing instruction, or by the special provision given against that specific item in B.2 of DEAS 949 :2019 The capacity of bundles of cylinders and tubes shall not exceed 1 000 L.

13.1.6 Packaging not specifically authorized in the applicable packing instruction shall not be used for transport of a substance or article unless specifically approved by the competent authority and provided:

a) the alternative packaging complies with the requirements of clause 8;

b) the relevant performance tests in accordance with clause 12 have been passed;

c) the alternative packaging provides at least the same level of safety as if the substance were packed in accordance with a method specified in the particular packing instruction indicated against the entry of the substance in DEAS 949 :2019; and

d) a copy of the competent authority approval accompanies each consignment, or the transport document includes an indication that alternative packaging was approved by the competent authority.

13.2 Packing provisions for unpackaged articles other than articles of class 1

13.2.1 A large and robust article, for example a flexible fuel containment system, military equipment, machinery or equipment that contains dangerous goods above the limited quantity thresholds (see clause 19) and that cannot be packaged in accordance with the requirements of clause 12 and the requirements of other international standards, can be transported empty, uncleaned and unpackaged, when so approved by the competent authority. The competent authority shall take into account that:

a) the article shall be strong enough to withstand the shocks and loadings normally encountered during transport, including trans-shipment between transport units and between transport units and warehouses, as well as removal from a pallet for subsequent manual or mechanical handling;

b) all closures and openings shall be sealed so as to prevent leakage or sifting of contents as a result of vibration and environmental conditions such as temperature, pressure or humidity that might be encountered during transport. No dangerous residue shall adhere to the outside of the article;

c) parts of the article that are in direct contact with the dangerous goods shall not

    1) be affected or significantly weakened by such dangerous goods, and

2) cause a dangerous effect, for example catalyzing a reaction or reacting with the dangerous goods;

d) an article that contains liquids shall be transported and secured in such a way that neither leakage nor permanent distortion of the article occurs during transport; and

e) the article shall be fixed in a cradle or a crate or another handling device in such a way that it will not become loose during normal conditions of transport.

13.2.2 The transport of an unpackaged article shall be approved by the competent authority in accordance with clause 8. In addition, the consignor of such an article shall ensure that a copy of such an approval be transported with the article.

13.3 Pressure receptacles for liquids and solids

13.3.1 Pressure receptacles intended for the transport of liquids and solids shall conforms to national or international standards on the design, construction, testing, manufacturing and inspection, as applied by the country in which the pressure receptacle is manufactured and provided that

a) the requirements of this clause are met, and

b) the construction of metallic cylinders, tubes, pressure drums and bundles of cylinders is such that the minimum burst ratio (burst pressure divided by test pressure) is

i) 1.50 for refillable pressure receptacles, and

ii) 2.00 for non-refillable pressure receptacles

13.3.2 Explosives, thermally unstable substances, organic peroxides, self-reactive substances, substances where significant pressure can develop by evolution of chemical reaction, and radioactive material (unless permitted by clause 15) are not permitted to be transported in pressure receptacles.

13.3.3 The requirements of this clause are not applicable to the substances mentioned in table 3 of packing instruction P200 (see 13.4).

13.3.4 Every design type of pressure receptacle intended for the transport of liquids and solids shall be approved by the competent authority of the country of manufacture.

13.3.5 Unless otherwise indicated, a pressure receptacle

a) shall have a minimum test pressure of 0,6 MPa, and

b) an emergency pressure relief device can be provided to avoid bursting in case of overfill or fire accidents.

13.3.6 The valves of a pressure receptacle shall be so designed and constructed that they are inherently able to withstand damage without release of the contents, or they shall be protected from damage that could cause inadvertent release of contents by one of the following methods:

a) the valves are placed inside the neck of the pressure receptacle and protected by a threaded plug or a cap. The cap shall be provided with vent-holes of sufficient cross-sectional area to release gas if leakage occurs at the valves;

b) the valves are protected by shrouds or guards;

c) the pressure receptacles are transported in frames, for example bundles; or

d) the pressure receptacles are transported in outer packaging. The packaging as prepared for transport shall be capable of meeting the requirements of the drop test (see 12.3.1) at the packing group I performance level.

13.3.7 The level of filling shall not exceed 95 % of the capacity of the pressure receptacle at 50 °C.Sufficient ullage (outage) shall be left to ensure that the pressure receptacle will not be liquid full at a temperature of 55 °C.

13.3.8 Unless otherwise indicated, pressure receptacles shall be subjected to periodic inspection and testing every five years. The periodic inspection shall include

a) an external examination,

b) an internal examination,

c) a pressure test or equivalent non-destructive test with agreement of the competent authority, and

d) inspection of all accessories such as tightness of valves, emergency relief valves or fusible elements

Pressure receptacles shall not be filled after they become due for periodic inspection and testing. However, they can be transported after the expiry of the time limit.

13.3.9 Repair of a pressure receptacle shall be consistent with the fabrication and testing requirements of the applicable design and construction standards and are only permitted as indicated in ISO 64061 or ISO 1046, as applicable. Pressure receptacles shall not be subjected to repairs of any of the following:

a) weld cracks or other weld defects;

b) cracks in walls; and

c) leaks or defects in the material of the wall, head or bottom.

13.3.10 Prior to filling, the filler shall perform an inspection of the pressure receptacle and ensure that the pressure receptacle is authorized for the substance to be transported and that the requirements of this standard have been met. Shut-off valves shall be closed after filling and remain closed during transport. The consignor shall verify that the closures and equipment are not leaking.

13.3.11 Refillable pressure receptacles shall not be filled with a substance different from that previously contained, unless the necessary operations for change of service have been performed.

13.3.12 Marking of pressure receptacles for liquids and solids shall be in accordance with the requirements of the competent authority of the country of manufacturing.

13.4 List of packing instructions

P001	PACKING INSTRUCTION (LIQUIDS) *(concluded)*	P001

The following types of packaging are authorized, provided the provisions of clause 8, 13.1 and 13.2 are met:

	Maximum capacity /net mass (see 3.1)		
	Packing group I	**Packing group II**	**Packing group III**
Composite packaging			
plastics receptacle in steel or aluminium drum (6HA1, 6HB1)	250 L	250 L	250 L
plastics receptacle in fibre, plastics or plywood drum (6HG1, 6HH1, 6HD1)	120 L	250 L	250 L
plastics receptacle in steel or aluminium crate or box or plastics receptacle in wood, plywood, fibreboard or solid plastics box (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2)	60 L	60 L	60 L
glass receptacle in steel, aluminium, fibre, plywood, solid plastics or expanded plastics drum (6PA1, 6PB1, 6PG1, 6PD1, 6PH1 or 6PH2) or in steel, aluminium, wood or fibreboard box or in a wickerwork hamper (6PA2, 6PB2, 6PC, 6PG2 or 6PD2)	60 L	60 L	60 L

[a] Only substances with a viscosity greater than 200 mm^2/s are permitted.

Special packing provisions:

PP1 UN 1133, UN 1210, UN 1263 and UN 1866 – for adhesives, printing inks, printing ink related materials, paints, paint related materials and resin solutions which are assigned to UN 3082, metal or plastics packaging for substances of packing groups II and III in quantities of 5 L or less per packaging are not required to meet the performance tests given in 12.3 when transported

(a) in a palletized load, a pallet box or unit load device, e.g. individual packaging placed or stacked and secured by strapping, shrink or stretch-wrapping or other suitable means to a pallet. For sea transport, the palletized loads, pallet boxes or unit load devices shall be firmly packed and secured in closed cargo transport units;

(b) as an inner packaging of a combination packaging with a maximum net mass of 40 kg.

PP2 UN 3065 – wooden barrels (2C1 and 2C2) with a maximum capacity of 250 L and which do not meet the provisions given in 12.3 may be used.

PP4 UN 1774 – packaging shall meet the packing group II performance level.

PP5 UN 1204 – packaging shall be so constructed that explosion is not possible by reason of increased internal pressure. Gas cylinders and gas receptacles shall not be used for this substance.

PP10 UN 1791 – packing group II packaging shall be vented.

PP31 UN 1131 – packaging shall be hermetically sealed.

PP33 UN 1308 – packing groups I and II, only combination packaging with a maximum gross mass of 75 kg.

PP81 For UN 1790 with more than 60 % but not more than 85 % hydrofluoric acid and UN 2031 with more than 55 % nitric acid – plastics drums and jerricans as single packaging are permitted for a period of two years from their date of manufacture.

13.4 List of packing instructions (*continued*)

P002	PACKING INSTRUCTION (SOLIDS)	P002
The following types of packaging are authorized, provided the provisions of clauses 8, 13.1 and 13.2 are met:		

Combination packaging		Maximum net mass (see 3.1)		
Inner packaging	**Outer packaging**	**Packing group I**	**Packing group II**	**Packing group III**
Glass 10 kg Plastics[a] 50 kg Metal 50 kg Paper[a, b, c] 50 kg Fibre[a, b, c] 50 kg	**Drums**			
	steel (1A2)	400 kg	400 kg	400 kg
	aluminium (1B2)	400 kg	400 kg	400 kg
	other metal (1N2)	400 kg	400 kg	400 kg
	plastics (1H2)	400 kg	400 kg	400 kg
	plywood (1D)	400 kg	400 kg	400 kg
	fibre (1G)	400 kg	400 kg	400 kg
	Boxes			
	steel (4A)	400 kg	400 kg	400 kg
	aluminium (4B)	400 kg	400 kg	400 kg
	natural wood (4C1)	250 kg	400 kg	400 kg
	natural wood with sift-proof walls (4C2)	250 kg	400 kg	400 kg
	plywood (4D)	250 kg	400 kg	400 kg
	reconstituted wood (4F)	125 kg	400 kg	400 kg
	fibreboard (4G)	125 kg	400 kg	400 kg
	expanded plastics (4H1)	60 kg	60 kg	60 kg
	solid plastics (4H2)	250 kg	400 kg	400 kg
	Jerricans			
	steel (3A2)	120 kg	120 kg	120 kg
	aluminium (3B2)	120 kg	120 kg	120 kg
	plastics (3H2)	120 kg	120 kg	120 kg
Single packaging				
Drums				
steel (1A1 or 1A2[d])		400 kg	400 kg	400 kg
aluminium (1B1 or 1B2[d])		400 kg	400 kg	400 kg
metal, other than steel, or aluminium (1N1 or 1N2[d])		400 kg	400 kg	400 kg
plastics (1H1 or 1H2[d])		400 kg	400 kg	400 kg
fibre (1G)[e]		400 kg	400 kg	400 kg
plywood (1D)[e]		400 kg	400 kg	400 kg
Jerricans				
steel (3A1 or 3A2[d])		120 kg	120 kg	120 kg
aluminium (3B1 or 3B2[d])		120 kg	120 kg	120 kg
plastics (3H1 or 3H2[d])		120 kg	120 kg	120 kg

13.4 List of packing instructions (*continued*)

P002	PACKING INSTRUCTION (SOLIDS) *(continued)*		P002
Single packaging *(continued)*			
Boxes			
steel (4A)[e]	Not allowed	400 kg	400 kg
aluminium (4B)[e]	Not allowed	400 kg	400 kg
natural wood (4C1)[e]	Not allowed	400 kg	400 kg
plywood (4D)[e]	Not allowed	400 kg	400 kg
reconstituted wood (4F)[e]	Not allowed	400 kg	400 kg
natural wood with sift proof walls (4C2)[e]	Not allowed	400 kg	400 kg
fibreboard (4G)[e]	Not allowed	400 kg	400 kg
solid plastics (4H2)[e]	Not allowed	400 kg	400 kg
Bags			
bags (5H3, 5H4, 5L3, 5M2)[e]	Not allowed	50 kg	50 kg
Composite packaging:			
plastics receptacle in steel, aluminium, plywood, fibre or plastics drum (6HA1, 6HB1, 6HG1[e], 6HD1[e] or 6HH1)	400 kg	400 kg	400 kg
plastics receptacle in steel or aluminium crate or box, wooden box, plywood box, fibreboard box or solid plastics box (6HA2, 6HB2, 6HC, 6HD2[e], 6HG2[e] or 6HH2)	75 kg	75 kg	75 kg
glass receptacle in steel, aluminium, plywood or fibre drum (6PA1, 6PB1, 6PD1[e] or 6PG1[e]) or in steel, aluminium, wood or fibreboard box or in wickerwork hamper (6PA2, 6PB2, 6PC, 6PD2[e] or 6PG2[e]) or in solid or expanded plastics packaging (6PH1 or 6PH2[e])	75 kg	75 kg	75 kg

13.4 List of packing instructions (*continued*)

P002	PACKING INSTRUCTION (SOLIDS) *(continued)*	P002
Special packing provisions:		
PP7	UN 2000 – celluloid can be transported unpacked on pallets, wrapped in plastic film and secured by appropriate means, such as steel bands as a full load in closed transport units. Each pallet shall not exceed 1 000 kg.	
PP8	UN 2002 – packaging shall be so constructed that explosion is not possible by reason of increased internal pressure. Gas cylinders and gas receptacles shall not be used for these substances.	
PP9	UN 3175, UN 3243 and UN 3244 – packaging shall conform to a design type that has passed a leakproofness test at packing group II performance level. For UN 3175 the leakproofness test is not required when the liquids are fully absorbed in solid material contained in sealed bags.	
PP11	UN 1309, packing group III, and UN 1362 – bags (5H1, 5L1 and 5M1) are allowed if they are overpacked in plastic bags and are stretched-wrapped or shrink-wrapped on pallets.	
PP12	UN 1361, UN 2213 and UN 3077 – bags (5H1, 5L1 and 5M1) are allowed when transported in closed transport units.	
PP13	Articles classified under UN 2870 – only combination packaging that meets the packing group I performance level is authorized.	
PP14	UN 2211, UN 2698 and UN 3314 – packaging is not required to meet the performance tests given in 12.3.	
PP15	UN 1324 and UN 2623 – packaging shall meet packing group III performance level.	
PP20	UN 2217 – any sift-proof, tear-proof receptacle can be used.	
PP30	UN 2471 – a paper or a fibre inner packaging is not permitted.	
PP34	UN 2969 (as whole beans) – bags (5H1, 5L1 and 5M1) are permitted.	
PP37	UN 2590 and UN 2212 – bags (5M1) are permitted. All bags of any type shall be transported in closed cargo transport units or be placed in closed rigid overpacks.	
PP38	UN 1309, packing group II – bags are permitted only in closed cargo transport units.	
PP84	UN 1057 – rigid outer packaging meeting packing group II performance level shall be used. The packaging shall be designed and constructed and arranged to prevent movement, inadvertent ignition of devices or inadvertent release of flammable gas or liquid.	
PP85	UN 1748, UN 2208 and UN 2880 – bags that are used as single packaging shall be adequately separated to allow for the dissipation of heat.	

13.4 List of packing instructions (*continued*)

P002	PACKING INSTRUCTION (SOLIDS) *(concluded)*	P002

[a] This inner packaging shall be sift-proof

[b] This inner packaging shall not be used when the substances being transported may become liquid during transport.

[c] Paper and fibre inner packaging shall not be used for substances of packing group I.

[d] This packaging shall not be used for substances of packing group I that may become liquid during transport.

[e] This packaging shall not be used when the substances being transported may become liquid during transport.

P003	PACKING INSTRUCTION	P003

Dangerous goods shall be placed in a suitable outer packaging. The packaging shall meet the provisions of 8.1.1, 8.2, 8.3, 8.5, 13.1 and 13.2 and be so designed that they meet the construction requirements of clause 11. Outer packaging shall be constructed of suitable material of adequate strength and design in relation to the packaging capacity and its intended use. Where this packing instruction is used for the transport of articles or inner packaging of combination packaging the packaging shall be designed and constructed to prevent inadvertent discharge of articles during normal conditions of transport.

Special packing provisions:

PP16 UN 2800 – batteries shall be protected from short circuit within the packaging.

PP17 UN 1950 and UN 2037 – packaging shall not exceed 55 kg net mass for fibreboard or 125 kg net mass for other packaging.

PP18 UN 1845 – packaging shall be designed and constructed to permit the release of carbon dioxide gas in order to prevent a build-up of pressure that could rupture the packaging.

PP19 UN 1327, UN 1364, UN 1365, UN 1856 and UN 3360 – transport as bales is authorized.

PP20 UN 1363, UN 1386, UN 1408 and UN 2793 – any sift-proof, tear-proof receptacle can be used.

PP32 UN 2857 and UN 3358 – can be transported unpackaged, in crates or in appropriate overpacks.

PP87 UN 1950 – waste aerosols transported in accordance with special provisions 327, the packagings shall have a means of retaining any free liquid that might escape during transport, for example, absorbent material. The packaging shall be adequately ventilated to prevent the creation of flammable atmosphere and the build up of pressure.

13.4 List of packing instructions (*continued*)

P099	PACKING INSTRUCTION	P099
Only packaging approved by the competent authority is permitted (see 13.1.6). A copy of the competent authority approval shall accompany each consignment or the transport document shall include an indication that the packaging was approved by the competent authority.		

P101	PACKING INSTRUCTION	P101
Only packaging approved by the competent authority is permitted. The code used for motor vehicles in international traffic of the country that authorized the use of the packaging shall be marked on the transport documents as follows: "Packaging approved by the competent authority of …."		

P110(a)	PACKING INSTRUCTION	P110(a)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics textile, plastic coated or lined rubber textile, rubberized textile	**Bags** plastics textile, plastic coated or lined rubber textile, rubberized **Receptacles** plastics metal	**Drums** steel, removable head (1A2) plastics, removable head (1H2)
Additional requirements: 1. The intermediate packaging shall be filled with water saturated material such as an anti-freeze solution or wetted cushioning material. 2. Outer packaging shall be filled with water saturated material such as an anti-freeze solution or wetted cushioning material. Outer packaging shall be constructed and sealed to prevent evaporation of the wetting solution, except where barium azide, dry (UN 0224) is being transported.		

13.4 List of packing instructions (*continued*)

P110(b)	PACKING INSTRUCTION	P110(b)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Receptacles metal wood rubber, conductive plastics, conductive **Bags** rubber, conductive plastics, conductive	**Divided partitions** metal wood plastics fibreboard	**Boxes** natural wood, sift-proof wall (4C2) plywood (4D) reconstituted wood (4F)
Special packing provision: **PP42** UN 0074, UN 0113, UN 0114, UN 0129, UN 0130, UN 0135 and UN 0224, the following conditions shall be met: (a) Inner packaging shall not contain more than 50 g of explosive substance (quantity corresponding to dry substance); (b) Compartments between dividing partitions shall not contain more than one inner packaging, firmly fitted; and (c) The outer packaging may be partitioned into up to 25 compartments.		

P111	PACKING INSTRUCTION	P111
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, waterproofed plastics textile, rubberised **Sheets** plastics textile, rubberized	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) fibreboard (1G) plastics, removable head (1H2)
Special packing provision: **PP43** UN 0159 – inner packaging is not required when metal (1A2 or 1B2) or plastics (1H2) drums are used as outer packaging.		

13.4 List of packing instructions (*continued*)

P112(a)	PACKING INSTRUCTION (Solid wetted, 1.1D)	P112(a)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, multiwall, water-resistant plastics textile textile, rubberized woven plastics **Receptacles** metal plastics	**Bags** plastics textile, plastic coated or lined **Receptacles** metal plastics	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)
Additional requirement: Intermediate packaging is not required if leak-proof removable head drums are used as the outer packaging.		
Special packing provisions: **PP26** UN 0004, UN 0076, UN 0078, UN 0154, UN 0219 and UN 0394 – packaging shall be lead free. **PP45** UN 0072 and UN 0226 – intermediate packaging is not required.		

13.4 List of packing instructions (*continued*)

P112(b)	PACKING INSTRUCTION (Solid dry, other than powder 1.1D)	P112(b)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, kraft paper, multiwall, water-resistant plastics textile textile, rubberized woven plastics	**Bags** (for UN 0150 only) plastics textile, plastic coated or lined	**Bags** woven plastics, sift-proof (5H2) woven plastics, water-resistant (5H3) plastics, film (5H4) textile, sift-proof (5L2) textile, water-resistant (5L3) paper, multiwall, water-resistant (5M2) **Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)
Special packing provisions:		
PP26 UN 0004, UN 0076, UN 0078, UN 0154, UN 0216, UN 0219 and UN 0386 – packaging shall be lead free.		
PP46 UN 0209 – bags, sift-proof (5H2) are recommended for flake or prilled TNT in the dry state and a maximum net mass of 30 kg is permitted.		
PP47 UN 0222 – inner packaging is not required when the outer packaging is a bag.		

13.4 List of packing instructions (*continued*)

P112(c)	PACKING INSTRUCTION (Solid dry powder 1.1D)	P112(c)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, multiwall, water-resistant plastics woven plastics **Receptacles** fibreboard metal plastics wood	**Bags** paper, multiwall, water-resistant with inner lining plastics **Receptacles** metal plastics	**Boxes** steel (4A) natural wood, ordinary (4C1) natural wood, sift-proof (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) aluminium (4B) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plywood (1D) plastics, removable head (1H2)
Additional requirements: 1. Inner packaging is not required if drums are used as the outer packaging. 2. The packaging shall be sift-proof.		
Special packing provisions: **PP26** UN 0004, UN 0076, UN 0078, UN 0154, UN 0216, UN 0219 and UN 0386 – packaging shall be lead free. **PP46** UN 0209 – bags, sift-proof (5H2) are recommended for flake or prilled TNT in the dry state and a maximum net mass of 30 kg is permitted. **PP48** UN 0504 – metal packaging shall not be used.		

13.4 List of packing instructions *(continued)*

P113	PACKING INSTRUCTION	P113
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper plastics textile, rubberized **Receptacles** fibreboard metal plastics wood	Not necessary	**Boxes** steel (4A) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) aluminium (4B) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plywood (1D) plastics, removable head (1H2)
Additional requirement: The packaging shall be sift-proof.		
Special packing provisions: **PP49** UN 0094 and UN 0305 – a maximum of 50 g of substance shall be packed in an inner packaging. **PP50** UN 0027 – inner packaging is not necessary when drums are used as the outer packaging. **PP51** UN 0028 – paper kraft or waxed paper sheets can be used as inner packaging.		

13.4 List of packing instructions (*continued*)

P114(a)	PACKING INSTRUCTION (Solid wetted)	P114(a)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics textile woven plastics **Receptacles** metal plastics	**Bags** plastics textile, plastic coated or lined **Receptacles** metal plastics	**Boxes** steel (4A) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2)
Additional requirement: Intermediate packaging is not required if leakproof removable head drums are used as the outer packaging.		
Special packing provisions: **PP26** UN 0077, UN 0132, UN 0234, UN 0235 and UN 0236 – packaging shall be lead free. **PP43** UN 0342 – inner packaging is not required when metal (1A2 or 1B2) or plastics (1H2) drums are used as outer packaging.		

13.4 List of packing instructions (*continued*)

P114(b)	PACKING INSTRUCTION (Solid dry)	P114(b)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, kraft plastics textile, sift-proof woven plastics, sift-proof **Receptacles** fibreboard metal paper plastics woven plastics, sift-proof	Not necessary	**Boxes** natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) fibre (1G) plastics, removable head (1H2)
Special packing provisions: **PP26** UN 0077, UN 0132, UN 0234, UN 0235 and UN 0236 – packaging shall be lead free. **PP48** UN 0508, metal packaging shall not be used. **PP50** UN 0160, UN 0161 and UN 0508 – inner packaging is not required if drums are used as the outer packaging. **PP52** UN 0160 and UN 0161 – metal drums (1A2 or 1B2) used as outer packaging, in conjunction with metal inner packaging, shall be so constructed that the risk of explosion, by reason of increased internal pressure from internal or external causes, is prevented.		

13.4 List of packing instructions (*continued*)

P115	PACKING INSTRUCTION	P115
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Receptacles plastics	**Bags** plastics in metal receptacles **Drums** metal	**Boxes** natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) fibre (1G) plastics, removable head (1H2)

Special packing provisions:

PP45 UN 0144 – intermediate packaging is not required.

PP53 UN 0075, UN 0143, UN 0495 and UN 0497 – inner packaging shall have taped screw cap closures and be not more than 5 L capacity each when boxes are used as outer packaging. Inner packaging shall be surrounded with non-combustible absorbent cushioning material. The amount of absorbent cushioning material shall be sufficient to absorb the liquid contents. Metal receptacles shall be cushioned from one another. The net mass of propellant is limited to 30 kg for each package when the outer packaging consists of boxes.

PP54 UN 0075, UN 0143, UN 0495 and UN 0497 – metal drums as intermediate packaging within drums as outer packaging, shall be surrounded with non-combustible cushioning material in a quantity sufficient to absorb the liquid contents. A composite packaging consisting of a plastics receptacle in a metal drum can be used instead of the inner and intermediate packaging. The net volume of propellant in each package shall not exceed 120 L.

PP55 UN 0144 – absorbent cushioning material shall be inserted.

PP56 UN 0144 – metal receptacles can be used as inner packaging.

PP57 UN 0075, UN 0143, UN 0495 and UN 0497 – bags shall be used as intermediate packaging when boxes are used as outer packaging.

PP58 UN 0075, UN 0143, UN 0495 and UN 0497 – drums shall be used as intermediate packaging when drums are used as outer packaging.

PP59 UN 0144 – fibreboard boxes (4G) can be used as outer packaging.

PP60 UN 0144 – aluminium drums, removable head (1B2) shall not be used.

P116	PACKING INSTRUCTION	P116
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, water- and oil-resistant plastics textile, plastic coated or lined woven plastics, sift-proof **Receptacles** fibreboard, water-resistant metal plastics wood, sift-proof **Sheets** paper, water-resistant paper, waxed plastics	Not necessary	**Bags** woven plastics (5H1) paper, multiwall, water-resistant (5M2) plastics, film (5H4) textile, sift-proof (5L2) textile, water-resistant (5L3) **Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D) **Jerricans** steel, removable head (3A2) plastics, removable head (3H2)
Special packing provisions: **PP61** UN 0082, UN 0241, UN 0331 and UN 0332 – inner packaging is not required if leakproof removable head drums are used as the outer packaging. **PP62** UN 0082, UN 0241, UN 0331 and UN 0332 – inner packaging is not required when the explosive is contained in a material impervious to liquid. **PP63** UN 0081 – inner packaging is not required when contained in rigid plastics which is impervious to nitric esters. **PP64** UN 0331 – inner packaging is not required when bags (5H2), (5H3) or (5H4) are used as outer packaging. **PP65** UN 0082, UN 0241, UN 0331 and UN 0332 – bags (5H2 or 5H3) can be used as outer packaging. **PP66** UN 0081 – bags shall not be used as outer packaging.		

13.4 List of packing instructions *(continued*

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P130	PACKING INSTRUCTION	P130
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Not necessary	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)
Special packing provision: **PP67** The following applies to UN Nos. 0006, 0009, 0010, 0015, 0016, 0018, 0019, 0034, 0035, 0038, 0039, 0048, 0056, 0137, 0138, 0168, 0169, 0171, 0181, 0182, 0183, 0186, 0221, 0243, 0244, 0245, 0246, 0254, 0280, 0281, 0286, 0287, 0297, 0299, 0300, 0301, 0303, 0321, 0328, 0329, 0344, 0345, 0346, 0347, 0362, 0363, 0370, 0412, 0424, 0425, 0434, 0435, 0436, 0437, 0438, 0451, 0488 and 0502: Large and robust explosives articles, normally intended for military use, without their means of initiation or with their means of initiation containing at least two effective protective features, may be carried unpackaged. When such articles have propelling charges or are self-propelled, their ignition systems shall be protected against stimuli encountered during normal conditions of transport. A negative test result obtained when an unpackaged article is tested in accordance with the procedures of test series 4 as described in Part I of the United Nations' *Manual of tests and criteria*, indicates that the article can be transported unpackaged. Such unpackaged articles can be fixed to cradles or contained in crates or other suitable handling devices.		

13.4 List of packing instructions (*continued*)

P131	PACKING INSTRUCTION	P131
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper plastics **Receptacles** fibreboard metal plastics wood **Reels**	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)
Special packing provision: **PP68** UN 0029, UN 0267 and UN 0455 – bags and reels shall not be used as inner packaging.		

P132(a)	PACKING INSTRUCTION (Articles consisting of closed metal, plastics or fibreboard casings that contain a detonating explosive, or consisting of plastics-bonded detonating explosives)	P132(a)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Not necessary	Not necessary	**Boxes** steel (4A) aluminium (4B) wood, natural, ordinary (4C1) wood, natural, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2)

13.4 List of packing instructions *(continued)*

P132(b)	PACKING INSTRUCTION (Articles without closed casings)	P132(b)
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Receptacles fibreboard metal plastics **Sheets** paper plastics	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2)

P133	PACKING INSTRUCTION	P133
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Receptacles fibreboard metal plastics wood **Trays, fitted with dividing partitions** fibreboard plastics wood	**Receptacles** fibreboard metal plastics wood	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2)
Additional requirement: Receptacles are only required as intermediate packaging when trays are used as inner packaging.		
Special packing provision: **PP69** UN 0043, UN 0212, UN 0225, UN 0268 and UN 0306 – trays shall not be used as inner packaging.		

13.4 List of packing instructions (*continued*)

P134	PACKING INSTRUCTION	P134
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags water-resistant **Receptacles** fibreboard metal plastics wood **Sheets** fibreboard, corrugated **Tubes** fibreboard	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) plastics, removable head (1H2) fibreboard (1G)

13.4 List of packing instructions *(continued)*

P135	PACKING INSTRUCTION	P135
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper plastics **Receptacles** fibreboard metal plastics wood **Sheets** paper plastics	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)

13.4 List of packing instructions (*continued*)

P136	PACKING INSTRUCTION	P136
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics textile **Boxes** fibreboard plastics wood **Dividing partitions in the outer packaging**	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)

13.4 List of packing instructions *(continued)*

P137	PACKING INSTRUCTION	P137
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics **Boxes** fibreboard **Tubes** fibreboard metal plastics **Dividing partitions in the outer packaging**	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) fibre (1G) plastics, removable head (1H2)
Special packing provision: **PP70** UN 0059, UN 0439, UN 0440 and UN 0441 – when the shaped charges are packed singly, the conical cavity shall face downwards and the package marked "THIS SIDE UP". When the shaped charges are packed in pairs, the conical cavities shall face inwards to minimize the jetting effect in the event of accidental initiation.		

13.4 List of packing instructions (*continued*)

P138	PACKING INSTRUCTION	P138
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) plastics, removable head (1H2) fibreboard (1G)
Additional requirement: Inner packaging is not required when the ends of the articles are sealed.		

13.4 List of packing instructions *(continued)*

P139	PACKING INSTRUCTION	P139
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics **Receptacles** fibreboard metal plastics wood **Reels** **Sheets** paper plastics	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) fibre (1G) plastics, removable head (1H2)
Special packing provisions: **PP71** UN 0065, UN 0102, UN 0104, UN 0289 and UN 0290 – the ends of the detonating cord shall be sealed, e.g. by a plug firmly fixed so that the explosive cannot escape. The ends of flexible detonating cord shall be fastened securely. **PP72** UN 0065 and UN 0289 – inner packaging is not required when the cards are in coils.		

13.4 List of packing instructions (*continued*)

P140	PACKING INSTRUCTION	P140
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags plastics **Reels** **Sheets** paper, kraft plastics	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plywood (1D) plastics, removable head (1H2)
Special packing provisions: **PP73** UN 0105 – no inner packaging is required if the ends of the fuse are sealed. **PP74** UN 0101 – the packaging shall be sift-proof except when the fuse is covered by a paper tube and both ends of the tube are covered with removable caps. **PP75** UN 0101 – steel or aluminium boxes or drums shall not be used.		

13.4 List of packing instructions *(continued)*

P141	PACKING INSTRUCTION	P141
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Receptacles fibreboard metal plastics wood **Trays, fitted with dividing partitions** plastics wood **Dividing partitions in the outer packaging**	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)

P142	PACKING INSTRUCTION	P142
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper plastics **Receptacles** fibreboard metal plastics wood **Sheets** paper **Trays, fitted with dividing partitions** plastics	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) fibre (1G) plastics, removable head (1H2) plywood (1D)

13.4 List of packing instructions (*continued*)

P143	PACKING INSTRUCTION	P143
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Bags paper, kraft plastics textile textile, rubberized **Receptacles** fibreboard metal plastics **Trays, fitted with dividing partitions** plastics wood	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary (4C1) natural wood, sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plywood (1D) fibre (1G) plastics, removable head (1H2)
Additional requirement: Instead of the above inner and outer packaging, a composite packaging of the type 6HH2 (plastics receptacle with outer solid box) can be used.		
Special packing provision: **PP76** UN 0271, UN 0272, UN 0415 and UN 0491 – when inner packaging and outer packaging of metal are used, the metal packaging shall be so constructed that the risk of explosion, by reason of increase in internal pressure from internal or external causes is prevented.		

13.4 List of packing instructions (*continued*)

P144	PACKING INSTRUCTION	P144
The following types of packaging are authorized, provided the general packing provisions of clauses 8, 13.1 and 13.2 and the special packing provisions of 13.5 are met.		
Inner packaging	**Intermediate packaging**	**Outer packaging**
Receptacles fibreboard metal plastics **Dividing partitions in the outer packaging**	Not necessary	**Boxes** steel (4A) aluminium (4B) natural wood, ordinary with metal liner (4C1) plywood (4D) with metal liner reconstituted wood (4F) with metal liner plastics, expanded (4H1) plastics, solid (4H2) **Drums** steel, removable head (1A2) aluminium, removable head (1B2) plastics, removable head (1H2)
Special packing provision: **PP77** UN 0248 and UN 0249 – packaging shall be protected against the ingress of water. When water-activated contrivances are transported unpackaged, they shall be provided with at least two independent protective features which prevent the ingress of water.		

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION	P200

For pressure receptacles, the packing requirements of 13.6 shall be met and for multi-element gas containers (MEGCs) the requirements of SANS 1518 shall be met.

Cylinders, tubes, pressure drums, bundles of cylinders constructed as specified in 11.20 are authorized for the transport of a specific substance when specified in the following tables. For some substances the special packing provisions may prohibit a particular type of cylinder, tube, pressure drum or bundle of cylinders.

1) Pressure receptacles containing toxic substances with an inhalation toxicity (LC_{50}) less than or equal to 200 mL/m^3 (ppm) shall not be equipped with any pressure relief device. Pressure relief devices shall be fitted on pressure receptacles used for the transport of UN 1013 (carbon dioxide) and UN 1070 (nitrous oxide). Other pressure receptacles shall be fitted with a pressure relief device if so specified by the competent authority of the country of use. The type of pressure relief device, the set to discharge pressure and the relief capacity of the pressure relief devices, if required, shall be specified by the competent authority of the country of use.

2) In this packing instruction compressed gases, liquefied and dissolved gases, and substances not in class 2 are listed separately providing:

   a) the UN number, name and description, and classification of the substance;

   b) the LC_{50} for toxic substances;

   c) the types of pressure receptacles authorized for the substance, shown by the letter “X”;

   d) the maximum test period for periodic inspection of the pressure receptacles;

      NOTE For pressure receptacles which make use of composite materials, the periodic inspection frequencies shall be as determined by the competent authority which approved the receptacles.

   e) the minimum test pressure of the pressure receptacles;

   f) the maximum working pressure of the pressure receptacles for compressed gases (where no value is given, the working pressure shall not exceed two thirds of the test pressure) or the maximum filling ratio(s) dependent on the test pressure(s) for liquefied and dissolved gases;

   g) special packing provisions that are specific to a substance.

3) Under no circumstances shall pressure receptacles be filled in excess of the limit permitted in the following requirements:

   a) for compressed gases, the working pressure shall not exceed two thirds of the test pressure of the pressure receptacles. Restrictions to this upper limit on working pressure are imposed by section 4, special packing provision “o”. The internal pressure at 65 °C shall not exceed the test pressure;

   b) for high pressure liquefied gases, the filling ratio shall be such that the settled pressure at 65 °C does not exceed the test pressure of the pressure receptacles.

      The use of test pressures and filling ratios other than those given in the tables of this packing instruction is permitted provided that the above criterion is met, except where section 4, special packing provision "o" applies, provided that:

         (i) the criteria of section 4, special provision “r” is met when applicable; or

         (ii) the above criteria is met in all other cases.

13.4 List of packing instructions (*continued*)

For high pressure liquefied gases for which data is not provided in the tables of this packing instruction, the maximum filling ratio (*FR*) (see 3.1.22) shall be determined as follows:

$$FR = 8{,}5 \times 10^{-4} \times d_g \times P_h$$

where

FR is the maximum filling ratio

d_g is the gas density (at 15 °C, 1 bar), in g/L

P_h is the minimum test pressure, in bar

If the density of the gas is unknown, the maximum filling ratio shall be determined as follows:

$$FR = \frac{P_h \times MM \times 10^{-3}}{R \times 338}$$

where

FR is the maximum filling ratio

P_h is the minimum test pressure, in bar

MM is the molecular mass, in g/mol

R is $8{,}31451 \times 10^{-2}$ bar.L/mol.K, gas constant

For gas mixtures, the average molecular mass is to be taken, taking into account the volumetric concentrations of the various components;

c) for low pressure liquefied gases, the maximum mass of contents per litre of water capacity (filling factor) shall equal 0,95 times the density of the liquid phase at 50 °C. In addition, the liquid phase shall not fill the pressure receptacle at any temperature up to 60 °C. The test pressure of the pressure receptacle shall be at least equal to the vapour pressure (absolute) of the liquid at 65 °C, minus 1 bar.

For low pressure liquefied gases for which filling data is not provided in the table, the maximum filling ratio shall be determined as follows:

$$FR = (0{,}0032 \times BP - 0{,}24) \times d_l$$

where

FR is the maximum filling ratio

BP is the boiling point, in Kelvin

d_l is the density of the liquid at boiling point, in kg/L

d) for UN 1001 (acetylene, dissolved) and UN 3374 (acetylene, solvent free), see (4), special packing provision "p".

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*	P200

4) Keys for column 14 "Special packing provisions" of tables 1 to 3 of this packing instruction:

Material compatibility (for gases see ISO 11114-1:1997 and ISO 11114-2:2000)

a: Aluminium alloy pressure receptacles are not authorized.

b: Copper valves shall not be used.

c: Metal parts in contact with the contents shall not contain more than 65 % copper.

d: When steel pressure receptacles are used, only those bearing the "H" mark shall be authorized.

Requirements for toxic substances with an LC_{50} less than or equal to 200 mL/m^3 (ppm)

k: Valve outlets shall be fitted with gas tight plugs or caps.

Each cylinder within a bundle shall be fitted with an individual valve that shall be closed during transport. After filling, the manifold shall be evacuated, purged and plugged.

Bundles containing UN 1045 Fluorine, compressed, can be constructed with isolation valves on groups of cylinders not exceeding 150 L total water capacity instead of isolation valves on every cylinder.

Cylinders and individual cylinders in a bundle shall have a test pressure greater than or equal to 20 MPa and a minimum wall thickness of 3,5 mm for aluminium alloy or 2 mm for steel. Individual cylinders not complying with this requirements shall be transported in a rigid outer packaging that adequately protects the cylinder and its fittings and meeting the packing group I performance level. Pressure drums shall have a minimum wall thickness as specified by the competent authority.

Pressure receptacles shall not be fitted with a pressure relief device.

Cylinders and individual cylinders in a bundle shall be limited to a maximum water capacity of 85 L.

Each valve shall have a taper threaded connection directly to the pressure receptacle and be capable of withstanding the test pressure of the pressure receptacle.

Each valve shall either be of the non-packing type with a non-perforated diaphragm, or be of a type which prevents leakage through, or past, the packing.

Each pressure receptacle shall be tested for leakage after filling.

13.4 List of packing instructions (*continued*)

P200	PACKING INSTRUCTION *(continued)*	P200

Gas specific provisions

l: UN 1040 (ethylene oxide) is permitted to be packed in hermetically sealed glass or metal inner packaging provided that such inner packaging is suitably cushioned in fibreboard, wooden or metal boxes that meet the performance level of packing group I. The maximum quantity permitted in any glass inner packaging is 30 g, and the maximum quantity permitted in any metal inner packaging is 200 g. After filling, each inner packaging shall be tested for leakproofness by placing the inner packaging in a hot waterbath at a temperature, and for a period of time, sufficient to ensure that an internal pressure equal to the vapour pressure of ethylene oxide at 55 °C is achieved. The total quantity of ethylene oxide in an outer packaging shall not exceed 2,5 kg.

m: A pressure receptacle shall be filled to a working pressure not exceeding 500 kPa.

n: Cylinders and individual cylinders in a bundle shall contain not more than 5 kg of the gas. When bundles containing Fluorine, compressed (UN 1045), are divided into groups of cylinders in accordance with special packing “k” each group shall contain not more than 5 kg of the gas.

o: Under no circumstances shall the working pressure or filling ratio shown in this packing instruction be exceeded.

p: A cylinder for UN 1001 (acetylene, dissolved) and UN 3374 (acetylene, solvent free) shall be filled with a homogeneous monolithic porous mass. The working pressure and the quantity of acetylene shall not exceed the values prescribed in ISO 3807-1:2000 or ISO 3807-2:2000, as applicable.

A cylinder for UN 1001 (acetylene, dissolved) shall contain a quantity of acetone or another suitable solvent as specified in ISO 3807-1:2000 or ISO 3807-2:2000, as applicable when a cylinder is fitted with a pressure relief device or when a number of cylinders are manifolded together in a bundle, they shall be transported vertically.

The test pressure of 5 200 kPa applies only to cylinders conforming to ISO 3807-2:2000.

q: The valve of a pressure receptacle for a pyrophoric gas or a flammable mixture of gases that contains more than 1 % of pyrophoric compounds shall be fitted with a gas-tight plug or a gas-tight cap. When these types of pressure receptacles are transported together in a bundle, each of the pressure receptacles shall be fitted with an individual valve that shall be closed during transport, and the manifold outlet valve shall be fitted with a gas-tight plug or a gas-tight cap.

r: The filling ration of this gas shall be limited such that, if complete decomposition occurs, the pressure does not exceed two thirds of the test pressure of the pressure receptacle.

s: An aluminium alloy pressure receptacle shall be equipped only with brass or stainless steel valves and cleaned in accordance with ISO 11621:1997 and not be contaminated with oil.

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*	P200

t: The wall thickness of a pressure receptacle shall not be less than 3 mm. Prior to transport it shall be ensured that the pressure has not risen due to potential hydrogen generation.

Periodic inspection

u: The interval between periodic tests may be extended to 10 years for an aluminium alloy pressure receptacle when the alloy of the pressure receptacle has been subjected to stress corrosion testing as specified in ISO 7866:1999.

v: The interval between periodic inspections for steel cylinders may be extended to 15 years if so approved by the competent authority.

Requirements for N.O.S. descriptions and for gas mixtures

z: The construction materials of the pressure receptacles and their accessories shall be compatible with the contents and shall not react to form harmful or dangerous compounds therewith.

The test pressure and filling ratio shall be calculated in accordance with the relevant requirements of clause 3 of this packing provision.

Unless otherwise specified in the tables of this packing instruction, toxic substances with an LC_{50} less than or equal to 200 mL/m^3 shall not be transported in pressure tubes and pressure drums or MEGCs and shall meet the requirements of special packing provision "k". However , UN 1975 Nitric oxide and dinitrogen tetroxide mixture may be transported in pressure drums.

The requirements of special provision "q" shall be complied with in the case of a pressure receptacle that contains a pyrophoric gas, or a flammable mixture of gases that contains more than 1 % pyrophoric compounds.

The necessary steps shall be taken to prevent dangerous reactions, e.g. polymerization or decomposition during transport. If necessary, stabilisation or the addition of an inhibitor shall be required.

A mixture of gases that contains diborane (UN 1911), shall be filled to a pressure such that, if complete decomposition of the diborane occurs, two thirds of the test pressure of the pressure receptacle shall not be exceeded.

A mixture of gases that contains germane (UN 2192), other than mixtures of up to 35% germane in hydrogen or nitrogen or up to 28% germane in helium or argon, shall be filled to a pressure such that, if complete decomposition of the germane occurs, two thirds of the test pressure of the pressure receptacle shall not be exceeded.

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 1 — COMPRESSED GASES													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m^3**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar [a]**	**Working pressure, bar [a]**	**Special packing provisions**
1002	AIR, COMPRESSED	2.2			X	X	X	X	X	10			
1006	ARGON, COMPRESSED	2.2			X	X	X	X	X	10			
1016	CARBON MONOXIDE, COMPRESSED	2.3	2.1	3 760	X	X	X	X	X	5			u
1023	COAL GAS, COMPRESSED	2.3	2.1		X	X	X	X	X	5			
1045	FLUORINE, COMPRESSED	2.3	5.1 8	185	X			X		5	200	30	a, k, n, o
1046	HELIUM, COMPRESSED	2.2			X	X	X	X	X	10			
1049	HYDROGEN, COMPRESSED	2.1			X	X	X	X	X	10			d
1056	KRYPTON, COMPRESSED	2.2			X	X	X	X	X	10			
1065	NEON, COMPRESSED	2.2			X	X	X	X	X	10			
1066	NITROGEN, COMPRESSED	2.2			X	X	X	X	X	10			
1071	OIL GAS, COMPRESSED	2.3	2.1		X	X	X	X	X	5			
1072	OXYGEN, COMPRESSED	2.2	5.1		X	X	X	X	X	10			s
1612	HEXAETHYL TETRA-PHOSPHATE AND COMPRESSED GAS MIXTURE	2.3			X	X	X	X	X	5			z
1660	NITRIC OXIDE, COMPRESSED	2.3	5.1 8	115	X			X		5	225	33	k, o
1953	COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1	≤5 000	X	X	X	X	X	5			z
1954	COMPRESSED GAS, FLAMMABLE, N.O.S.	2.1			X	X	X	X	X	10			z
1955	COMPRESSED GAS, TOXIC, N.O.S.	2.3		≤5 000	X	X	X	X	X	5			z
1956	COMPRESSED GAS, N.O.S.	2.2			X	X	X	X	X	10			z
1957	DEUTERIUM, COMPRESSED	2.1			X	X	X	X	X	10			d
1964	HYDROCARBON GAS MIXTURE, COMPRESSED, N.O.S.	2.1			X	X	X	X	X	10			z

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 1 — COMPRESSED GASES *(concluded)*													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar[a]**	**Working pressure, bar[a]**	**Special packing provisions**
1971	METHANE, COMPRESSED or NATURAL GAS, COMPRESSED, with high methane content	2.1			X	X	X	X	X	10			
2034	HYDROGEN AND METHANE MIXTURE, COMPRESSED	2.1			X	X	X	X	X	10			d
2190	OXYGEN DIFLUORIDE, COMPRESSED	2.3	5.1 8	2.6	X			X		5	200	30	a, k, n, o
3156	COMPRESSED GAS, OXIDIZING, N.O.S.	2.2	5.1		X	X	X	X	X	10			z
3303	COMPRESSED GAS, TOXIC, OXIDIZING, N.O.S.	2.3	5.1	≤ 5 000	X	X	X	X	X	5			z
3304	COMPRESSED GAS, TOXIC, CORROSIVE, N.O.S.	2.3	8	≤ 5 000	X	X	X	X	X	5			z
3305	COMPRESSED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	2.3	2.1 8	≤ 5 000	X	X	X	X	X	5			z
3306	COMPRESSED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	2.3	5.1 8	≤ 5 000	X	X	X	X	X	5			Z
[a] Where the entries are blank, the working pressure shall not exceed two thirds of the test pressure.													

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
1001	ACETYLENE, DISSOLVED	2.1			X		X			10	60 52		c, p
1005	AMMONIA, ANHYDROUS	2.3	8	4 000	X	X	X	X	X	5	29	0,54	b
1008	BORON TRIFLUORIDE	2.3	8	387	X	X	X	X	X	5	225 300	0,715 0,86	
1009	BROMOTRIFLUORO-METHANE (REFRIGERANT GAS R 13B1)	2.2			X	X	X	X	X	10	42 120 250	1,13 1,44 1,60	
1010	BUTADIENES, STABILIZED 1,2-butadiene or 1,3-butadiene or BUTADIENES AND HYDROCARBON MIXTURE, STABILIZED, containing > 40 % butadienes	 2.1 2.1 2.1			 X X X	 X X X	 X X X	 X X X	 X X X	 10 10 10	 10 10	 0,59 0,55	 z, v
1011	BUTANE	2.1			X	X	X	X	X	10	10	0,52	v
1012	BUTYLENE butylenes mixture or 1-butylene or cis-2-butylene or trans-2-butylene	 2.1 2.1 2.1 2.1			 X X X X	 X X X X	 X X X X	 X X X X	 X X X X	 10 10 10 10	 10 10 10 10	 0,50 0,53 0,55 0,54	 z
1013	CARBON DIOXIDE	2.2			X	X	X	X	X	10	190 250	0,68 0,76	
1017	CHLORINE	2.3	5.1 8	293	X	X	X	X	X	5	22	1,25	a
1018	CHLORODIFLUORO-METHANE (REFRIGERANT GAS R 22)	2.2			X	X	X	X	X	10	27	1,03	
1020	CHLOROPENTAFLUORO-ETHANE (REFRIGERANT GAS R 115)	2.2			X	X	X	X	X	10	25	1,05	
1021	1-CHLORO-1,2,2,2-TETRA-FLUOROETHANE (REFRIGERANT GAS R 124)	2.2			X	X	X	X	X	10	12	1,20	
1022	CHLOROTRIFLUORO-METHANE (REFRIGERANT GAS R 13)	2.2			X	X	X	X	X	10	100 120 190 250	0,83 0,90 1,04 1,11	
1026	CYANOGEN	2.3	2.1	350	X	X	X	X	X	5	100	0,70	u
1027	CYCLOPROPANE	2.1			X	X	X	X	X	10	18	0,55	
1028	DICHLORODIFLUORO-METHANE (REFRIGERANT GAS R 12)	2.2			X	X	X	X	X	10	16	1,15	
1029	DICHLOROFLUORO-METHANE (REFRIGERANT GAS R 21)	2.2			X	X	X	X	X	10	10	1,23	

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES *(continued)*													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
1030	1,1-DIFLUOROETHANE (REFRIGERANT GAS R 152a)	2.1			X	X	X	X	X	10	16	0,79	
1032	DIMETHYLAMINE, ANHYDROUS	2.1			X	X	X	X	X	10	10	0,59	b
1033	DIMETHYL ETHER	2.1			X	X	X	X	X	10	18	0,58	
1035	ETHANE	2.1			X	X	X	X	X	10	95 120 300	0,25 0,30 0,40	
1036	ETHYLAMINE	2.1			X	X	X	X	X	10	10	0,61	b
1037	ETHYL CHLORIDE	2.1			X	X	X	X	X	10	10	0,80	a
1039	ETHYL METHYL ETHER	2.1			X	X	X	X	X	10	10	0,64	
1040	ETHYLENE OXIDE or ETHYLENE OXIDE WITH NITROGEN up to a total pressure of 1 MPa at 50°C	2.3	2.1	2 900	X	X	X	X	X	5	15	0,78	l
1041	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with > 9 % but ≤ 87 % ethylene oxide	2.1			X	X	X	X	X	10	190 250	0,66 0,75	
1043	FERTILIZER AMMONIATING SOLUTION with free ammonia	2.2			X	X	X			5			b, z
1048	HYDROGEN BROMIDE, ANHYDROUS	2.3	8	2 860	X	X	X	X	X	5	60	1,51	a, d
1050	HYDROGEN CHLORIDE, ANHYDROUS	2.3	8	2 810	X	X	X	X	X	5	100 120 150 200	0,30 0,56 0,67 0,74	a, d a, d a, d a, d
1053	HYDROGEN SULFIDE	2.3	2.1	712	X	X	X	X	X	5	48	0,67	d, u
1055	ISOBUTYLENE	2.1			X	X	X	X	X	10	10	0,52	
1058	LIQUEFIED GASES, non-flammable, charged with nitrogen, carbon dioxide or air	2.2			X	X	X	X	X	10	Test pressure = 1,5 x working pressure		
1060	METHYLACETYLENE AND PROPADIENE MIXTURE, STABILIZED or METHYLACETYLENE AND PROPADIENE MIXTURE, STABILIZED (Propadiene with 1 % to 4 % methyl-acetylene)	2.1 2.1			X X	X X	X X	X X	X X	10 10	22	0,52	c, z c
1061	METHYLAMINE, ANHYDROUS	2.1			X	X	X	X	X	10	13	0,58	b
1062	METHYL BROMIDE	2.3		850	X	X	X	X	X	5	10	1,51	a
1063	METHYL CHLORIDE (REFRIGERANT GAS R 40)	2.1			X	X	X	X	X	10	17	0,81	a

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES *(continued)*													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
1064	METHYL MERCAPTAN	2.3	2.1	1 350	X	X	X	X	X	5	10	0,78	d, u
1067	DINITROGEN TETROXIDE (NITROGEN DIOXIDE)	2.3	5.1 8	115	X	X	X			5	10	1,30	k
1069	NITROSYL CHLORIDE	2.3	8	35	X		X			5	13	1,10	k
1070	NITROUS OXIDE	2.2	5.1		X	X	X	X	X	10	180 225 250	0,68 0,74 0,75	
1075	PETROLEUM GASES, LIQUEFIED	2.1			X	X	X	X	X	10			v, z
1076	PHOSGENE	2.3	8	5	X	X	X			5	20	1,23	k
1077	PROPYLENE	2.1			X	X	X	X	X	10	27	0,43	
1078	REFRIGERANT GAS, N.O.S.	2.2			X	X	X	X	X	10			z
1079	SULFUR DIOXIDE	2.3	8	2 520	X	X	X	X	X	5	12	1,23	
1080	SULFUR HEXAFLUORIDE	2.2			X	X	X	X	X	10	70 140 160	1,06 1,34 1,38	
1081	TETRAFLUOROETHYLENE, STABILIZED	2.1			X	X	X	X	X	10	200		m, o
1082	TRIFLUOROCHLORO-ETHYLENE, STABILIZED	2.3	2.1	2 000	X	X	X	X	X	5	19	1,13	u
1083	TRIMETHYLAMINE, ANHYDROUS	2.1			X	X	X	X	X	10	10	0,56	b
1085	VINYL BROMIDE, STABILIZED	2.1			X	X	X	X	X	10	10	1,37	a
1086	VINYL CHLORIDE, STABILIZED	2.1			X	X	X	X	X	10	12	0,81	a
1087	VINYL METHYL ETHER, STABILIZED	2.1			X	X	X	X	X	10	10	0,67	
1581	CHLOROPICRIN AND METHYL BROMIDE MIXTURE	2.3		850	X	X	X	X	X	5	10	1,51	a
1582	CHLOROPICRIN AND METHYL CHLORIDE MIXTURE	2.3			X	X	X	X	X	5	17	0,81	a
1589	CYANOGEN CHLORIDE, STABILIZED	2.3	8	80	X		X			5	20	1,03	k
1741	BORON TRICHLORIDE	2.3	8	2 541	X	X	X	X	X	5	10	1,19	
1749	CHLORINE TRIFLUORIDE	2.3	5.1 8	299	X	X	X	X	X	5	30	1,40	a
1858	HEXAFLUOROPROPYLENE (REFRIGERANT GAS R 1216)	2.2			X	X	X	X	X	10	22	1,11	
1859	SILICON TETRAFLUORIDE	2.3	8	450	X	X	X	X	X	5	200 300	0,74 1,10	
1860	VINYL FLUORIDE, STABILIZED	2.1			X	X	X	X	X	10	250	0,64	a
1911	DIBORANE	2.3	2.1	80	X		X			5	250	0,07	d, k, o

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES *(continued)*													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	Name and description	Class or division	Subsidiary risk	LC_{50}, mL/m³	Cylinders	Tubes	Pressure drums	Bundles of cylinders	MEGCs	Test period, years	Test pressure, bar	Filling ratio	Special packing provisions
1912	METHYL CHLORIDE AND METHYLENE CHLORIDE MIXTURE	2.1			X	X	X	X	X	10	17	0,81	a
1952	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with ≤ 9% ethylene oxide	2.2			X	X	X	X	X	10	190 250	0,66 0,75	
1958	1,2-DICHLORO-1,1,2,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 114)	2.2			X	X	X	X	X	10	10	1,30	
1959	1,1-DIFLUOROETHYLENE (REFRIGERANT GAS R 1132a)	2.1			X	X	X	X	X	10	250	0,77	
1962	ETHYLENE	2.1			X	X	X	X	X	10	225 300	0,34 0,38	
1965	HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S.	2.1			X	X	X	X	X	10			v, z
1967	INSECTICIDE GAS, TOXIC, N.O.S.	2.3			X	X	X	X	X	5			z
1968	INSECTICIDE GAS, N.O.S.	2.2			X	X	X	X	X	10			z
1969	ISOBUTANE	2.1			X	X	X	X	X	10	10	0,49	v
1973	CHLORODIFLUORO-METHANE AND CHLORO-PENTAFLUOROETHANE MIXTURE with a fixed boiling point, with ± 49 % chloro-difluoromethane (REFRIGERANT GAS R 502)	2.2			X	X	X	X	X	10	31	1,01	
1974	CHLORODIFLUORO-BROMOMETHANE (REFRIGERANT GAS R 12B1)	2.2			X	X	X	X	X	10	10	1,61	
1975	NITRIC OXIDE AND DINITROGEN TETROXIDE MIXTURE (NITRIC OXIDE AND NITROGEN DIOXIDE MIXTURE)	2.3	5.1 8	115	X	X	X			5			k, z
1976	OCTAFLUOROCYCLO-BUTANE (REFRIGERANT GAS RC 318)	2.2			X	X	X	X	X	10	11	1,32	
1978	PROPANE	2.1			X	X	X	X	X	10	23	0,43	v
1982	TETRAFLUOROMETHANE (REFRIGERANT GAS R 14)	2.2			X	X	X	X	X	10	200 300	0,71 0,90	
1983	1-CHLORO-2,2,2-TRI-FLUOROETHANE (REFRIGERANT GAS R 133a)	2.2			X	X	X	X	X	10	10	1,18	

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
1984	TRIFLUOROMETHANE (REFRIGERANT GAS R 23)	2.2			X	X	X	X	X	10	190 250	0,88 0,96	
2035	1,1,1-TRIFLUOROETHANE (REFRIGERANT GAS R 143a)	2.1			X	X	X	X	X	10	35	0,73	
2036	XENON	2.2			X	X	X	X	X	10	130	1,28	
2044	2,2-DIMETHYLPROPANE	2.1			X	X	X	X	X	10	10	0,53	
2073	AMMONIA SOLUTION, relative density < 0,880 at 15 °C in water, with 35 % < ammonia ≤ 40 % with 40 % < ammonia ≤ 50 %	2.2			 X X	 X X	 X X	 X X	 X X	 5 5	 10 12	 0,80 0,77	 b b
2188	ARSINE	2.3	2.1	20	X		X			5	42	1,10	d, k
2189	DICHLOROSILANE	2.3	2.1 8	314	X	X	X	X	X	5	10 200	0,90 1,08	
2191	SULFURYL FLUORIDE	2.3		3 020	X	X	X	X	X	5	50	1.10	u
2192	GERMANE	2.3	2.1	620	X	X	X	X	X	5	250	0.064	d,q,r
2193	HEXAFLUOROETHANE (REFRIGERANT GAS R 116)	2.2			X	X	X	X	X	10	200	1,13	
2194	SELENIUM HEXAFLUORIDE	2.3	8	50	X		X			5	36	1,46	k
2195	TELLURIUM HEXAFLUORIDE	2.3	8	25	X		X			5	20	1,00	k
2196	TUNGSTEN HEXAFLUORIDE	2.3	8	160	X		X			5	10	3.08	a, k
2197	HYDROGEN IODIDE, ANHYDROUS	2.3	8	2 860	X	X	X	X	X	5	23	2,25	a, d
2198	PHOSPHORUS PENTAFLUORIDE	2.3	8	190	X		X			5	200 300	0,90 1,25	k k
2199	PHOSPHINE	2.3	2.1	20	X		X			5	225 250	0,30 0,45	d, k,q d, k,q
2200	PROPADIENE, STABILIZED	2.1			X	X	X	X	X	10	22	0,50	
2202	HYDROGEN SELENIDE, ANHYDROUS	2.3	2.1	2	X		X			5	31	1,60	k
2203	SILANE	2.1			X	X	X	X	X	10	225 250	0,32 0,36	q q
2204	CARBONYL SULFIDE	2.3	2.1	1 700	X	X	X	X	X	5	30	0,87	u
2417	CARBONYL FLUORIDE	2.3	8	360	X	X	X	X	X	5	200 300	0,47 0,70	
2418	SULFUR TETRAFLUORIDE	2.3	8	40	X		X			5	30	0,91	k
2419	BROMOTRIFLUORO-ETHYLENE	2.1			X	X	X	X	X	10	10	1,19	
2420	HEXAFLUOROACETONE	2.3	8	470	X	X	X	X	X	5	22	1,08	
2421	NITROGEN TRIOXIDE	2.3	5.1 8	57	X		X			5			k
2422	OCTAFLUOROBUT-2-ENE (REFRIGERANT GAS R 1318)	2.2			X	X	X	X	X	10	12	1,34	

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13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
2424	OCTAFLUOROPROPANE (REFRIGERANT GAS R 218)	2.2			X	X	X	X	X	10	25	1,04	
2451	NITROGEN TRIFLUORIDE	2.2	5.1		X	X	X	X	X	10	200	0,50	
2452	ETHYLACETYLENE, STABILIZED	2.1			X	X	X	X	X	10	10	0,57	c
2453	ETHYL FLUORIDE (REFRIGERANT GAS R 161)	2.1			X	X	X	X	X	10	30	0,57	
2454	METHYL FLUORIDE (REFRIGERANT GAS R 41)	2.1			X	X	X	X	X	10	300	0,63	
2455	METHYL NITRITE	2.2											
2517	1-CHLORO-1,1-DIFLUORO-ETHANE (REFRIGERANT GAS R 142b)	2.1			X	X	X	X	X	10	10	0,99	
2534	METHYLCHLOROSILANE	2.3	2.1 8	600	X	X	X	X	X	5			z
2548	CHLORINE PENTAFLUORIDE	2.3	5.1 8	122	X			X		5	13	1,49	a, k
2599	CHLOROTRIFLUORO-METHANE AND TRIFLUOROMETHANE AZEOTROPIC MIXTURE with ± 60 % chlorotrifluoro-methane (REFRIGERANT GAS R 503)	2.2			X	X	X	X	X	10	31 42 100	0,11 0,17 0,64	
2601	CYCLOBUTANE	2.1			X	X	X	X	X	10	10	0,63	
2602	DICHLORODIFLUORO-METHANE AND DIFLUORO-ETHANE AZEOTROPIC MIXTURE with ± 74 % dichlorodifluoro-methane (REFRIGERANT GAS R 500)	2.2			X	X	X	X	X	10	22	1,01	
2676	STIBINE	2.3	2.1	20	X			X		5	200	0.49	k, r
2901	BROMINE CHLORIDE	2.3	5.1 8	290	X	X	X	X	X	5	10	1,50	a
3057	TRIFLUOROACETYL CHLORIDE	2.3	8	10	X		X	X		5	17	1,17	k
3070	ETHYLENE OXIDE AND DICHLORODIFLUORO-METHANE MIXTURE with ≤ 12,5 % ethylene oxide	2.2			X	X	X	X	X	10	18	1,09	
3083	PERCHLORYL FLUORIDE	2.3	5.1	770	X	X	X	X	X	5	33	1,21	u
3153	PERFLUORO (METHYL VINYL ETHER)	2.1			X	X	X	X	X	10	20	0,75	
3154	PERFLUORO (ETHYL VINYL ETHER)	2.1			X	X	X	X	X	10	10	0,98	
3157	LIQUEFIED GAS, OXIDIZING, N.O.S.	2.2	5.1		X	X	X	X	X	10			z

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(continued)*												P200
TABLE 2 — LIQUEFIED GASES AND DISSOLVED GASES													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	Name and description	Class or division	Subsidiary risk	LC_{50}, mL/m^3	Cylinders	Tubes	Pressure drums	Bundles of cylinders	MEGCs	Test period, years	Test pressure, bar	Filling ratio	Special packing provisions
3340	REFRIGERANT GAS R 407C	2.2			X	X	X	X	X	10	30	0,95	
3354	INSECTICIDE GAS, FLAMMABLE, N.O.S.	2.1			X	X	X	X	X	10			z
3355	INSECTICIDE GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1		X	X	X	X	X	5			z
3374	ACETYLENE, SOLVENT FREE	2.1			X			X		5	60 52		c, p

13.4 List of packing instructions *(continued)*

P200	PACKING INSTRUCTION *(concluded)*	P200

TABLE 3 — SUBSTANCES NOT IN CLASS 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
UN No.	**Name and description**	**Class or division**	**Subsidiary risk**	**LC_{50}, mL/m³**	**Cylinders**	**Tubes**	**Pressure drums**	**Bundles of cylinders**	**MEGCs**	**Test period, years**	**Test pressure, bar**	**Filling ratio**	**Special packing provisions**
1051	HYDROGEN CYANIDE, STABILIZED containing water < 3 %	6.1	3	40	X			X		5	100	0,55	k
1052	HYDROGEN FLUORIDE, ANHYDROUS	8	6.1	966	X		X	X		5	10	0,84	t
1745	BROMINE PENTAFLUORIDE	5.1	6.1 8	25	X		X	X		5	10	*	k
1746	BROMINE TRIFLUORIDE	5.1	6.1 8	50	X		X	X		5	10	*	k
2495	IODINE PENTAFLUORIDE	5.1	6.1 8	120	X		X	X		5	10	*	k
2983	ETHYLENE OXIDE AND PROPYLENE OXIDE MIXTURE containing ethylene oxide ≤ 30 %	3	6.1		X		X	X		5	10		z

* A minimum ullage of 8 % by volume is required.

P201	PACKING INSTRUCTION	P201

This instruction applies to UN 3167, UN 3168 and UN 3169.

The following packaging is authorized:

a) compressed gas cylinders and gas receptacles conforming to the construction, testing and filling requirements approved by the competent authority; and

b) in addition, the following packaging is authorized provided that the general provisions of clauses 8, 13 and 13.2 are met:

1) **non-toxic gases –** combination packaging with hermetically sealed inner packaging of glass or metal with a maximum capacity of 5 L per package which meet the packing group III performance level; and

2) **toxic gases –** combination packaging with hermetically sealed inner packaging of glass or metal with a maximum capacity of 1 L per package which meet the packing group III performance level.

P202	PACKING INSTRUCTION	P202
	Reserved	

P203	PACKING INSTRUCTION	P203

This instruction applies to class 2 refrigerated liquefied gases in closed cryogenic receptacles. Refrigerated liquefied gases in open cryogenic receptacles shall conform to the construction, testing and filling requirements approved by the competent authority.

For closed cryogenic receptacles, the general requirements of 13.6 shall be met.

Closed cryogenic receptacles constructed as specified in 11.20 are authorized for the transport of refrigerated liquefied gases.

The closed cryogenic receptacles shall be so insulated that they do not become coated with frost.

1) **Test pressure**

Refrigerated liquids shall be filled in closed cryogenic receptacles with the following minimum test pressures:

a) For closed cryogenic receptacles with vacuum insulation, the test pressure shall not be less than 1,3 times the sum of the maximum internal pressure of the filled receptacle, including during filling and discharge, plus 100 kPa;

b) For other closed cryogenic receptacles, the test pressure shall be not less than 1,3 times the maximum internal pressure of the filled receptacle, taking into account the pressure developed during filling and discharge.

2) **Degree of filling**

For non-flammable, non-toxic refrigerated liquefied gases the volume of liquid phase at the filling temperature and at a pressure of 100 kPa shall not exceed 98 % of the water capacity of the pressure receptacle.

For flammable refrigerated liquefied gases the degree of filling shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the opening pressure of the relief valve, the volume of the liquid phase would reach 98 % of the water capacity at that temperature.

3) **Pressure-relief devices**

Closed cryogenic receptacles shall be fitted with at least one pressure-relief device.

4) **Compatibility**

Materials used to ensure the leakproofness of the joints or for the maintenance of the closures shall be compatible with the contents. In the case of receptacles intended for the transport of oxidizing gases, (i.e. with a subsidiary risk of 5.1) these materials shall not react with these gases in a dangerous manner.

13.4 List of packing instructions *(continued)*

P300	PACKING INSTRUCTION	P300
This instruction applies to UN 3064.		
Combination packaging is authorized, provided that the general provisions of clauses 8, 13.1 and 13.2 are met and that the inner packaging consists of metal cans of not more than 1 L capacity each with wooden boxes (4C1, 4C2, 4D or 4F) as the outer packaging and containing not more than 5 L of solution.		
Additional requirements: 1. The metal cans shall be completely surrounded with absorbent cushioning material. 2. The wooden boxes shall be completely lined with suitable material impervious to water and nitroglycerin.		

P301	PACKING INSTRUCTION	P301
This instruction applies to UN 3165.		
The packaging given in this packing instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) **Aluminium pressure vessels made from tubing and fitted with welded heads** The primary containment of the fuel within this vessel shall consist of a welded aluminium bladder that has a maximum internal volume of 46 L. The outer vessel shall have a minimum design gauge pressure of 1,275 kPa and a minimum burst gauge pressure of 2,755 kPa. Each vessel shall be checked for leakproofness during manufacture and before shipment and shall be found leakproof. Each pressure vessel shall be securely packed in non-combustible cushioning material, such as vermiculite, in a strong outer metal packaging that is capable of being tightly closed and can adequately protect all the fittings of the pressure vessel. The maximum quantity of fuel permitted per unit and package is 42 L. 2) **Aluminium pressure vessels** The primary containment of the fuel within this vessel shall consist of a welded vapour tight fuel compartment with an elastomeric bladder that has a maximum internal volume of 46 L. The outer vessel shall have a minimum design gauge pressure of 2,680 kPa and a minimum burst pressure of 5,170 kPa. Each vessel shall be checked for leakproofness during manufacture and before shipment and shall be found leakproof. Each pressure vessel shall be securely packed in non-combustible cushioning material, such as vermiculite, in a strong outer metal packaging that is capable of being tightly closed and adequately protect all the fittings of the pressure vessel. The maximum quantity of fuel permitted per unit and package is 42 L.		

Special packing provision:

PP83 UN 2813 – In order to prevent heat formation during transport, waterproof bags that contain not more than 20 g of substance per bag are permitted. Each waterproof bag shall be sealed in a plastics bag and placed in an intermediate packaging. No outer packaging shall contain more than 400 g of substance. Water or liquid which might react with the water reactive substance shall not be included in the packaging.

P404 PACKING INSTRUCTION P404

This instruction applies to pyrophoric solid: UN 1383, UN 1854, UN 1855, UN 2005, UN 2008, UN 2441, UN 2545, UN 2546, UN 2846, UN 2881, UN 3200, UN 3391, UN 3393 and UN 3461.

The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.

1) **Combination packaging**

Outer packaging: (1A2, 1B2, 1N2, 1H2, 1D, 4A, 4B, 4C1, 4C2, 4D, 4F or 4H2).

Inner packaging: Metal packaging with a maximum net mass of 15 kg each. Inner packaging shall be hermetically sealed and have threaded closures.

2) **Metal packaging**: (1A1, 1A2, 1B1, 1N1, 1N2, 3A1, 3A2, 3B1 and 3B2). Maximum gross mass : 150 kg.

3) **Composite packaging**: Plastics receptacle in a steel or aluminum drum (6HA1 or 6HB1) Maximum gross mass: 150 kg.

Pressure receptacles, provided that the general provisions of 13.5 are met.

Special packing provision

PP86 UN 3391 and UN 3393 – Air shall be eliminated from the vapour space by nitrogen or by other means.

13.4 List of packing instructions *(continued)*

P302	PACKING INSTRUCTION	P302
This instruction applies to UN 3269.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. Combination packaging which meets the packing group II or III performance level according to the criteria for class 3, applied to the base material. The base material and the activator (organic peroxide) shall each be separately packed in the inner packaging. The components may be placed in the same outer packaging provided they will not interact dangerously in the event of a leakage. The activator shall have a maximum quantity of 125 ml per inner packaging if liquid, and 500 grams per inner packaging if solid.		

13.4 List of packing instructions *(continued)*

P400	PACKING INSTRUCTION	P400

The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.

1) Pressure receptacles, provided that the general provisions of 13.6 are met. They shall be made of steel and shall be subjected to an initial test and periodic tests every 10 years at a pressure not less than 1000 kPa (gauge pressure). During transport, the liquid shall be under a layer of inert gas with a gauge pressure of not less than 20 kPa.

   Cylinders, pressure drums and tubes shall be secured to prevent movement in the outer packaging and shall be packaged and transported so that pressure relief devices remain in the vapour space during normal conditions of handling and transport. Filling shall not be greater than 90 % of the capacity of the cylinder, pressure drum or tube.

2) Boxes (4A, 4B, 4C1, 4C2, 4D, 4F or 4G), drums (1A2, 1B2, 1N2, 1D or 1G) or jerricans (3A2 or 3B2) enclosing hermetically sealed metal cans with inner packaging of glass or metal. The capacity of each inner packaging shall not exceed 1 L and they shall be provided with threaded closures fitted with gaskets.

   Inner packaging shall be cushioned on all sides with dry, absorbent, non-combustible material in a quantity sufficient to absorb the entire contents. Inner packaging shall not be filled to more than 90 % of their capacity.

   The outer packaging shall have a maximum net mass of 125 kg.

3) Steel, aluminium or metal drums (1A2, 1B2 or 1N2), jerricans (3A2 or 3B2) or boxes (4A or 4B) with a maximum net mass of 150 kg each as outer packaging. The outer packaging shall enclose hermetically sealed metal cans with a capacity of not more than 4 L each, and provided with threaded closures fitted with gaskets.

   Inner packaging shall be cushioned on all sides with dry, absorbent, non-combustible material in a quantity sufficient to absorb the entire contents. Each layer of inner packaging shall be separated by a dividing partition in addition to the cushioning material. Inner packaging shall not be filled to more than 90 % of their capacity.

Special packing provision:

PP86 UN 3392 and UN 3394 – air shall be eliminated from the vapour space by nitrogen or other means.

P401	PACKING INSTRUCTION	P401
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.		
(1) Pressure receptacles, provided that the general provisions of 13.6 are met. They shall be made of steel and subjected to an initial test and periodic tests every 10 years at a pressure of not less than 0,6 MPa (gauge pressure). During transport, the liquid shall be under a layer of inert gas with a gauge pressure of not less than 20 kPa.		
(2) Combination packagings with inner packagings of glass metal or plastics which have threaded closures surrounded in inert cushioning and absorbent material in a quantity sufficient to absorb the entire contents.	**Maximum capacity/Net mass (see definition)**	
	Inner packaging	**Outer packaging**
	1 L	30 kg

P402	PACKING INSTRUCTION	P402
The packaging given in this instruction is authorized, provided the general provisions of clause 8, 13.1 and 13.2 are met.		
(1) Pressure receptacles, provided that the general provisions of 13.6 are met. They shall be made of steel and subjected to an initial test and periodic tests every 10 years at a pressure of not less than 0,6 MPa (gauge pressure). During transport, the liquid shall be under a layer of inert gas with a gauge pressure of not less than 20 kPa.		
(2) Combination packagings with inner packagings of glass, metal or plastics which have threaded closures surrounded in inert cushioning and absorbent material in a quantity sufficient to absorb the entire contents.	**Maximum net mass**	
	Inner packaging	**Outer packaging**
	10 kg (glass)	125 kg
	15 kg (metal or plastics)	125 kg
(3) Steel drums (1A1) with a maximum capacity of 250 L.		
(4) Composite packagings consisting of plastics receptacle in a steel or aluminium drum (6HA1 or 6HB1) with a maximum capacity of 250 L.		

13.4 List of packing instructions *(continued)*

P403	PACKING INSTRUCTION	P403
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.		
Combination packaging		
Inner packaging, maximum net mass	**Outer packaging**	**Maximum net mass**
Glass 2 kg Plastic 15 kg Metal 20 kg Inner packaging shall be hermetically sealed by taping or by threaded closures	**Drums** steel (1A2) aluminium (1B2) other metal (1N2) plastics (1H2) plywood (1D) fibre (1G) **Boxes** steel (4A) aluminium (4B) natural wood (4C1) natural wood with sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) expanded plastics (4H1) solid plastics (4H2) **Jerricans** steel (3A2) aluminium (3B2) plastics (3H2)	 400 kg 400 kg 400 kg 400 kg 400 kg 400 kg 400 kg 400 kg 250 kg 250 kg 250 kg 125 kg 125 kg 60 kg 250 kg 120 kg 120 kg 120 kg
Single packaging		**Maximum net mass**
Drums steel (1A1, 1A2) aluminium (1B1, 1B2) metal other than steel or aluminium (1N1, 1N2) plastics (1H1, 1H2)		 250 kg 250 kg 250 kg 250 kg
Jerricans steel (3A1, 3A2) aluminium (3B1, 3B2) plastics (3H1, 3H2)		 120 kg 120 kg 120 kg
Composite packaging plastics receptacle in steel or aluminium drums (6HA1 or 6HB1) plastics receptacle in fibre, plastics or plywood drums (6HG1, 6HH1 or 6HD1) plastics receptacle in steel, aluminium, wood, plywood, fibreboard or solid plastics boxes (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2)		 250 kg 75 kg 75 kg
Pressure receptacles, provided that the general provisions of 13.5 are met.		

P403	PACKING INSTRUCTION *(concluded)*	P403
Special packing provision:		
PP83	UN 2813 – In order to prevent heat formation during transport, waterproof bags that contain not more than 20 g of substance per bag are permitted. Each waterproof bag shall be sealed in a plastics bag and placed in an intermediate packaging. No outer packaging shall contain more than 400 g of substance. Water or liquid which might react with the water reactive substance shall not be included in the packaging.	

P404	PACKING INSTRUCTION	P404
This instruction applies to pyrophoric solid: UN 1383, UN 1854, UN 1855, UN 2005, UN 2008, UN 2441, UN 2545, UN 2546, UN 2846, UN 2881, UN 3200, UN 3391, UN 3393 and UN 3461.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) **Combination packaging** Outer packaging: (1A2, 1B2, 1N2, 1H2, 1D, 4A, 4B, 4C1, 4C2, 4D, 4F or 4H2). Inner packaging: Metal packaging with a maximum net mass of 15 kg each. Inner packaging shall be hermetically sealed and have threaded closures. 2) **Metal packaging**: (1A1, 1A2, 1B1, 1N1, 1N2, 3A1, 3A2, 3B1 and 3B2). Maximum gross mass : 150 kg. 3) **Composite packaging**: Plastics receptacle in a steel or aluminium drum (6HA1 or 6HB1) Maximum gross mass: 150 kg. **Pressure receptacles,** provided that the general provisions of 13.5 are met.		
Special packing provision		
PP86	UN 3391 and UN 3393 – Air shall be eliminated from the vapour space by nitrogen or by other means.	

13.4 List of packing instructions *(continued)*

P405	PACKING INSTRUCTION	P405
This instruction applies to UN 1381.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) **UN 1381, phosphorus wet:** a) Combination packaging Outer packaging: (4A, 4B, 4C1, 4C2, 4D or 4F) Maximum net mass: 75 kg Inner packaging: i) hermetically sealed metal cans, with a maximum net mass of 15 kg; or ii) glass inner packaging cushioned on all sides with dry, absorbent, non-combustible material in a quantity sufficient to absorb the entire contents with a maximum net mass of 2 kg; or b) Drums (1A1, 1A2, 1B1, 1B2, 1N1 or 1N2); maximum net mass: 400 kg Jerricans (3A1 or 3B1); maximum net mass: 120 kg. This packaging shall be capable of passing the leakproofness test specified in 12.3.2 at the packing group II performance level. 2) **UN 1381, dry phosphorus:** a) When fused, drums (1A2, 1B2 or 1N2) with a maximum net mass of 400 kg; or b) In projectiles or hard cased articles when transported without class I components as specified by the competent authority.		

13.4 List of packing instructions *(continued)*

P406	PACKING INSTRUCTION	P406
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.		
1) Combination packaging outer packaging: (4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2, 1G, 1D, 1H2 or 3H2) inner packaging: water-resistant packaging 2) Plastics, plywood or fibreboard drums (1H2, 1D or 1G) or boxes (4A, 4B, 4C1, 4D, 4F, 4C2, 4G and 4H2) with a water-resistant inner bag, plastics film lining or water-resistant coating. 3) Metal drums (1A1, 1A2, 1B1, 1B2, 1N1 or 1N2), plastics drums (1H1 or 1H2), metal jerricans (3A1, 3A2, 3B1 or 3B2), plastics jerricans (3H1 or 3H2), plastics receptacle in steel or aluminium drums (6HA1 or 6HB1), plastics receptacle in fibre, plastics or plywood drums (6HG1, 6HH1 or 6HD1), plastics receptacle in steel, aluminium, wood, plywood, fibreboard or solid plastics boxes (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2).		
Additional requirements: 1. Packaging shall be designed and constructed to prevent the loss of water or alcohol content or the content of the phlegmatizer. 2. Packaging shall be so constructed and closed as to avoid an explosive over pressure or pressure build-up of more than 300 kPa. 3. The type of packaging and the maximum quantity of substance permitted per packaging depend on whether the substance is excluded from class 1 (see SANS 10228).		
Special packing provisions: **PP24** UN 2852, UN 3364, UN 3365, UN 3366, UN 3367, UN 3368 and UN 3369 – quantities of more than 500 g per package are not permitted for transport. **PP25** UN 1347 – quantities of more than 15 kg per package are not permitted for transport. **PP48** UN 3474 – metal packaging shall not be used. **PP26** UN 1310, UN 1320, UN 1321, UN 1322, UN 1344, UN 1347, UN 1348, UN 1349, UN 1517, UN 2907, UN 3317, UN 3344 and UN 3376 – packaging shall be lead free. **PP78** UN 3370 – quantities of more than 11,5 kg per package are not permitted for transport. **PP80** UN 2907 and UN 3344 – packaging shall meet packing group II performance level. Packaging meeting the test criteria of packing group I shall not be used.		

P407	PACKING INSTRUCTION	P407
This instruction applies to UN 1331, UN 1944, UN 1945 and UN 2254.		
The following packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. Combination packaging comprising securely closed inner packaging to prevent accidental ignition under normal conditions of transport. The maximum gross mass of the outer packaging shall not exceed 45 kg, except for fibreboard boxes which shall not exceed 30 kg.		
Additional requirement: Matches shall be tightly packed.		
Special packing provision: **PP27** UN 1331 – Strike-anywhere matches shall not be packed in the same outer packaging with any other dangerous goods other than safety matches or wax Vesta matches, which shall be packed in separate inner packaging. Inner packaging shall not contain more than 700 strike-anywhere matches.		

13.4 List of packing instructions *(continued)*

P408	PACKING INSTRUCTION	P408
This instruction applies to UN 3292.		
The following packaging is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) **Cells**: Outer packaging with sufficient cushioning material to prevent contact between cells and between cells and the internal surfaces of the outer packaging and to ensure that no dangerous movement of the cells within the outer packaging occurs during transport. Packaging shall conform to packing group II performance level. 2) **Batteries:** Batteries can be transported unpacked or in protective enclosures (e.g. in fully enclosed or wooden slatted crates). The terminals shall not support the weight of other batteries or materials packed with the batteries.		
Additional requirement: Batteries shall be protected against short circuit and shall be isolated in such a manner as to prevent short circuits.		

P409	PACKING INSTRUCTION	P409
This instruction applies to UN 2956, UN 3242 and UN 3251.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) A fibre drum (1G) which can be fitted with a liner or coating. The net mass of the contents of the drum shall not exceed 50 kg. 2) Combination packaging: Fibreboard box (4G) with a single inner plastic bag. The net mass of the contents of the box shall not exceed 50 kg. 3) Combination packaging: Fibreboard box (4G) or fibre drum (1G) with inner plastics packaging each containing a maximum of 5 kg. The net mass of the contents of the combination packaging shall not exceed 25 kg.		

13.4 List of packing instructions *(continued)*

P410	PACKING INSTRUCTION		P410
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.			
Combination packaging			
Inner packaging, maximum net mass	**Outer packaging**	**Maximum net mass**	
		Packing group II	**Packing group III**
Glass 10 kg Plastics[a] 30 kg Metal 40 kg Paper[a, b] 10 kg Fibre[a, b] 10 kg	**Drums**		
	steel (1A2)	400 kg	400 kg
	aluminium (1B2)	400 kg	400 kg
	other metal (1N2)	400 kg	400 kg
	plastics (1H2)	400 kg	400 kg
	plywood (1D)	400 kg	400 kg
	fibre (1G)[a]	400 kg	400 kg
	Boxes		
	steel (4A)	400 kg	400 kg
	aluminium (4B)	400 kg	400 kg
	natural wood (4C1)	400 kg	400 kg
	natural wood with sift-proof walls (4C2)	400 kg	400 kg
	plywood (4D)	400 kg	400 kg
	reconstituted wood (4F)	400 kg	400 kg
	fibreboard (4G)[a]	400 kg	400 kg
	expanded plastics (4H1)	60 kg	60 kg
	solid plastics (4H2)	400 kg	400 kg
	Jerricans		
	steel (3A2)	120 kg	120 kg
	aluminium (3B2)	120 kg	120 kg
	plastics (3H2)	120 kg	120 kg
[a] Packaging shall be sift-proof. [b] This inner packaging shall not be used when the substances being transported can become liquid during transport (see 13.1.4).			

13.4 List of packing instructions *(continued)*

P410	PACKING INSTRUCTION *(continued)*	P410
Single packaging	**Maximum net mass**	
	Packing group II	**Packing group III**
Drums		
steel (1A1or 1A2)	400 kg	400 kg
aluminium (1B1 or 1B2))	400 kg	400 kg
metal other than steel or aluminium (1N1 or 1N2)	400 kg	400 kg
plastics (1H1 or 1H2)	400 kg	400 kg
Jerricans		
steel (3A1 or 3A2)	120 kg	120 kg
aluminium (3B1 or 3B2)	120 kg	120 kg
plastics (3H1 or 3H2)	120 kg	120 kg
Boxes		
steel (4A)[c]	400 kg	400 kg
aluminium (4B)[c]	400 kg	400 kg
natural wood (4C1)[c]	400 kg	400 kg
plywood (4D)[c]	400 kg	400 kg
reconstituted wood (4F)[c]	400 kg	400 kg
natural wood with sift-proof walls (4C2)[c]	400 kg	400 kg
fibreboard (4G)[c]	400 kg	400 kg
solid plastics (4H2)[c]	400 kg	400 kg
	400 kg	400 kg
Bags		
Bags (5H3, 5H4, 5L3, 5M2)[c, d]	50 kg	50 kg
Composite packaging		
plastics receptacle in steel, aluminium, plywood, fibre or plastics drum (6HA1, 6HB1, 6HG1, 6HD1 or 6HH1)	400 kg	400 kg
plastics receptacle in steel or aluminium crate or box, wooden box, plywood box, fibreboard box or solid plastics box (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2)	75 kg	75 kg
glass receptacle in steel, aluminium, plywood or fibre drum (6PA1, 6PB1, 6PD1 or 6PG1) or in steel, aluminium, wooden, wickerwood hamper or fibreboard box (6PA2, 6PB2, 6PC, 6PD2 or 6PG2) or in solid or expanded plastics packaging (6PH1 or 6PH2)	75 kg	75 kg

[c] This packaging shall not be used when the substance being transported is liable to become liquid during transport.

[d] This packaging shall only be used for packing group II substances when transported in a closed transport unit.

13.4 List of packing instructions *(continued)*

P410	PACKING INSTRUCTION *(concluded)*	P410
Special packing provisions:		
PP39	UN 1378 – a venting device is required for metal packaging.	
PP40	UN 1326, UN 1352, UN 1358, UN 1437 and UN 1871, and for UN 3182, packing group II – bags are not allowed.	
PP83	UN 2813 – not more than 20 g of the substance shall be packaged in a waterproof bag in order to prevent heat formation during transport. Each waterproof bag shall be sealed in a plastics bag and placed within an intermediate packaging. No outer packaging shall contain more than 400 g of substance. Water or liquid that can react with the water reactive substance shall not be included in the package.	

P411	PACKING INSTRUCTION	P411
This instruction applies to UN 3270.		
The following packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) Fibreboard box with a maximum gross mass of 30 kg; 2) Other packaging, provided that explosion is not possible by reason of increased internal pressure. The maximum net mass of the contents of the package shall not exceed 30 kg.		

P500	PACKING INSTRUCTION	P500
This instruction applies to UN 3356.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. The packaging shall conform to packing group II performance level. The generator(s) shall be transported in a package which meets the following requirements when one generator in the package is actuated: a) other generators in the package will not be actuated; b) packaging material will not ignite; and c) the outside surface temperature of the completed package shall not exceed 100 °C.		

13.4 List of packing instructions *(continued)*

P501	PACKING INSTRUCTION	P501
This instruction applies to UN 2015.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.		
Combination packaging	**Inner packaging maximum capacity**	**Outer packaging maximum net mass**
1) Boxes (4A, 4B, 4C1, 4C2, 4D, 4H2) or drums (1A2, 1B2, 1N2, 1H2, 1D) or jerricans (3A2, 3B2, 3H2) with glass, plastics or metal inner packaging	5 L	125 kg
2) Fibreboard box (4G) or fibre drum (1G), with plastics or metal inner packaging each in a plastics bag	2 L	50 kg
Single packaging		**Maximum capacity**
Drums steel (1A1) aluminum (1B1) metal other than steel or aluminium (1N1) plastics (1H1)		250 L
Jerricans steel (3A1) aluminum (3B1) plastics (3H1)		60 L
Composite packaging		
plastics receptacle in steel or aluminium drum (6HA1, 6HB1)		250 L
plastics receptacle in fibre, plastics or plywood drum (6HG1, 6HH1 or 6HD1)		250 L
plastics receptacle in steel or aluminium crate or box or plastics receptacle in wood, plywood, fibreboard or solid plastics box (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2)		60 L
glass receptacle in steel, aluminium, fibre, plywood, solid plastics or expanded plastics drum (6PA1, 6PB1, 6PG1, 6PD1, 6PH1 or 6PH2) or in a steel, aluminium, wood or fibreboard box (6PA2, 6PB2, 6PC, 6PG2 or 6PD2)		60 L
Additional requirements: 1. The packaging shall have a minimum ullage of 10 %. 2. The packaging shall be vented.		

13.4 List of packing instructions *(continued)*

P502	PACKING INSTRUCTION *(concluded)*	P502
		Maximum capacity
Composite packaging		
plastics receptacle in steel or aluminium drum (6HA1, 6HB1)		250 L
plastics receptacle in fibre, plastics or plywood drum (6HG1, 6HH1 or 6HD1)		250 L
plastics receptacle in steel or aluminium crate or box or plastics receptacle in wood, plywood, fibreboard or solid plastics box (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2)		60 L
glass receptacle in steel, aluminium, fibre, plywood, solid plastics or expanded plastics drum (6PA1, 6PB1, 6PG1, 6PD1, 6PH1 or 6PH2) or in a steel, aluminium, wood, fibreboard or plywood box (6PA2, 6PB2, 6PC, 6PG2 or 6PD2)		60 L
Special packing provision:		
PP28	UN 1873 – only glass inner packaging and glass inner receptacles are authorized respectively for combination packaging and composite packaging.	

13.4 List of packing instructions *(continued)*

P503	PACKING INSTRUCTION	P503
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.		
Combination packaging		**Maximum net mass**
Inner packaging: Glass 5 kg Metal 5 kg Plastic 5 kg	**Drums** steel (1A2) aluminium (1B2) metal other than steel or aluminium (1N2) plastics (1H2) plywood (1D) fibre (1G)	 125 kg 125 kg 125 kg 125 kg 125 kg 125 kg
	Boxes steel (4A) aluminium (4B) natural wood (4C1) natural wood with sift-proof walls (4C2) plywood (4D) reconstituted wood (4F) fibreboard (4G) expanded plastics (4H1) solid plastics (4H2)	 125 kg 125 kg 125 kg 125 kg 125 kg 125 kg 40 kg 60 kg 125 kg
Single packaging		
Metal drums (1A1, 1A2, 1B1, 1B2, 1N1 or 1N2) with a maximum net mass of 250 kg. Fibreboard (1G) or plywood drums (1D) fitted with inner liners with a maximum net mass of 200 kg.		

13.4 List of packing instructions *(continued)*

P504	PACKING INSTRUCTION	P504
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met.		
Combination packaging		**Maximum net mass**
1) Outer packaging: (1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G, 4H2) Inner packaging: Glass receptacles with a maximum capacity of 5 litres		75 kg
2) Outer packaging: (1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G, 4H2) Inner packaging: Plastic receptacles with a maximum capacity of 30 litres		75 kg
3) Outer packaging: 1G, 4F or 4G Inner packaging: Metal receptacles with a maximum capacity of 40 litres		125 kg
4) Outer packaging: (1A2, 1B2,1N2, 1H2, 1D, 4A, 4B, 4C1, 4C2, 4D, 4H2) Inner packaging: Metal receptacles with a maximum capacity of 40 litres		225 kg
Single packaging		**Maximum capacity**
Drums		
steel, non-removable head (1A1)		250 L
aluminium, non-removable head (1B1)		250 L
metal other than steel or aluminium, non-removable head (1N1)		250 L
plastics, non-removable head (1H1)		250 L
Jerricans		
steel, non-removable head (3A1)		60 L
aluminium, non-removable head (3B1)		60 L
plastics, non-removable head (3H1)		60 L
Composite packaging		
plastics receptacle in steel or aluminium drum (6HA1, 6HB1)		250 L
plastics receptacle in fibre, plastics or plywood drums (6HG1, 6HH1 or 6HD1)		120 L
plastics receptacle in steel or aluminium crate or box or plastic receptacle in wood, plywood, fibreboard or solid plastics box (6HA2, 6HB2, 6HC, 6HD2, 6HG2 or 6HH2)		60 L
glass receptacle in steel, aluminium, fibre, plywood, solid plastics or expanded plastics drum (6PA1, 6PB1, 6PG1, 6PD1, 6PH1 or 6PH2) or in a steel, aluminium, wood, fibreboard or plywood box (6PA2, 6PB2, 6PC, 6PG2 or 6PD2)		60 L
Special packing provision:		
PP10 UN Nos. 2014 and 3149 – the packaging shall be vented.		

13.4 List of packing instructions *(continued)*

P520	PACKING INSTRUCTION	P520

This instruction applies to organic peroxides of division 5.2 and self-reactive substances of division 4.1.

The packaging given in this instruction is authorized, provided the general provisions of clause 8, 13.1 and 13.2 are met.

The packing methods are designated OP1 to OP8. The packing methods appropriate for the individual currently assigned organic peroxides and self-reactive substances are listed in B.2 of SANS 10228. The quantities specified for each packing method are the maximum quantities authorized per package. The following packaging is authorized:

1) combination packaging with outer packaging comprising boxes (4A, 4B, 4C1, 4C2, 4D, 4F, 4G, 4H1 and 4H2), drums (1A2, 1B2, 1G, 1H2 and 1D), jerricans (3A2, 3B2 and 3H2);

2) single packaging consisting of drums (1A1, 1A2, 1B1, 1B2, 1G, 1H1, 1H2 and 1D) and jerricans (3A1, 3A2, 3B1, 3B2, 3H1 and 3H2); and

3) composite packaging with plastics inner receptacles (6HA1, 6HA2, 6HB1, 6HB2, 6HC, 6HD1, 6HD2, 6HG1, 6HG2, 6HH1 and 6HH2).

Maximum quantity per packaging/package [a] for packing methods OP1 to OP8

Packing method / Maximum quantity	OP1	OP2[a]	OP3	OP4[a]	OP5	OP6	OP7	OP8
Maximum mass (kg) for solids and for combination packaging (liquid and solid)	0,5	0,5/10	5	5/25	25	50	50	400[b]
Maximum contents in litres for liquids [c]	0,5	-	5	-	30	60	60	225[d]

[a] If two values are given, the first applies to the maximum net mass per inner packaging and the second to the maximum net mass of the complete package.

[b] 60 kg for jerricans, 200 kg for boxes and 400 kg for solids in combination packaging with outer packaging comprising boxes (4C1, 4C2, 4D, 4F, 4G, 4H1 and 4H2) and with inner packaging of plastics or fibre with a maximum net mass of 25 kg.

[c] Viscous liquids shall be treated as solids when they do not meet the criteria provided in the definition for "liquids" (see 3.1.27).

[d] 60 litres for jerricans.

13.4 List of packing instructions *(continued)*

P520	PACKING INSTRUCTION *(concluded)*	P520
Additional requirements: 1. Metal packaging, including inner packaging of combination packaging and outer packaging of combination or composite packaging may only be used for packing methods OP7 and OP8; 2. In combination packaging, glass receptacles may only be used as inner packaging with maximum content of 0,5 kg for solids or 0,5 litre for liquids. 3. In combination packaging, cushioning materials shall not be readily combustible. 4. The packaging of an organic peroxide or self-reactive substance required to bear an "EXPLOSIVE" subsidiary risk label shall also comply with the provisions given in 13.7.		
Special packing provisions: **PP21** For certain self-reactive substances of types B or C (see SANS 10228), and for UN 3221, UN 3222, UN 3223, UN 3224, UN 3231, UN 3232, UN 3233 and UN 3234, a smaller packaging than that allowed by packing methods OP5 or OP6 respectively shall be used (see 13.6 of this standard and B.2 of SANS 10228). **PP22** UN 3241, 2-Bromo-2-nitropropane-1,3-diol, shall be packed in accordance with packing method OP6.		

P600	PACKING INSTRUCTION	P600
This instruction applies to UN Nos. 1700, 2016 and 2017.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. The outer packaging: (1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G, 4H2) shall meet the packing group II performance level. The articles shall be individually packaged and separated from each other by using partitions, dividers, inner packaging or cushioning material to prevent inadvertent discharge during normal conditions of transport. Maximum net mass: 75 kg.		

13.4 List of packing instructions *(continued)*

P601	PACKING INSTRUCTION	P601

The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met and the packagings are hermetically sealed:

1) Combination packaging consisting of glass inner packaging of capacity not exceeding 1 L packed in metal receptacles with sufficient absorbent material to absorb the entire contents and inert cushioning material. The metal receptacles shall be individually packed in 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2 outer packaging with a maximum gross mass of 15 kg. The inner packaging shall not be filled to more than 90 % of its capacity. The closure of each inner packaging shall be physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transport.

2) Combination packagings consisting of metal inner packagings not exceeding 5 L in capacity individually packed with absorbent material sufficient to absorb the contents and inert cushioning material in 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2 outer packagings with a maximum gross mass of 75 kg. Inner packagings shall not be filled to more than 90 % of their capacity. The closure of each inner packaging shall be physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transport.

3) Packaging consisting of:

   Outer packaging:

   Plastics or steel drums, removable head (1A2 or 1H2), tested in accordance with clause 12 and at a mass corresponding to the mass of the assembled package either as a packaging intended to contain inner packaging, or as a single packaging intended to contain solids or liquids, and marked accordingly.

   Inner packaging:

   Drums and composite packaging (1A1, 1B1, 1N1, 1H1 or 6HA1), meeting the requirements of clauses 11 and 12 for single packaging, subject to the following conditions:

   a) the hydraulic pressure test shall be conducted at a pressure of at least 300 kPa (gauge pressure);

   b) the design and production leakproofness tests shall be conducted at a test pressure of 30 kPa;

   c) they shall be isolated from the outer drum by the use of inert shock-mitigating cushioning material which surrounds the inner packaging on all sides;

   d) their capacity shall not exceed 125 L; and

   e) closures shall be of a screw cap type that are:

      i) physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transport; and

      ii) provided with a cap seal;

P601	PACKING INSTRUCTION *(concluded)*	P601

f) the outer and inner packaging shall be subjected periodically to a leakproofness test according to (b) at intervals of not more than two and a half years; and

g) the outer and inner packaging shall bear in clearly legible and durable characters:

i) the date (month, year) of the initial testing and the latest periodical test;

ii) the name or authorized symbol of the party performing the tests and inspections.

4) Pressure receptacles, provided that the general provisions of 13.5 are met. They shall be subjected to an initial test and periodic tests every 10 years at a pressure of not less than 1000 kPa (gauge pressure). Pressure receptacles may not be equipped with any pressure relief device. Each pressure receptacle containing a toxic by inhalation liquid with an LC_{50} less than or equal to 200 ml/m^3 (ppm) shall be closed with a plug or valve conforming to the following:

(a) Each plug or valve shall have a taper-threaded connection directly to the pressure receptacle and be capable of withstanding the test pressure of the pressure receptacle without damage or leakage;

(b) Each valve shall be of the packless type with non-perforated diaphragm, except that, for corrosive substances, a valve may be of the packed type with an assembly made gas-tight by means of a seal cap with gasket joint attached to the valve body or the pressure receptacle to prevent loss of substance through or past the packing;

(c) Each valve outlet shall be sealed by a threaded cap or threaded solid plug and inert gasket material;

(d) The materials of construction for the pressure receptacle, valves, plugs, outlet caps, luting and gaskets shall be compatible with one another and with the contents.

Each pressure receptacle with a wall thickness at any point of less than 2,0 mm and each pressure receptacle which does not have fitted valve protection shall be transported in an outer packaging. Pressure receptacles shall not be manifolded or interconnected.

13.4 List of packing instructions *(continued)*

P602	PACKING INSTRUCTION	P602

The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met and the packagings are hermetically sealed:

(1) Combination packagings with a maximum gross mass of 15 kg, consisting of

- one or more glass inner packaging(s) with a maximum capacity of 1 L each and filled to not more than 90 % of their capacity; the closure(s) of which shall be physically held in place by any means capable of preventing back-off or loosening by impact or vibration during transport, individually placed in
- metal receptacles together with cushioning and absorbent material sufficient to absorb the entire contents of the glass inner packaging(s), further packed in
- 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2 outer packagings.

(2) Combination packagings consisting of metal inner packagings individually packed with absorbent material sufficient to absorb the contents and inert cushioning material in 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2 outer packagings with a maximum gross mass of 75 kg. Inner packagings shall not be filled to more than 90 % of their capacity. The closure of each inner packaging shall be physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transport. Inner packagings shall not exceed a capacity of 5 L.

(3) Drums and composite packagings (1A1, 1B1, 1N1, 1H1, 6HA1 or 6HH1), subject to the following conditions:

(a) The hydraulic pressure test shall be conducted at a pressure of at least 300 kPa (gauge pressure);

(b) The design and production leakproofness tests shall be conducted at a test pressure of 30 kPa; and

(c) Closures shall be of a screw cap type that are:

(i) physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transport; and

(ii) provided with a cap seal.

(4) Pressure receptacles, provided that the general provisions of 13.5 are met. They shall be subjected to an initial test and periodic tests every 10 years at a pressure of not less than 1000 kPa (gauge pressure). Pressure receptacles may not be equipped with any pressure relief device. Each pressure receptacle containing a toxic by inhalation liquid with an LC_{50} less than or equal to 200 ml/m^3 (ppm) shall be closed with a plug or valve conforming to the following:

(a) Each plug or valve shall have a taper-threaded connection directly to the pressure receptacle and be capable of withstanding the test pressure of the pressure receptacle without damage or leakage;

(b) Each valve shall be of the packless type with non-perforated diaphragm, except that, for corrosive substances, a valve may be of the packed type with an assembly made gas-tight by means of a seal cap with gasket joint attached to the valve body or the pressure receptacle to prevent loss of substance through or past the packing;

(c) Each valve outlet shall be sealed by a threaded cap or threaded solid plug and inert gasket material;

(d) The materials of construction for the pressure receptacle, valves, plugs, outlet caps, luting and gaskets shall be compatible with each other and with the contents.

Each pressure receptacle with a wall thickness at any point of less than 2,0 mm and each pressure receptacle which does not have fitted valve protection shall be transported in an outer packaging. Pressure receptacles shall not be manifolded or interconnected.

13.4 List of packing instructions *(continued)*

P620	PACKING INSTRUCTION	P620

This instruction applies to UN Nos. 2814 and 2900.

The following packagings are authorized provided that the requirements of special packing provisions 14.1 are met:

(a) Inner packagings comprising:

(i) leakproof primary receptacle(s);

(ii) a leakproof secondary packaging;

(iii) other than for solid infectious substances, an absorbent material in sufficient quantity to absorb the entire contents placed between the primary receptacle(s) and the secondary packaging; if multiple primary receptacles are placed in a single secondary packaging, they shall be either individually wrapped or separated so as to prevent contact between them;

(b) A rigid outer packaging. The smallest external dimension shall be not less than 100 mm.

Additional requirements:

1. Inner packagings containing infectious substances shall not be consolidated with inner packagings containing unrelated types of goods. Complete packages may be overpacked in accordance with the provisions of 8.12. Such an overpack may contain dry ice.

2. Other than for exceptional consignments, for example whole organs which require special packaging, the following additional requirements shall apply:

(a) Substances consigned at ambient temperatures or at a higher temperature. Primary receptacles shall be of glass, metal or plastics. Positive means of ensuring a leakproof seal shall be provided, e.g. a heat seal, a skirted stopper or a metal crimp seal. If screw caps are used, they shall be secured by positive means, for example tape, paraffin sealing tape or manufactured locking closure;

(b) Substances consigned refrigerated or frozen. Ice, dry ice or other refrigerant shall be placed around the secondary packaging(s) or alternatively in an overpack with one or more complete packages marked in accordance with 14.2. Interior supports shall be provided to secure secondary packaging(s) or packages in position after the ice or dry ice has dissipated. If ice is used, the outer packaging or overpack shall be leakproof. If dry ice is used, the outer packaging or overpack shall permit the release of carbon dioxide gas. The primary receptacle and the secondary packaging shall maintain their integrity at the temperature of the refrigerant used;

(c) Substances consigned in liquid nitrogen. Plastics primary receptacles capable of withstanding very low temperature shall be used. The secondary packaging shall also be capable of withstanding very low temperatures, and in most cases will need to be fitted over the primary receptacle individually. Provisions for the consignment of liquid nitrogen shall also be fulfilled. The primary receptacle and the secondary packaging shall maintain their integrity at the temperature of the liquid nitrogen;

(d) Lyophilized substances may also be transported in primary receptacles that are flame-sealed glass ampoules or rubber-stoppered glass vials fitted with metal seals.

3. Whatever the intended temperature of the consignment, the primary receptacle or the secondary packaging shall be capable of withstanding without leakage an internal pressure producing a pressure differential of not less than 95 kPa and temperatures in the range -40 °C to +55 °C.

4. Alternative packagings for the transport of animal material may be authorized by the competent authority in accordance with the provisions of 14.2.4.

13.4 List of packing instructions *(continued)*

P621	PACKING INSTRUCTION	P621
This instruction applies to UN 3291.		
The packaging is authorized, provided the provisions of clauses 8, 13.1, 13.2 and 14.1 are met. 1) Rigid, leakproof packaging meeting the requirements for solids, at packing group II performance level, provided there is sufficient absorbent material to absorb the entire amount of liquid present and the packaging is capable of retaining liquids. 2) For packages containing larger quantities of liquid, rigid packaging meeting the requirements for liquids at packing group II performance level.		
Additional requirement: Packaging intended to contain sharp objects such as broken glass and needles shall be resistant to puncture and retain liquids under the performance test conditions given in 14.3.		

13.4 List of packing instructions *(continued)*

P650	PACKING INSTRUCTION	P650

This packing instruction applies to UN 3373.

1. The packaging shall be of good quality, strong enough to withstand the shocks and loadings normally encountered during transport, including transhipment between transport units and between transport units and warehouses as well as any removal from a pallet or overpack for subsequent manual or mechanical handling. Packaging shall be constructed and closed to prevent any loss of contents that might be caused under normal conditions of transport by vibration or by changes in temperature, humidity or pressure.

2. The packaging shall consist of three components:

   a) a primary receptacle,

   b) a secondary packaging, and

   c) an outer packaging

   of which the secondary or outer packaging shall be rigid.

3. Primary receptacles shall be packed in secondary packaging in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the secondary packaging. Secondary packaging shall be secured in outer packaging with suitable cushioning material. Any leakage of the contents shall not compromise the integrity of the cushioning material or of the outer packaging.

4. For transport, the mark illustrated below shall be displayed on the external surface of the outer packaging on a background of a contrasting colour and shall be clearly visible and legible. The mark shall be in the form of a square set at an angle of 45° (diamond shaped) with each side having a length of at least 50 mm; the width of the line shall be at least 2 mm; the letters and numbers shall be at least 6 mm high. The proper shipping name " BIOLOGICAL SUBSTANCE, CATEGORY B " in letters at least 6 mm high shall be marked on the outer packaging adjacent to the diamond-shaped mark.

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5. At least one surface of the outer packaging shall have a minimum dimension of 100 mm x 100 mm.

6. The completed package shall be capable of successfully passing the drop test specified in 14.5.1 except that the height of the drop shall not be less than 1,2 m. Following the appropriate drop sequence, there shall be no leakage from the primary receptacle which shall remain protected by absorbent material, when required, in the secondary packaging.

13.4 List of packing instructions *(continued)*

P650	**PACKING INSTRUCTION** *(concluded)*	P650

7. For liquid substances:

   a) the primary receptacle(s) shall be leakproof;
   b) the secondary packaging shall be leakproof;
   c) if multiple fragile primary receptacles are placed in a single secondary packaging, they shall be either individually wrapped or separated to prevent contact between them;
   d) absorbent material shall be placed between the primary receptacle(s) and the secondary packaging. The absorbent material shall be in quantity sufficient to absorb the entire contents of the primary receptacle(s) so that any release of the liquid substance will not compromise the integrity of the cushioning material or of the outer packaging; and
   e) the primary receptacle or the secondary packaging shall be capable of withstanding, without leakage, an internal pressure of 95 kPa.

8. For solid substances:

   a) the primary receptacle(s) shall be sift-proof;
   b) the secondary packaging shall be sift-proof; and
   c) if multiple fragile primary receptacles are placed in a single secondary packaging, they shall be either individually wrapped or separated to prevent contact between them.

9. Refrigerated or frozen specimens: Ice, dry ice and liquid nitrogen:

   a) when dry ice or liquid nitrogen is used to keep specimens cold, all applicable requirements of this standard shall be met. When used, ice or dry ice shall be placed outside the secondary packaging or in the outer packaging or an overpack. Interior supports shall be provided to secure the secondary packaging in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging or overpack shall be leakproof. If carbon dioxide, solid (dry ice) is used, the packaging shall be designed and constructed as to permit the release of carbon dioxide gas to prevent a build-up of pressure that could rupture the packaging. Such a packaging shall be marked “Carbon dioxide, solid” or “Dry ice”; and

   b) the primary receptacle and the secondary packaging shall maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

10. When packages are placed in an overpack, the package markings required by this packing instruction shall either be clearly visible or be reproduced on the outside of the overpack.

11. Infectious substances assigned to UN 3373 which are packed and marked in accordance with this packing instruction are not subject to any other requirement of this standard.

12. Clear instructions on the filling and the closing of packages shall be provided by packaging manufacturers and subsequent distributors to the consignor or to the person who prepares the package (e.g. patient) to enable the package to be correctly prepared for transport.

13. Other dangerous goods shall not be packed in the same packaging as division 6.2, infectious substances unless they are necessary for maintaining the viability, stabilizing or preventing degradation or neutralizing the hazards of the infectious substances. A quantity of 30 ml or less of dangerous goods included in classes 3, 8 or 9 may be packed in each primary receptacle containing infectious substances. When these small quantities of dangerous goods are packed with infectious substances in accordance with this packing instruction no other requirements in this standard need be met.

Additional requirements:

Alternative packagings for the transport of animal material may be authorized by the competent authority in accordance with the provisions of 14.2.4.

13.4 List of packing instructions *(continued)*

P800	PACKING INSTRUCTION	P800
This instruction applies to UN 2803 and UN 2809.		
The following types of packaging are authorized, provided the provisions of clauses 8, 13.1 and 13.2 are met: 1) pressure receptacles, provided that the general provisions of 13.6 are met; 2) steel flasks or bottles with threaded closures with a capacity not exceeding 3 L; or 3) combination packaging which conforms to the following requirements: a) inner packaging comprising glass, metal or rigid plastics intended to contain liquids with a maximum net mass of 15 kg each; b) inner packaging packed with sufficient cushioning material to prevent breakage; and c) either the inner packaging or the outer packaging shall have inner liners or bags of strong leakproof and puncture-resistant material impervious to the contents and completely surrounding the contents to prevent it from escaping from the package irrespective of its position or orientation. d) The following outer packaging and maximum net masses are authorized:		
Outer packaging		**Maximum net mass**
Drums		
steel (1A2)		400 kg
other metal (1N2)		400 kg
plastics (1H2)		400 kg
plywood (1D)		400 kg
fibre (1G)		400 kg
Boxes		
steel (4A)		400 kg
natural wood (4C1)		250 kg
natural wood with sift-proof walls (4C2)		250 kg
plywood (4D)		250 kg
reconstituted wood (4F)		125 kg
fibreboard (4G)		125 kg
expanded plastics (4H1)		60 kg
solid plastics (4H2)		125 kg
Special packing provision: **PP41** UN 2803 – gallium required to be transported at low temperatures in order to maintain it in a completely solid state, can be packed in the above packaging and overpacked in a strong, water-resistant outer packaging which contains dry ice or other means of refrigeration. If a refrigerant is used, all of the above materials used in the packaging of gallium shall be chemically and physically resistant to the refrigerant and shall have impact resistance at the low temperatures of the refrigerant employed. If dry ice is used, the outer packaging shall permit the release of carbon dioxide gas.		

13.4 List of packing instructions *(continued)*

P801	PACKING INSTRUCTION	P801
This instruction applies to new and used batteries assigned to UN 2794, UN 2795 or UN 3028.		
The packaging is authorized, provided the general provisions of clauses 7, 8.1 and 13.1 are met. 1) rigid outer packaging; 2) wooden slatted crates; and 3) pallets Used storage batteries can also be transported loose in stainless steel or plastics battery boxes capable of containing any free liquid.		
Additional requirements: 1. Batteries shall be protected against short circuits. 2. Batteries that are stacked shall be adequately secured in tiers separated by a layer of non-conductive material. 3. Battery terminals shall not support the weight of other superimposed elements. 4. Batteries shall be packaged or secured to prevent inadvertent movement.		

P802	PACKING INSTRUCTION	P802
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) Combination packaging Outer packaging : 1A2, 1B2, 1N2, 1H2, 1D, 4A, 4B, 4C1, 4C2, 4D, 4F or 4H2; maximum net mass : 75 kg Inner packaging : glass or plastics; maximum capacity: 10 L. 2) Combination packaging Outer packaging : 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2; maximum net mass : 125 kg Inner packaging : metal; maximum capacity: 40 L. 3) Composite packaging : Glass receptacle in steel, aluminium, plywood or solid plastics drum (6PA1, 6PB1, 6PD1 or 6PH2) or in a steel, aluminium, wood or plywood box (6PA2, 6PB2, 6PC or 6PD2); maximum capacity: 60 L. 4) Austenitic steel drums (1A1) with a maximum capacity of 250 L. 5) Cylinders, pressure drums and tubes conforming to the provisions of packing instruction P200.		
Special packing provision: **PP79** UN 1790 – see P001 when the concentration is more than 60 % but not more than 85 % hydrofluoric acid.		

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13.4 List of packing instructions *(continued)*

P803	PACKING INSTRUCTION	P803
This instruction applies to UN 2028.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1) Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G); 2) Boxes (4A, 4B, 4C1, 4C2, 4D, 4F, 4G, 4H2); Maximum net mass: 75 kg. The articles shall be individually packaged and separated from each other by means of partitions, dividers, inner packaging or cushioning material to prevent inadvertent discharge during normal conditions of transport.		

P804	PACKING INSTRUCTION	P804
This packing instruction applies to UN 1744.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1. **Combination packagings** with a maximum gross mass of 25 kg, consisting of one or more glass inner packagings with a maximum capacity of 1,3 L each and filled to not more than 90 % of their capacity. The closure of each inner packaging shall be physically held in place by any means capable of preventing back-off or loosening by impact or vibration during transport. Inert cushioning material and sufficient absorbent material shall be used to absorb the entire contents of the inner packaging(s), The outer packaging to be used are 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2. 2. **Combination packagings** with a maximum gross mass of 75 kg, consisting of metal or polyvinylidene fluoride (PVDF) inner packagings of capacity not exceeding 5 L each and filled to not more than 90 % of their capacity. The closure of each inner packaging shall be physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transport. Cushioning material shall be used and each inner packaging shall be individually packed with sufficient absorbent material to absorb the entire contents. The outer packaging to be used are 1A2, 1B2, 1N2, 1H2, 1D, 1G, 4A, 4B, 4C1, 4C2, 4D, 4F, 4G or 4H2. 3. **Packagings** consisting of Outer packagings Steel or plastic drums, removable head (1A2 or 1H2) tested in accordance with the test requirements of 12.3 at a mass corresponding to the mass of the assembled package either as a packaging intended to contain inner packagings, or as a single packaging intended to contain solids or liquids, and marked accordingly; Inner packagings Drums and composite packagings (1A1, 1B1, 1N1, 1H1, or 6H1) as single packaging and subject to the following conditions: a) the hydraulic pressure test shall be conducted at a pressure of at least 300 kPa (gauge pressure); b) the design and production leakproofness test shall be conducted at a pressure of 30 kPa; c) the inner packaging shall be isolated from the outer drum by means of inert shock-mitigating cushioning material which surrounds the inner packaging on all sides;		

P901	PACKING INSTRUCTION	P901
This instruction applies to UN 3316.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. Packaging conforming to the performance level consistent with the packing group assigned to the kit as a whole in accordance with special provision 251 (see SANS 10228). Maximum quantity of dangerous goods per outer packaging: 10 kg.		
Additional requirement: The dangerous goods in kits shall be packed in inner packaging not exceeding either 250 mL or 250 g, and shall be protected from other materials in the kit.		

P902	PACKING INSTRUCTION	P902
This instruction applies to UN 3268.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1. The packaging shall conform to packing group III performance level. The packaging shall be designed and constructed to prevent movement of the articles and inadvertent operation during normal conditions of transport. 2. The articles can also be transported unpackaged in dedicated handling devices, vehicles, containers or wagons when moved from where they are manufactured to an assembly plant.		
Additional requirement: A pressure vessel shall comply with the requirements of the competent authority for the substance(s) contained in the pressure vessel(s)		

P903	PACKING INSTRUCTION	P903
This instruction applies to UN 3090, UN 3091, 3480 and 3481.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 3.12 are met. Packaging complying with packing group II performance level. When lithium cells and batteries are packed with equipment, they shall be packed in inner fibreboard packaging that meets the requirements for packing group II. When lithium cells and batteries included in class 9 are contained in equipment, the equipment shall be packed in strong outer packaging in such a manner as to prevent accidental operation during transport. In addition, batteries employing a strong, impact resistant outer casing of a gross mass of 12 kg or more, and assemblies of such batteries, may be packed in strong outer packagings, in protective enclosures (for example, in fully enclosed or wooden slatted crates) unpackaged or on pallets. Batteries shall be secured to prevent inadvertent movement, and the terminals shall not support the weight of other superimposed elements.		
Additional requirement: Batteries shall be protected against short circuit.		

P905	PACKING INSTRUCTION	P905
This instruction applies to UN 3072 and UN 2990.		
Any suitable packaging is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. However, the packaging need not comply with the requirements of clauses 9, 10 and 11. When the life saving appliances are constructed to incorporate or are contained in rigid outer weatherproof casings (such as for lifeboats), they can be transported unpackaged.		
Additional requirements: 1) All dangerous substances and articles contained as equipment within the appliances shall be secured to prevent inadvertent movement. In addition: a) signal devices of class 1 shall be packed in plastics or fibreboard inner packaging ; b) gases (division 2.2) shall be contained in cylinders as specified by the competent authority, which may be connected to the appliance; c) electric storage batteries (class 8) and lithium batteries (class 9) shall be disconnected or electrically isolated and secured to prevent any spillage of liquid; and d) small quantities of other dangerous substances, for example flammable liquids of class 3 or organic peroxides of division 5.2 and flammable solids, self-reactive substance and solid desensitized explosives of division 4.1 shall be packed in strong inner packaging. 2) Preparation for transport and packaging shall include provisions to prevent any accidental inflation of the appliance.		

P906	PACKING INSTRUCTION	P906
This instruction applies to UN 2315, UN 3151 and UN 3152.		
The packaging given in this instruction is authorized, provided the general provisions of clauses 8, 13.1 and 13.2 are met. 1. Liquids and solids containing or contaminated with polychlorinated biphenyls (PCBs) or polyhalogenated biphenyls or terphenyls shall be packed in accordance with P001 or P002, as appropriate. 2. Transformers and condensers and other devices shall be contained in leakproof packaging which is capable of containing, in addition to the devices, at least 1,25 times the volume of the liquid polychlorinated biphenyls (PCBs) or polyhalogenated biphenyls or terphenyls that are present in them. There shall be sufficient absorbent material in the packaging to absorb at least 1,1 times the volume of liquid which is contained in the devices. In general, transformers and condensers shall be carried in leakproof metal packaging capable of holding, in addition to the transformers and condensers, at least 1,25 times the volume of the liquid present in them. Notwithstanding the above, liquids and solids not packaged in accordance with P001 and P002, and unpackaged transformers and condensers can be transported in cargo transport units fitted with a leakproof metal tray to a height of at least 800 mm, containing sufficient inert absorbent material to absorb at least 1,1 times the volume of any free liquid. **Additional requirement:** Adequate provisions shall be taken to seal the transformers and condensers in such a manner that leakage is prevented during normal conditions of transport.		

P907	PACKING INSTRUCTION	P907
Machinery or apparatus constructed and designed to contain dangerous goods need not be packed in outer packaging if the receptacles containing the dangerous goods are afforded adequate protection. Dangerous goods in machinery or apparatus shall otherwise be packed in outer packaging constructed of suitable material of adequate strength and design in relation to its capacity and intended use and shall meet the requirements of 8.1.1. A receptacle that contains dangerous goods shall comply with 8.1.1, 8.1.3 to 8.1.8 (inclusive) and 8.2. In the case of machinery or apparatus that contains dangerous goods of division 2.2 gases in a cylinder or pressure receptacle, the contents and filling density of the cylinder or pressure receptacle shall be to the satisfaction of the competent authority of the country in which the cylinder or receptacle is filled. In addition, the manner in which a receptacle with dangerous goods is contained within the machinery or apparatus shall be such that damage to the receptacle is unlikely during normal conditions of transport. No leakage of dangerous solids or liquids from a receptacle contained in machinery or apparatus shall occur. This can, inter alia, be achieved by providing the receptacle with a leakproof liner. A receptacle that contains dangerous goods shall be so installed, secured or cushioned in the machinery or apparatus that its movement is controlled as to prevent breakage and leakage of the receptacle during normal conditions of transport. Cushioning material shall not react dangerously with the contents of the receptacle. Any leakage of the contents shall not substantially impair the protective properties of the cushioning material.		

13.5 Special packing provisions for explosives of class 1

13.5.1 Explosives of class 1 shall meet the general provisions of clause 8.

13.5.2 Packaging for explosives of class 1 shall be so designed and constructed to

a) protect the explosives against the risk of unintended ignition or initiation when subjected to normal conditions of transport, including environmental changes such as temperature, humidity and pressure,

b) ensure that the package can be handled safely during normal conditions of transport, and

c) withstand any loading imposed by foreseeable stacking to which the packaging will be subjected during normal conditions of transport. Such stacking shall not add to the risk presented by the explosives, in that the containment function of the packaging shall stay intact and the packaging shall not be deformed in any way that could reduce their strength and thus cause instability of the stack.

13.5.3 Packaging for explosives shall comply with the requirements of clause 8 and clause 9 and shall meet the test requirements of clause 12. Packaging other than metal packaging meeting the test criteria of packing group I can be used. However, to avoid unnecessary confinement, metal packaging of packaging group I shall **not** be used.

13.5.4 Packaging that contains liquid explosives shall be fitted with a closure device that ensures double protection against leakage.

13.5.5 The closure device of a metal drum shall include a suitable gasket. If the closure includes a screw thread, the ingress of explosive substances into the screw-thread shall not be possible.

13.5.6 Packaging for water soluble explosive substances shall be water-resistant. Packaging for desensitized or phlegmatized explosive substances shall be closed in such a manner as to prevent changes in concentration during transport.

13.5.7 In cases where the packaging includes a double envelope filled with water that can freeze during transport, a sufficient quantity of anti-freeze agent shall be added to the water to prevent freezing. However, anti-freeze that could create a fire hazard because of its inherent flammability shall not be used.

13.5.8 Nails, staples and other closure devices made of metal, and that do not have protective covering, shall not penetrate the inside of the outer packaging unless the inner packaging adequately protects the explosives against contact with the metal.

13.5.9 Inner packaging, fittings and cushioning materials, and the placing of explosive substances or articles in packages shall be such that minimal movement can occur within packages during transport.

Metallic components of an article shall be prevented from making contact with metal packaging. Articles that contain explosive substances not enclosed in an outer casing shall be separated from each other in order to prevent friction and impact. Padding, trays, partitioning in the inner or outer packaging, mouldings or receptacles can be used for this purpose.

13.5.10 In principle, explosives shall not be packed together with explosives of a different nature. However, in cases where such mixed packing is allowed, it shall be so packaged that an accidental explosion of any part of the contents of the package cannot be communicated to the rest of the contents.

13.5.11 Packaging shall be made of material compatible with, and impermeable to, the explosives contained in the package. Neither interaction between the explosive and the packaging material, nor

leakage of the explosive, shall cause the explosive to become unsafe during transport, or change the hazard division or compatibility group of the explosive DEAS 949:2019

13.5.12 Steps shall be taken to prevent the ingress of explosive substances into the recesses of seamed metal packaging.

13.5.13 Plastics packaging shall not be liable to generate or accumulate sufficient static electricity for the discharge to cause the packaged explosive to ignite, initiate or function.

13.5.14 Each outer package shall be marked, on the outside, with the name of its contents, the appropriate class I label (see table 19), the relevant UN number the net mass of the explosives and other marking required by the relevant national legislations and regulations (see foreword).

13.5.15 Explosive substances shall not be packed in inner or outer packaging where the differences in internal and external pressures, because of thermal or other effects, could cause an explosion or rupture of the package.

13.5.16 Large and robust explosives articles, normally intended for military use, without their means of initiation or with their means of initiation and containing at least two effective protective features, can be transported unpackaged. When such articles have propelling charges or are self-propelled, their ignition systems shall be protected against stimuli encountered during normal conditions of transport.

NOTE A negative result obtained on an unpackaged article when tested in accordance with test series 4 of Part I of the United Nations' *Manual of tests and criteria* indicates that the said article can be considered for transport unpackaged. Such an unpackaged article shall be fixed to a cradle, contained in a crate, or other suitable handling, storage or launching device in such a way that it will not become loose during normal conditions of transport.

13.5.17 Whenever loose explosive substances or the explosive substance of an uncased or a partly cased article can come into contact with the inner surface of metal packaging (1A2, 1B2, 4A, 4B and metal receptacles) the metal packaging shall be provided with an inner liner or coating (see 8.2).

13.5.18 Packing instruction P101 can be used for any explosive, provided the package has been approved by the competent authority and regardless of whether the packaging complies with the packing instruction assignment as given in B.2 of DEAS 949:2019.

13.6 Special packing provisions for dangerous goods of class 2

13.6.1 This clause provides requirements applicable to the use of pressure receptacles intended for the transport of gases of class 2 and other goods in pressure receptacles, for example hydrogen cyanide, stabilized (UN 1051).

13.6.2 Pressure receptacles shall be constructed and closed so as to prevent any loss of contents which might be caused during normal conditions of transport, such as vibration and changes in temperature, humidity or pressure.

13.6.3 A pressure receptacle and its parts, including closures, that are in direct contact with dangerous goods shall not be affected or weakened by those dangerous goods and shall not cause a dangerous effect, such as catalysing a reaction or reacting dangerously with the goods. The provisions of ISO 11114-1 and ISO 11114-2, as applicable, shall be met.

13.6.4 Pressure receptacles intended for the transport of UN 1001 (acetylene, dissolved) and UN 3374 (acetylene, solvent free) shall be filled with a porous mass that is uniformly distributed and is of a type that:

a) is compatible with the pressure receptacle and does not form harmful or dangerous compounds, either with the acetylene or with the solvent (in the case of UN 1001); and

b) is capable of preventing the spread of decomposition of the acetylene in the porous mass.

13.6.5 The solvent used for acetylene (UN 1001) shall be compatible with the pressure receptacle.

13.6.6 A refillable pressure receptacle shall not be filled with a gas or a gas mixture different from that previously contained, unless the necessary operations for change of gas service has been performed. The change of service for compressed and liquefied gases shall be in accordance with ISO 11621, as applicable. In addition, a pressure receptacle that previously contained a corrosive substance of class 8 or a substance of another class with a corrosive subsidiary risk shall not be authorized to be transported as a class 2 substance, unless the necessary inspection and testing as specified in relevant international standards have been performed.

13.6.7 Prior to filling the filler shall perform an inspection of the pressure receptacle in accordance with relevant international standards and ensure that the pressure receptacle is authorized for the transport of the gas and that all the relevant provisions of this standard are met. Shut-off valves shall be closed after filling and remain closed during transport. The consignor shall verify that the closures and equipment are not leaking.

13.6.8 A pressure receptacle shall be filled in accordance with the working pressure, filling ratio and provisions specified in the appropriate packing instruction for the specific substance being filled. Reactive gases and gas mixtures shall be filled to a pressure such that if complete decomposition of the gas occurs, the working pressure of the pressure receptacle shall not be exceeded. Bundles of cylinders shall not be filled in excess of the lowest working pressure of any given cylinder in the bundle.

13.6.9 When an outer packaging is prescribed, the pressure receptacle shall be firmly secured therein. Unless otherwise specified in the detailed packing instruction, one or more inner receptacle can be enclosed in an outer packaging.

13.6.10 Valves shall be designed and constructed in such a way that they are inherently able to withstand damage without release of the contents. Alternatively, they shall be protected from damage which could cause inadvertent release of the contents of the pressure receptacle, by one of the following means:

a) valves shall be placed inside the neck of the pressure receptacle and shall be protected by a threaded plug or a cap;

b) valves shall be protected by caps which shall possess vent-holes of sufficient cross-sectional area to evacuate the gas if leakage occurs at the valves;

c) valves shall be protected by shrouds or guards;

d) pressure receptacles shall be transported in frames, for example bundles; or

e) pressure receptacles shall be transported in an outer packaging which, as prepared for transport shall comply with the drop test as described in 12.3.1 at packing group I performance level. Pressure receptacles with valves as described in (b) and (c) above, shall comply with the requirements of ISO 11117. Valves with inherent protection shall comply with the requirements of Annex B of ISO 10297.

13.6.11 Non-refillable receptacles shall:

a) be transported in an outer packaging, such as a box, a crate, a shrink-wrapped tray or a stretch wrapped tray;

b) be of water capacity less than or equal to 1,25 L when filled with flammable gas or toxic gas;

c) not be used for toxic gases with an inhalation toxicity (*LC*50) less than or equal to 200 mL/m3; and

d) not be repaired after being put into service.

13.6.12 Refillable pressure receptacles, other than cryogenic receptacles, shall be periodically inspected at intervals as given in provisions "u" and "v" of packing instruction P200.

13.6.13 A pressure receptacle shall not be filled after becoming due for periodic inspection but can be transported after the time limit has expired.

13.6.14 Repairs shall be consistent with the manufacture and testing requirements of the applicable design and construction standards and are only permitted as indicated in ISO 6404, ISO 10461, ISO 10462 and ISO 11623, as applicable. A pressure receptacle, other than the jacket of a closed cryogenic receptacle, shall not be subjected to repair of any of the following:

a) weld cracks or other weld defects;

b) cracks in the walls; and

c) leaks or defects in the material of the wall, head or bottom.

13.6.15 A pressure receptacle shall not be offered for filling:

a) when damaged to such an extent that the integrity of the pressure receptacle or its service equipment can be affected;

b) unless the pressure receptacle and its service equipment has been examined and found to be in good working order; or

c) unless the required certification, retest, and filling markings are legible.

13.6.16 A filled pressure receptacle shall not be offered for transport:

a) when leaking;

b) when damaged to such an extent that the integrity of the pressure receptacle or its service equipment may be affected;

c) unless the pressure receptacle and its service equipment has been examined and found to be in goods working order; or

d) unless the required certification, retest and filling markings are legible.

13.7 Special packing provisions for self-reactive substances of division 4.1 and organic peroxides of division 5.2

13.7.1 General

A receptacle used for the transport of an organic peroxide shall be "effectively closed". Where significant internal pressure could develop in a package by the evolution of a gas, a vent shall be

fitted, provided the gas emitted will not cause danger. Alternatively, the degree of filling could be limited. Any venting device shall be so constructed that liquid will not escape when the package is in an upright position and the entry of foreign substances through the vent does not occur under normal conditions of transport. The outer packaging, if any, shall be so designed as not to interfere with the operation of the venting device.

13.7.2 Use of packaging

13.7.2.1 Packaging for an organic peroxide and a self-reactive substance shall comply with the requirements of clause 8 and clause 11 and shall meet the test requirements of clause 12 at packing group II performance level. To avoid unnecessary confinement, metal packaging meeting the test criteria of packing group I shall not be used.

13.7.2.2 The packing methods for organic peroxides and self-reactive substances are listed in packing instruction P520 and are designated OP1 to OP8. The quantities specified for each packing method are the maximum quantities authorized per package.

13.7.2.3 The packing methods appropriate for the individual currently assigned organic peroxide and self-reactive substance are listed in DEAS 949:2019.

13.7.2.4 For new organic peroxides, new self-reactive substances or new formulations of currently assigned organic peroxides or self-reactive substances the following procedures shall be used to assign the appropriate packing method:

a) ORGANIC PEROXIDE, TYPE B or SELF-REACTIVE SUBSTANCE, TYPE B
Packing method OP5 shall be assigned, provided that the organic peroxide or the self-reactive substance, as packaged for transport, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in the package. In such a case, the packaging shall bear an "Explosive" subsidiary risk label. If an organic peroxide or a self-reactive substance can only satisfy these criteria in a smaller packaging than those authorized by packing method OP5, one of the packaging listed for OP1 to OP4 can be used;

b) ORGANIC PEROXIDE, TYPE C or SELF-REACTIVE SUBSTANCE, TYPE C
Packing method OP6 shall be assigned, provided that the organic peroxide or the self-reactive substances, as packaged for transport, cannot detonate or deflagrate rapidly or undergo a thermal explosion in the package. In such a case, the packaging need not bear an "Explosive" subsidiary risk label. If an organic peroxide or a self-reactive substance can only satisfy these criteria in a smaller packaging than those authorized by packing method OP6, one of the packaging listed for OP1 to OP5 can be used;

c) ORGANIC PEROXIDE, TYPE D or SELF-REACTIVE SUBSTANCE, TYPE D
Packing method OP7 shall be assigned to this type of organic peroxide or self-reactive substance;

d) ORGANIC PEROXIDE, TYPE E or SELF-REACTIVE SUBSTANCE, TYPE E
Packing method OP8 shall be assigned to this type of organic peroxide or self-reactive substance; and

e) ORGANIC PEROXIDE, TYPE F or SELF-REACTIVE SUBSTANCE, TYPE F
Packing method OP8 shall be assigned to this type of organic peroxide or self-reactive substance

14 Special provisions for infectious substances, category A of division 6.2

14.1 General

14.1.1 A consignor of infectious substances shall ensure that packages are prepared in such a manner that they arrive at their destination in good condition and present no hazard to persons or animals during transport.

14.1.2 The requirements of clause 8 apply to the packaging of infectious substances. However, liquids shall be filled into packaging which have an appropriate resistance to the internal pressure that may develop under normal conditions of transport. See 14.3 for the testing requirements of packaging for infectious substances.

14.1.3 An itemized list of the contents shall be enclosed between the secondary packaging and the outer packaging of infectious substances assigned to UN 2814 and UN 2900. When an infectious substance intended for transport is unknown, but is suspected of meeting the criteria for inclusion in category A (KS 2324) and assignment to UN 2814 or UN 2900, the words "suspected category A infectious substance" shall be shown, in parenthesis, after the proper shipping name on the document inside the outer packaging.

14.1.4 Before an empty packaging is returned to the consignor, or sent elsewhere, it shall be disinfected or sterilized to nullify any hazard and any label or marking indication that it had contained an infectious substance shall be removed or obliterated.

14.1.5 Provided an equivalent level of performance is maintained, the following variations in the primary receptacles within a secondary packaging are allowed without further testing of the complete package:

a) the primary receptacle is of similar design as the tested primary receptacle, for example round shape, or rectangular shape;

b) the material of construction of the primary receptacle, for example glass, plastics or metal offers resistance to impact and stacking forces equal to or greater than that of the originally tested primary receptacle;

c) the primary receptacle has the same or smaller openings and the closure is of similar design, for example screw cap or friction lid;

d) sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the primary receptacle(s); and

e) the primary receptacle(s) are oriented within the secondary packaging in the same manner as in the tested package.

14.1.6 A lesser number of the tested primary receptacles, or of the alternative types of primary receptacles can be used, provided that sufficient cushioning material is added to fill the void space(s) and to prevent significant movement of the primary receptacle(s).

14.1.7 The provisions of this section do not apply to infectious substances, category B of division 6.2 (UN 3373). See packing instruction P650.

14.2 Marking requirements

14.2.1 On satisfactory completion of the design type testing (see 14.3) and the issue of a certificate of compliance (see 10.1.3), each outer packaging shall bear marking that is durable, legible and of such a size relative to the packaging as to be readily visible (see also 10.2.1.2 and 10.2.1.3).

14.2.2 The manufacturer shall mark all packaging produced under authority of the certificate of compliance issued by the certification authority.

14.2.3 Each outer packaging approved in terms of this standard shall bear the following marking:

a) the United Nations' packaging symbol

b) the code designating the type of packaging according to the requirements of clause 9;

c) the text "CLASS 6.2";

d) the date of manufacture, indicated by the last two digits of the year, for example 03;

e) the country that authorized the use of the UN packaging symbol, indicated by the distinguishing sign for motor vehicles in international traffic;

NOTE The code "ZA" is used for South Africa.

f) the approval reference number issued by an accredited test laboratory, for example CT02; and

g) the letter "U" shall be inserted immediately following the marking required in (b) above for packagings that meet the requirements of 14.4.5 (see also 14.2.4); and

h) the name of the manufacturer and any other identification of the packaging as specified by the competent authority.

14.2.4 The codes for designating types of packaging are given in 9.1 to 9.3 (inclusive) and table 1. The letters "U" and "W" can follow the packaging code. The letter "U" signifies a special packaging that meets the requirements of 14.3.4.5. The letter "W" signifies that the packaging, although of the same type indicated by the code is manufactured to a specification different from that in clause 11, but is considered to meet the requirements of 8.1.3.

14.2.5 The markings shall be applied in the sequence given in 14.2.3 and the following layout shall be followed:

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14.2.6 Manufacturers and subsequent distributors of packaging shall provide information regarding the procedures to be followed to ensure that packages as presented for transport are capable of passing the applicable performance tests of this clause. The procedures shall include a description of the types and dimensions of closures and if applicable, gaskets and any other components that might be needed.

14.3 Performance testing and frequency of test

14.3.1 The design type of each packaging, except packaging used for live animals and organisms, shall be prepared for testing as described in 14.4 before subjected to the tests in 14.5.

14.3.2 Equivalent preparation and tests are permitted for safety reasons, provided that the preparation and tests are as effective as those given in 14.4 and 14.5 respectively.

14.3.3 Each packaging design type shall successfully pass the performance tests before being used. A packaging design type is defined by the design, size, material and thickness, manner of construction and packing, but can include various surface treatments. It also includes packaging of a height less than that of the design type.

14.3.4 Tests shall be repeated on production samples at intervals established by the competent authority.

14.3.5 Tests shall also be repeated after each modification that alters the design, material or manner of construction of the packaging.

14.3.6 The competent authority can permit the selective testing of packaging that differ only in the following minor respects from the tested type, for example:

a) smaller sizes or lower net mass of primary receptacles; and

b) packaging such as drums, bags and boxes that are manufactured with small reductions in external dimension(s).

14.3.7 Primary receptacles of any type can be placed within a secondary packaging and transported without testing of the rigid outer packaging, provided that

a) the rigid outer packaging shall have been successfully passed the performance tests given 14.5 with fragile, i.e. glass primary receptacles;

b) the combined gross mass of primary receptacle shall not exceed one half of the gross mass of primary receptacles used for the drop test prescribed in 14.5.1;

c) the thickness of cushioning material between the primary receptacles and the outside of the secondary packaging shall not be reduced below the corresponding thickness in the originally tested packaging. If a single primary receptacle was used in the original test, the thickness of cushioning material between the primary receptacles shall not be less than the thickness of cushioning material between the outside of the secondary packaging and the primary receptacle in the original test. When either fewer, or smaller, primary receptacles are used, compared to the primary receptacles used in the drop test, sufficient additional cushioning material shall be used to take up the void spaces;

d) the rigid outer packaging shall pass the stacking test given in 12.3.5 while empty. The total mass of identical packages shall be based on the combined mass of the packagings used in the drop test in c) above;

e) where the primary receptacles contain liquids, an adequate quantity of absorbent material shall be used to absorb the entire liquid content of the primary receptacles;

f) where rigid outer packaging is intended to contain primary receptacles for liquids and is not leakproof, or where the rigid outer packaging is intended to contain solids and is not sift-proof, a means of containment of the liquid or the solid contents shall be provided in the form of a leak proof liner, plastics bag, or other equally effective means of containment; and

g) in addition to the markings prescribed in 14.2.3 a) to f), packaging's shall be marked in accordance with 14.2.3 g).

14.3.8 The competent authority can at any time require proof, by tests in accordance with this section, that serially-manufactured packagings meet the requirements of the design type tests.

14.3.9 With the approval of the competent authority, several tests can be performed on one specimen, provided that the validity of the test results is not affected.

14.4 Preparation of packaging for testing

14.4.1 General

14.4.1.1 Specimens of each packaging shall be prepared as for transport except that a liquid or a solid infectious substance shall be replaced with water or, where conditioning at a temperature of -18 °C is specified, with a mixture of water and antifreeze. Each primary receptacle shall be filled to 98 % of its capacity.

14.4.1.2 Packaging prepared as for transport shall be subjected to the tests given in table 7. For test purposes, packaging is categorized according to the properties of the material of construction, for example outer packaging of:

a) fibre board or similar material whose performance can be rapidly affected by moisture;

b) plastics that becomes brittle at low temperature; or

c) other material, such as metal, that is not affected by moisture or temperature.

14.4.1.3 The material of construction of the secondary packaging are not taken into account when selecting the test or the conditioning for the test.

14.4.1.4 In cases where a primary receptacle is manufactured from two or more different materials, the material most liable to undergo damage shall determine the appropriate test.

14.4.2 Explanation for the use of Table 7

For fibre board outer packaging with primary plastics receptacles, Table 7 indicates that

a) five specimens shall undergo the water spray test before the drop test.

b) a further five specimens shall be conditioned to –18 ° before the drop test, and

c) if the packaging is intended to contain dry ice, another single specimen shall be dropped five times (see 14.5.1).

Table 7 — Performance tests required

1	2	3	4	5	6	7	8	9
Types of packaging [a]			**Tests required**					
Rigid outer packaging	**Primary receptacle**		**Water spray**	**Cold condi-tioning**	**Drop**	**Additional drop**	**Puncture**	**Stack**
	Plastic	**Other**	**Number of speci-mens**	**Number of speci-mens**	**Number of speci-mens**	**Number of speci-mens**	**Number of speci-mens**	**Number of speci-mens**
Fibreboard box	X		5	5	10	One specimen when the packaging is intended to contain dry ice	2	Three speci-mens when testing a "U" marked packaging (see 14.2.4)
		x	5	0	5		2	
Fibreboard drum	X		3	3	6		2	
		x	3	0	3		2	
Plastics box	X		0	5	5		2	
		x	0	5	5		2	
Plastics drums/ jerricans	X		0	3	3		2	
		x	0	3	3		2	
Boxes of other material	X		0	5	5		2	
		x	0	0	5		2	
Drums/ jerricans of other material	X		0	3	3		2	
		x	0	0	3		2	

[a] "Type of packaging" categorizes packagings for test purposes in accordance with the kind of packaging and its characteristics.

14.5 Performance testing

14.5.1 Drop test

14.5.1.1 Special preparation

14.5.1.1.1 Subject a fibre board outer packaging to a water spray that simulates exposure to rainfall of approximately 5 cm/h for at least 1 h.

14.5.1.1.2 Cool a plastics primary receptacle or a plastics outer packaging and its contents to −18 °C or lower for a period of at least 24 h. Subject the specimen to the drop test within 15 min after removal from the conditioning atmosphere. The conditioning period may be reduced to 4 h if the specimen is packed in dry ice.

14.5.1.1.3 Subject an outer packaging intended to contain dry ice to an additional drop test. When appropriate, subject the packaging to water spray or cold conditioning. Store one specimen so that all the dry ice dissipates and then drop the specimen in one of the orientations as described in Table 8 which shall be the most likely to result in failure of the packaging.

14.5.1.2 Procedure

14.5.1.2.1 Fill the primary receptacles as prescribed in 14.4.1.1.

14.5.1.2.2 Drop the specimen in a free-fall from a height of 9 m onto a target as prescribed in 12.3.1.2.

14.5.1.2.3 See Table 8 for the number of test specimens (per design type and manufacturer) and the points of impact.

Table 8 – Number of test specimens and points of impact for the drop test of packaging for infectious substances

1	2	3
Type of packaging	**Number of specimens**	**Point of impact** [a]
Box	5	First drop — flat on the bottom Second drop — flat on the top Third drop — flat on the long side Fourth drop — flat on the short side Fifth drop — on a corner
Drum	3	First drop — diagonally on the top chime with the centre of gravity direct above the point of impact Second drop — diagonally on the bottom chime Third drop — flat on the side
[a] The specimen is to be released in the required orientation, but it is accepted that, for aerodynamic reasons, impact cannot always take place in that orientation.		

14.5.1.2.4 Acceptance criteria

There shall be no leakage from the primary receptacle(s), which shall remain protected by the cushioning material, or the absorbent material, in the secondary packaging.

14.5.2 Puncture test

14.5.2.1 Apparatus

Target, see 12.3.1.2.

Cylindrical steel rod, of mass not exceeding 7 kg, of diameter not exceeding 38 mm, and the impact end tapered to a diameter not exceeding 6 mm.

14.5.2.2 Procedure for packaging of gross mass not exceeding 7 kg

14.5.2.2.1 Position two specimen packages on the target as follows:

a) one specimen on its base; and

b) a second specimen in an orientation perpendicular to that of the first specimen.

14.5.2.2.2 Aim the tapered impact end of the steel rod at the package in such a way that it will penetrate the primary receptacle.

14.5.2.2.3 Drop the rod in a vertical free fall from a height of 1 m, measured from the impact end to the impact surface of the specimen.

14.5.2.3 Procedure for packages of gross mass exceeding 7 kg

14.5.2.3.1 Position the steel rod vertically on a level hard surface in such a way that the tapered impact end protrudes a distance from the surface at least equal to the primary receptacle(s) and the outer surface of the outer packaging, and that is not less than 200 mm.

14.5.2.3.2 Drop two specimen packages in a vertical free fall from a height of 1 m, measured from the top of the steel rod, as follows:

a) one specimen with its base aimed at the rod; and

b) the second specimen in an orientation perpendicular to that of the first specimen.

14.5.2.3.3 Acceptance criteria

After each impact, there shall be no leakage from the primary receptacle(s).

14.6 Test report

See 12.3.7.

14.7 Clinical and medical waste

14.7.1 Waste of infectious substances is derived from the medical treatment of animals or humans or from bio-research and shall be classified in accordance with DEAS 949:2019.

14.7.2 Clinical and medical waste shall be transported in rigid, leak proof packaging or in intermediate bulk containers that satisfy the performance tests for solids, packaging group II, of clause 12 of this standard, or the test methods specified in, as relevant.

14.7.3 The packaging shall contain sufficient absorbent material to completely absorb the entire amount of liquid present.

14.7.4 Packaging or intermediate bulk containers (IBCs) intended to contain sharp objects, such as broken glass and needles, shall be resistant to puncture and shall retain liquids under the performance test conditions given in 14.5.

14.8 Action to be taken in the event of damage or leakage

In the event of damage or leakage of the packaging,

a) avoid handling the package or keep handling to a minimum,

b) inspect adjacent packages for contamination and put aside those that might have been contaminated,

c) inform the local public health authority or the local veterinary authority, whichever is appropriate, and provide them with information on any other city or country of transit where people might have been exposed to danger, and

d) notify the consignor or consignee (or both).

15 Provisions for radioactive material of class 7

15.1 General

The provisions of this clause establish standards of safety that provide an acceptable level of control of radiation, criticality and thermal hazards to persons, property and the environment that are associated with the transport of radioactive material. The provisions are based on the IAEA *Regulations for the safe transport of radioactive material* (2005 edition), Safety standards series No. TS-R-1, published by the IAEA, Vienna (2005).

NOTE Explanatory material on the 2005 edition of TS-R-1 can be found in *Advisory material for the IAEA regulations for the safe transport of radioactive material*, Safety standards Series No. TS-G-1.1 (ST-2), Vienna (2007).

15.2 Authorities responsible for the control of radioactive material

Respective Regulatory authorities in the Partner States shall be responsible for the control of radioactive materials and shall be consulted for information regarding these materials and matters pertaining to them.

15.3 Special packing provisions

15.3.1 The relevant competent authority shall ensure that the consignment, acceptance for transport and the transport of radioactive material are subject to a radiation protection programme.

The competent authority shall arrange for periodic assessments of the radiation doses to persons owing to the transport of radioactive material to ensure that the system of protection and safety complies with the *International basic safety standards for protection against ionizing radiation and for the safety of radiation sources,* Safety series No. 115, IAEA, Vienna (1996).

15.3.2 Radioactive material, packaging and packages shall meet the design requirements and testing requirements of 15.8. DEAS 949:2019 for the classification of radioactive material for transport.

15.3.3 Non-fixed radioactive contamination on the external surfaces of a package shall be kept as low as practicable and, under routine transport, shall not exceed the following limits:

a) 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; and

b) 0.4 Bq/cm^2 for all other alpha emitters.

NOTE These limits are applicable when averaged over any area of 300 cm^2 of any part of the surface.

15.3.4 A package shall not contain any other items except such articles and documents as are necessary for the use of the radioactive material. The interaction between these items and the package shall not reduce the safety of the package under normal conditions of transport.

15.3.5 Except as provided in 15.3.6, the level of non-fixed contamination on the external and the internal surfaces of over packs, freight containers, tanks, intermediate bulk containers) and conveyance shall not exceed the limits specified in 15.3.3.

15.3.6 A freight container, a tank, an intermediate bulk container or a conveyance dedicated to the transport of unpackaged radioactive material under exclusive use shall be excepted from the requirements of 15.3.5 and 15.3.7 solely with regard to its internal surfaces and only as long as it remains under that specific exclusive use.

15.3.7 Any conveyance, or equipment, or part thereof that became contaminated with radioactive material above the limits specified in 15.3.3 during normal conditions of transport, or show a radiation level in excess of 5 μS/h shall be decontaminated as soon as possible by a qualified person. Such conveyance or equipment, or part thereof can only be re-used when the non-fixed contamination does not exceed the limits specified in 15.3.3 and the radiation level resulting from the fixed contamination on surfaces after decontamination is less than 5 μS/h at the surface.

15.3.8 Before the first shipment of any package, the following requirements shall be fulfilled:

a) where the design pressure of the containment system exceeds 35 kPa (gauge), the containment system of each package shall conform to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure;

b) the effectiveness of the shielding, containment, heat transfer characteristics and confinement system (as applicable) of Type B(U), Type B(M) and Type C package (see 15.4), and packages containing fissile material, shall be within the limits applicable to, or specified for, the approved design; and

c) checks shall be performed on packages containing fissile material to confirm the presence and distribution of neutron poisons where, in order to comply with 15.5.6, neutron poisons are specifically included as components of the package.

15.3.9 Before each shipment of any package, the following requirements shall be met:

a) all the requirements specified for a package in the relevant clauses of this standard;

b) lifting attachments that do not meet the requirements of 15.7.1.2 shall be removed or otherwise rendered incapable of being used for lifting of the package (see 15.7.1.3);

c) a package that requires competent authority approval shall meet all the requirements as specified in the approval certificate;

d) each Type B(U), Type B(M) and Type C package shall be

   1) held until equilibrium conditions have been approached closely enough to demonstrate compliance with temperature and pressure requirements, unless an exemption from these requirements has received unilateral approval, and
   2) inspected or tested (or both) to ensure that all closures, valves and other openings of the containment system through which radioactive contents might escape, are properly closed and sealed;

e) special form radioactive material shall meet all the requirements as specified in the approval certificate and the relevant clauses of this standard;

f) each package that contains fissile material, shall meet the measurement requirements specified in 15.7.9.2 and the tests to demonstrate closure of a package (see 15.15) shall be performed where applicable; and

g) low dispersible material shall meet the requirements as specified in the approval certificate and the relevant clauses of this standard.

15.3.10 The consignor shall have a copy of any instructions with regard to the proper closing of the package and any preparation for shipment before making any shipment under the terms of the certificates.

15.3.11 In addition to the radioactive and fissile properties, any subsidiary risk of the contents of a package, such as explosiveness, flammability, pyrophoric properties, chemical toxicity and corrosiveness, shall also be taken into account in the documentation, packing, labelling and marking in order to be compliant with all relevant provisions of this standard.

15.4 Types of packaging

15.4.1 In the case of radioactive material, a package is the packaging with its radioactive contents as presented for transport. The types of package are as follows:

a) excepted package;

b) industrial package type 1 (type IP-1 package);

c) industrial package type 2 (type IP-2 package);

d) industrial package type 3 (type IP-3 package);

e) type A package;

f) type B(U) package;

g) type B(M) package; and

h) type C package.

NOTE Packages that contain fissile material or uranium hexafluoride are subject to additional requirements.

15.4.2 In the case of radioactive material a packaging is the assembly of components necessary to enclose the radioactive contents completely and can consist of:

a) one or more receptacles, absorbent material, spacing structures, radiation shielding and service equipment for filling, emptying, venting and pressure relief;

b) devices for cooling, absorbing mechanical shocks, handling and tie-down, thermal insulation; and

c) service devices that are integral to the package.

15.4.3 The packaging for radioactive material can be a box, a drum or a similar receptacle, or it can also be a freight container, a tank or an intermediate bulk container

15.5 Activity limits and material restrictions

15.5.1 Excepted packages

15.5.1.1 For radioactive material other than articles manufactured of natural uranium, depleted uranium or natural thorium, an excepted package shall not contain activities greater than:

a) the limits for each individual item and each individual package as given in columns 2 and 3, respectively, of table 9. These limits pertain to radioactive material enclosed in, or included as, a component part of an instrument or other manufactured article, such as a clock or electronic apparatus; and

b) the package limits as specified in column 4 of table 9. These limits pertain to radioactive material not enclosed in, or not included as, a component of an instrument or other manufactured article.

Table 9 — Activity limits for excepted packages

1	2	3	4
Physical state of contents	**Instruments or articles**		**Materials**
	Item limits[a]	**Package limits[a]**	**Package limits[a]**
Solids			
special form	10^{-2} A_1	A_1	10^{-3} A_1
other form	10^{-2} A_2	A_2	10^{-3} A_2
Liquids	10^{-3} A_2	10^{-1} A_2	10^{-4} A_2
Gases			
tritium	2×10^{-2} A_2	2×10^{-1} A_2	2×10^{-2} A_2
special form	10^{-3} A_1	10^{-2} A_1	10^{-3} A_1
other forms	10^{-3} A_2	10^{-2} A_2	10^{-3} A_2

[a] See the relevant annex in DEAS 949 :2019 for the basic radionuclide values ($A1$ and $A2$) for individual radionuclides and for mixtures of radionuclides.

15.5.1.2 An excepted package, intended for the transport of articles manufactured of natural uranium or natural thorium, can contain any quantity of such material provided that the outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some other substantial material.

15.5.2 Industrial packages

The radioactive contents in a single package of LSA material or in a single package of SCO shall be so restricted that the radiation level specified in 15.6.1 shall not be exceeded. The activity in a single package shall be so restricted that the activity limits for a conveyance given in table 10 shall not be exceeded.

A single package of non-combustible solid LSA-II or LSA-III material, if transported by air, shall not contain an activity greater than 3 000 $A2$.

Table 10 — Conveyance activity limits for LSA material and SCO in industrial packages or unpackaged

1	2
Nature of material	**Activity limits for conveyance by road or rail**
LSA-I	**No limit**
LSA-II and LSA-III non-combustible solids	**No limit**
LSA-II and LSA-III combustible solids, and all liquids and gases	**100**
SCO	**100**
See DEAS 949:2019 for the descriptions of LSA material and SCO	

15.5.3 Type A packages

15.5.3.1 Type A packages shall not contain activities greater than;

a) *A*1 for special radioactive material, and

b) *A*2 for all other radioactive material.

NOTE DEAS 949:2019 for the basic radionuclide values (*A*1 and *A*2).

15.5.3.2 For mixtures of radionuclides whose identities and respective activities are known, the following formula applies to the radioactive contents of a type A package:

$$\sum_i \frac{B(i)}{A1(i)} + \sum_j \frac{C(j)}{A2(j)} \leq 1$$

where

B(i) is the activity of radionuclide *i* as special form radioactive material;

*A*1*(i)* is the *A*1 value for radionuclide *i*;

C(j) is the activity of radionuclide *j* as other than special form radioactive material;

*A*2*(j)* is the *A*2 value of radionuclide *j*;

N is the number of different radionuclides.

15.5.4 Type B(U) and type B(M) packages

As specified in the approval certificates (see 15.22), type B(U) and type B(M) packages shall not contain

a) activities greater than those authorized for the package design,

b) radionuclides different from those authorized for the package design, or

c) contents in a form, or physical or chemical state different from those authorized for the package design.

NOTE 1 See 15.6.6 for the package design of type B(U) packages.

NOTE 2 See 15.6.7 for the package design of type B(M) packages.

15.5.5 Type C packages

As specified in the approval certificates (see 15.22), type C packages shall not contain

a) activities greater than those authorized for the package design,

b) radionuclide's different from those authorized for the package design, or

c) contents in a form, or physical or chemical state different from those authorized for the package design.

NOTE See 15.6.8 for the package design of type C packages.

15.5.6 Packages containing fissile material

As specified in the approval certificates (see 15.22), packages containing fissile material (uranium-233, uranium-235, plutonium-241, or any combination of these radionuclides), shall not contain

a) a mass of fissile material different from that authorized for the package design,

b) any radionuclide of fissile material different from those authorized for the package design, or

c) contents in a form, or in a physical or a chemical state, or in a spatial arrangement, different from those authorized for the package design.

NOTE See 15.7.9 for the package design of packages containing fissile material.

15.5.7 Packages containing uranium hexafluoride

The mass of uranium hexafluoride in a package shall not exceed a value that would lead to an ullage smaller than 5 % at the maximum temperature of the package as specified for the plant systems where the package shall be used. The uranium hexafluoride shall be in solid form and the internal pressure of the package shall be below atmospheric pressure when presented for transport.

15.6 Requirements and controls for the transport of LSA material and SCO

15.6.1 The quantity of LSA material or SCO in a single type IP-1 package, type IP-2 package, type IP-3 package, or object or collection of objects, whichever is appropriate, shall be so restricted that the external radiation level at 3 m from the unshielded material or object or collection of objects does not exceed 10 mSv/h.

15.6.2 LSA material and SCO which are, or which contain, fissile material shall be segregated during transport and storage in transit as follows:

a) any group of packages, over packs, and freight containers containing fissile material stored in transit in any storage area shall be so limited that the total sum of criticality safety indexes (CSIs) (see 15.9) in the group does not exceed 50. Each group of packaging shall be segregated at least 6 m from other such groups; and

b) where the total sum of the CSI on a vehicle or in a freight container exceeds 50, a segregation distance of at least 6 m from other groups of packages, over packs or freight containers containing fissile material or other radioactive material shall be maintained.

15.6.3 LSA material and SCO in groups, LSA-I and SCO-I can be transported unpackaged, provided that:

a) all unpackaged material, other than ores containing only naturally occurring radionuclide's, shall be transported in such a manner that, under normal conditions of transport, no escape of radioactive contents shall occur from the means of transport, nor will there be any loss of shielding;

b) each conveyance shall be under exclusive use, except when only SCO-I is transported, in which case the contamination on the accessible and the inaccessible surfaces shall not be greater than ten times the applicable level.

c) radioactive material is not released into the conveyance in the case of SCO-I, where it is suspected that non-fixed contamination exists on inaccessible surfaces in excess of the nonfixed contamination on the accessible surface averaged over 300 cm2 (or the area of the surface if less than 300 cm2), and does not exceed 4 Bq/cm2 for beta and gamma emitters and low toxicity alpha emitters, or 0,4 Bq/cm2 for all other alpha emitters.

15.6.4 LSA material and SCO, except as otherwise specified in 15.6.3, shall be packaged in accordance with Table 11.

Table 11 — Industrial package requirements for LSA material and SCO

1	2	3
Radioactive contents	**Industrial package type**	
	Exclusive use	**Not under exclusive use**
LSA-I solid[a] liquid	 Type IP-I Type IP-1	 Type IP-1 Type IP-2
LSA-II solid liquid or gas	 Type IP-2 Type IP-2	 Type IP-2 Type IP-3
LSA-III	Type IP-2	Type IP-3
SCO-I[a]	Type IP-1	Type IP-1
SCO-II	Type IP-2	Type IP-2
[a] See 15.6.3 for the transport of LSA-I material and SCO-I unpackaged.		

[a] See 15.6.3 for the transport of LSA-I material and SCO-I unpackaged.

15.7 Design requirements

15.7.1 General

15.7.1.1 A package shall be so designed in relation to its mass, volume and shape that it can be easily and safely transported. In addition, the package shall be so designed that it can be properly secured during transport.

15.7.1.2 The design of a package shall be such that any lifting attachments will not fail when used in the intended manner. In the event of failure of the lifting attachments, the ability of the package to meet other requirements of this standard shall not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.

15.7.1.3 Attachments and any other features on the outer surface of a package, which could be used to lift the package, shall be designed either to support its mass in accordance with the requirements of 15.7.1.2 or shall be removable, or otherwise rendered incapable of being used during transport.

15.7.1.4 The design and finish of a packaging shall be such that the external surfaces are free from protruding features to ensure that packaging can be easily decontaminated.

15.7.1.5 The outer layer of a package shall be so designed as to prevent the collection and retention of water.

15.7.1.6 Any features added to a package at the time of transport and that are not part of the package shall not reduce its safety.

15.7.1.7 A package shall be capable of withstanding the effects of acceleration, vibration, or vibration resonance, which can arise under normal conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles, or any deterioration in the integrity of the package as a whole. In particular, nuts, bolts and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.

15.7.1.8 The materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with the radioactive contents. Account shall be taken of the behaviour of the packing material, components and structures under irradiation.

15.7.1.9 All valves through which the radioactive contents could escape shall be protected against unauthorized operation.

15.7.1.10 The design of a package shall take into account ambient temperatures and pressures that are likely to be encountered under normal conditions of transport.

15.7.1.11 The package design for radioactive material that also exhibits other dangerous properties (subsidiary risks), shall take those properties into account (see also 15.3.11). Such packaging shall fully comply with the relevant requirements of this clause, as appropriate, as well as other applicable requirements of this standard.

15.7.1.12 Manufacturers and subsequent distributors of packaging containing radioactive material shall provide information regarding procedures to be followed to ensure that packages as presented for transport are capable of passing the applicable performance tests of this clause. The procedures shall include a description of the types and dimensions of closures and, if applicable, of gaskets, and any other components that might be needed.

15.7.2 Design for excepted packages

An excepted package shall be designed to meet the requirements specified in 15.5.1.

15.7.3 Design for industrial packages

15.7.3.1 Type IP-1, type IP-2 and type IP-3 packages shall meet the design requirements specified in 15.5.2.

15.7.3.2 A type IP-2 package shall, if subjected to the free drop test (see 15.11.3) and the stacking test (see 15.11.4), be capable of preventing

a) loss or dispersal of radioactive contents, and

b) loss of shielding integrity which could result in more than a 20 % increase in the radiation level at any external surface of the package.

15.7.3.3 A type IP-3 package shall meet the design requirements specified in 15.7.5.1.2 to 15.7.5.1.15 (inclusive).

15.7.3.4 Packages can be used as a type IP-2 package provided that:

a) the requirements of 15 7.3.1 are satisfied;

b) the design conforms to the requirements of clause 8 to clause 12 (inclusive), or other requirements at least equivalent to them; and

c) when subjected to the tests required for packing groups I and II (see clause 12), the package prevents

1) loss or dispersal of the radioactive contents, and

2) loss of shielding integrity which would result in more than a 20 % increase in the radiation level at any external surface of the package.

15.7.3.5 The smallest overall external dimension of an industrial package shall not be less than 100 mm.

15.7.4 Design for packages containing uranium hexafluoride

15.7.4.1 A package designed to contain uranium hexafluoride shall comply with the requirements pertaining to the radioactive and fissile properties of the material (see DEAS 949:2019).

15.7.4.2 A package designed to contain uranium hexafluoride in quantities of 0,1 kg or more shall be capable to withstand:

a) the structural test given in ISO 7195 without leakage and without unacceptable stress (see also 15.17);

b) the free drop test (see 15.11.3) without loss or dispersal of the uranium hexafluoride; and

c) the thermal test (see 15.13.3) without rupture of the containment system.

15.7.4.3 A package designed to contain uranium hexafluoride in quantities of 0.1 kg or more shall not be provided with a pressure relief device.

15.7.4.4 Subject to approval by the competent authority, a package designed to contain uranium hexafluoride in quantities of 0.1 kg or more can be transported if the package is designed

a) in accordance with international or national standards other than ISO 7195, and provided that an equivalent level of safety is maintained, and

b) to withstand a test pressure of less than 2,76 MPa without leakage and without unacceptable stress.

15.7.5 Design for type A packages

15.7.5.1 General

15.7.5.1.1 A type A package shall be designed to comply with the general requirements of 15.7.1.

15.7.5.1.2 The smallest overall external dimension of a type A package shall not be less than 100 mm.

15.7.5.1.3 The outside of the package shall incorporate a feature such as a seal which is not readily breakable and which, while intact, will prove that it has not been opened.

15.7.5.1.4 Any tie-down attachments on the package shall be so designed that, under normal and accident conditions of transport, the forces in those attachments shall not impair the ability of the package to meet the requirements of this standard.

15.7.5.1.5 The components of a type A package shall be able to withstand temperatures ranging from – 40 °C to +70 °C. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within this temperature range.

15.7.5.1.6 The design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority.

15.7.5.1.7 The design shall include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by pressure which might arise within the package.

15.7.5.1.8 Special form radioactive material can be considered as a component of the containment system.

15.7.5.1.9 If the containment system forms a separate unit of the package, it shall be capable of being securely closed by a positive fastening device which is independent of any other part of the packaging.

15.7.5.1.10 The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials, and the generation of gas by chemical reaction and radiolysis.

15.7.5.1.11 The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.

15.7.5.1.12 All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.

15.7.5.1.13 A radiation shield which encloses a component of the package, specified as a part of the containment system, shall be so designed as to prevent the unintentional release of that component from the shield. Where the radiation shield and such component within it form a separate unit, the radiation shield shall be capable of being securely closed by a positive fastening device that is independent of any other packaging structure.

15.7.5.1.14 A package shall be so designed that, if subjected to the tests specified for the ability to withstand normal conditions of transport (see 15.12), it would prevent:

a) loss or dispersal of the radioactive contents; and

b) loss of shielding integrity which could result in more than a 20 % increase in the radiation level at any external surface of the package.

15.7.5.1.15 The design of a package intended for the transport of liquid radioactive material shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics.

15.7.5.2 Design for type A packages containing liquids

A type A package, designed for the containment of liquid radioactive material, shall comply with the requirements of 15.7.5.1.14(a) if subjected to the tests specified in 15.12, and shall either be provided with

a) sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material shall be suitably positioned so as to contact the liquid in the event of leakage, or

b) a containment system composed of primary inner and secondary outer containment components designed to ensure retention of the liquid contents, within the secondary outer containment components, even if the primary inner components leak.

15.7.5.3 Design for type A packages containing gas

A type A package, designed for the containment of radioactive gas, shall prevent loss or dispersal of the radioactive contents when tested in accordance with 15.12. However, no testing is required for a type A package designed to contain tritium gas or noble gases.

15.7.6 Design for type B(U) packages

15.7.6.1 The design of a type B(U) package shall meet the requirements of 15.7.1.

15.6.7.2 A type B(U) package shall be so designed that, under an assumed ambient temperature of 38 °C and assumed solar conditions as specified in table 12, the heat generated within the package by the radioactive contents shall not, under normal conditions of transport (see 15.11), adversely affect the package in such a way that it would fail to meet the applicable requirements for containment and shielding if left unattended for a period of one week. Particular attention shall be paid to the effects of heat, which might

a) alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material (for example clad fuel elements), is enclosed in a can or a receptacle, cause the can, receptacle or radioactive material to deform or melt,

b) lessen the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material, or

c) accelerate corrosion in combination with moisture.

Table 12 — Solar insolation conditions

1	2	3
Case	**Form and location of surface**	**Insolation for 12 h/d** W/m^2
1	Flat surfaces transported horizontally-downward facing	0
2	Flat surfaces transported horizontally – upward facing	800
3	Surfaces transported vertically	200[a]
4	Other downward facing (not horizontal) surfaces	200[a]
5	All other surfaces	400[a]
[a] Alternatively, a sine function may be used, with an adopted absorption coefficient and neglecting the effects of possible reflection from neighbouring objects.		

[a] Alternatively, a sine function may be used, with an adopted absorption coefficient and neglecting the effects of possible reflection from neighbouring objects.

15.7.6.3 With the exception of packages transported under exclusive use, a type B(U) package shall be so designed that, at an ambient temperature of 38 °C, the temperature of the accessible surfaces of the package does not exceed 50 °C.

15.7.6.4 A type B(U) package provided with thermal protection for the purpose of satisfying the requirements of the thermal test (see 15.13.3), shall be so designed that such protection will remain effective if the package is subjected to the tests specified in 15.10 for the ability of a package to withstand normal conditions of transport. In addition, the package shall be subjected to the drop tests specified in 15.13.2(a) and (b), or the drop tests specified in 15.13.2(b) and (c), as appropriate, to ascertain the ability of the package to withstand accident conditions during transport. The thermal protection on the exterior of the package shall not be rendered ineffective by ripping, cutting, skidding, abrasion or rough handling.

15.7.6.5 The loss of radioactive contents from a type B(U) package shall not exceed 10-6 *A*2/h when tested in accordance with 15.11.

15.7.6.6 A type B(U) package (see 15.7.6.7 and 15.7.6.8) shall

a) retain sufficient shielding to ensure that the radiation level at a distance of 1 m from the surface of the package does not exceed 10 mSv/h of the maximum radioactive contents for which the package is designed to contain, and

b) restrict the accumulated loss of radioactive contents over a period of one week to not more than 10 *A*2 for krypton-85 and not more than *A*2 for all other radionuclides.

15.7.6.7 A type B(U) package of mass not greater than 500 kg, an overall density not greater than 1 000 kg/m3 (based on the external dimensions), and radioactive contents greater than 1 000 *A*2 shall comply with the requirements of 15.7.6.6 when subjected to the drop tests as described in 15.13.2 b) and c), the thermal test as given in 15.13.3 and the water immersion test as given in 15.13.4.
NOTE Special form radioactive material is excluded from this provision.

15.7.6.8 A type B(U) package, other than that specified in 15.7.6.7, shall comply with the requirements of 15.7.6.6 when subjected to the drop tests described in 15.13.2 a) and b), the thermal test as given in 15.13.3 and the water immersion test as given in 15.13.4.

15.7.6.9 Where mixtures of different radionuclides are present, the basic values for individual radionuclides, as given in KS2324, shall apply. However, in the case of krypton-85, an effective *A*2(i) value equal to 10 *A*2 may be used. The external contamination limits given in 15.3.3 shall be taken into account for the assessment of the loss of radioactive contents (see 15.7.6.5).

NOTE The *A*2(i) value is the *A*2 value of radionuclide “i”.

15.7.6.10 A package intended for radioactive contents of activity greater than 105 *A*2 shall be so designed that no rupture of the containment system shall occur when tested in accordance with 15.14.

15.7.6.11 Compliance with the permitted activity release limits shall not depend upon filters or upon a mechanical cooling system.

15.7.6.12 A package shall not include a pressure relief system from the containment system which would allow the release of radioactive material to the environment under the test conditions specified in 15.11 and 15.13.

15.7.6.13 A package shall be so designed that, when at the maximum normal operating pressure and when tested in accordance with 15.11 and 15.13, the level of strains in the containment system would

not attain values that can adversely affect the package in such a way that it fails to meet the applicable requirements.

15.7.6.14 The maximum normal operating pressure of a package shall not exceed a gauge pressure of 700 kPa.

15.7.6.15 The maximum temperature of any surface of a type B(U) package readily accessible during transport shall not exceed 85 °C in the absence of insolation and at an ambient temperature of 38 °C (see also 15.7.6.17). The package shall be transported under exclusive use (see 15.7.6.3) if the maximum temperature exceeds 50 °C. Barriers or screens intended to give protection to persons can be considered. Such barriers or screens need not be subjected to any tests.

15.7.6.16 A type B(U) package that contains low dispersible radioactive material shall be so designed that any features added to the low dispersible radioactive material that are not part of it, or any internal components of the packaging, shall not adversely affect the performance of the low dispersible radioactive material.

15.7.6.17 A package shall be designed for an ambient temperature range from −40 °C to +38 °C.

15.7.7 Design for type B(M) packages

15.7.7.1 A type B(M) package shall meet the requirements of 15.7.1, with the exception of packages intended to be transported solely within a specified country or solely between specified countries. In the latter case, conditions other than those given in 15.7.5.1.5, 15.7.6.2, and 15.7.6.9 to 15.7.6.15 (inclusive) can be assumed with the approval of the competent authorities of these countries. Notwithstanding, the requirements for type B(U) packages given in 15.7.6.9 to 15.7.6.15 (inclusive) shall be met as far as practicable.

15.7.7.2 Intermittent venting of a type B(M) package may be permitted during transport, provided that the operational controls for venting are acceptable to the relevant competent authority.

15.7.8 Design for type C packages

15.7.8.1 A type C package shall be designed to comply with the following:

a) 15.7.5.1.1 to 15.7.5.1.13 (inclusive), 15.7.5.1.14(b) and 15.7.5.1.15 as for type A packages; and
b) 15.7.6.2, 15.7.6.10 and 15.7.6.16 as for type B(U) packages.

15.7.8.2 A type C package shall be capable of meeting the assessment criteria prescribed in 15.7.6.7 and 15.7.6.12 after burial in an environment defined by a thermal conductivity of 0,33 W/(m.K) and a temperature of 38 °C in the steady state. Initial conditions for the assessment shall assume that any thermal insulation of the package remains intact, the package is at the maximum normal operating pressure and the ambient temperature is 38 °C.

15.7.8.3 A type C package shall be so designed that, when at the maximum normal operating pressure and subjected to

a) the tests specified in 15.11, the loss of radioactive contents is restricted to not more than 10 6 *A*2 /h, and

b) the test sequence specified in 15.16.1, it shall

1) retain sufficient shielding to ensure that the radiation level at 1 m from the surface of the package does not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain, and

2) restrict the accumulated loss of radioactive contents in a period of one week to not more than 10 *A*2 for krypton-85 and not more than *A*2 for all other radionuclides.

Where mixtures of different radionuclides are present, the requirements of DEAS 949:2019 regarding the basic values, *A*1 and *A*2, shall apply with the exception of krypton-85 where an effective value equal to 10 *A*2 may be used.

In the case of 15.7.8.3(a), the assessment shall take into account the non-fixed radioactive contamination limits given in 15.3.3.

15.7.8.4 A type C package shall be so designed that no rupture of the containment system shall occur when tested in accordance with 15.14.

15.7.9 Design for packages containing fissile material

15.7.9.1 Fissile material shall be transported so as to:

a) Maintain subcriticality during normal and accident conditions of transport. In particular, the following contingencies shall be considered:

1) water leaking into, or out of, packages;

2) the loss of efficiency of built-in neutron absorbers or moderators;

3) rearrangement of the contents either within the package or as a result of loss from the package;

4) reduction of spaces within, or between, packages;

5) packages becoming immersed in water or buried in snow; and

6) temperature changes.

b) Ensure that the smallest overall dimension of the package shall not be less than 100 mm and that any other requirement of this standard pertaining to the radioactive properties of the material be adhered to. Additionally, the requirements of 15.7.9.3 to 15.7.9.11 (inclusive) shall be met, unless excepted by 15.7.9.2.

15.7.9.2 Fissile material that meets one of the requirements given in a) to d) (inclusive) below is exempted from being transported in packages that comply with 15.7.9.3 to 15.7.9.11 (inclusive), as well as other requirements of this standard that apply to fissile material. However, only one type of exception is allowed per consignment:

a) A mass limit per consignment such that:

+ < 1
Y
F
X
M
where

M is the mass of uranium-235 (U-235), in grams (g);

F is the mass of other fissile material, in grams (g);

X and *Y* are the mass limits defined in table 13,

and provided that

1) each individual package contains not more than 15 g of fissile material. For unpackaged material, this quantity limitation shall apply to the consignment being carried in or on the conveyance,

2) the fissile material is a homogeneous hydrogenous solution or mixture where the ratio of fissile nuclides to hydrogen is less than 5 % by mass, or

3) there is not more than 5 g of fissile material in any 10 L volume of material.

Neither beryllium nor deuterium in hydrogenous material enriched in deuterium shall be present in quantities exceeding 1 % of the applicable consignment mass limits given in Table 13.

b) Uranium enriched in uranium-235 to a maximum of 1 % by mass, and with a total plutonium and uranium-233 content not exceeding 1 % of the mass of uranium-235, provided that the fissile material is distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it shall not form a lattice arrangement.

c) A liquid solution of uranyl nitrate enriched in uranium-235 to a maximum of 2 % by mass, with atotal plutonium and uranium-233 content not exceeding 0,002 % of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2.

d) An individual package contains a total plutonium mass of not more than 1 kg, of which not more than 20 %, by mass, can consist of plutonium-239, plutonium-241 or any combination of these radionuclides.

Table 13 — Consignment mass limits for exemptions from the requirements

1	2	3
Fissile material	**Fissile material mass mixed with substances having an average hydrogen density less than or equal to water g**	**Fissile material mass mixed with substances having an average hydrogen density greater than water g**
Uranium-235 *(X)*	400	290
Other fissile material *(Y)*	250	180

15.7.9.3 Where the chemical or physical form, the isotopic composition, the mass or concentration, the moderation ratio or density, or the geometric configuration is not known, the assessments given in 15.7.9.7 to 15.7.9.11 (inclusive) shall be performed. Each parameter that is not known shall be assumed to have the value which gives the maximum neutron multiplication consistent with the known conditions and parameters in these assessments.

15.7.9.4 The assessments given in 15.7.9.7 to 15.7.9.11 (inclusive) for irradiated nuclear fuel shall be based on an isotopic composition demonstrated to provide

a) the maximum neutron multiplication during the irradiation history, or

b) a conservative estimate of the neutron multiplication for the package assessments. After irradiation but prior to shipment, a measurement shall be performed to confirm the conservatism of the isotopic composition.

15.7.9.5 The package, after being subjected to the tests specified in 15.11, shall prevent the entry of a cube with sides of 100 mm.

15.7.9.6 The package shall be designed for an ambient temperature range of –40 °C to +38 °C unless otherwise specified by the competent authority in the certificate of approval for the package design.

15.7.9.7 For a package in isolation, it shall be assumed that water can leak into, or out of, all void spaces of the package, including those void spaces within the containment system. However, if the design incorporates special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage can be assumed in respect of those void spaces. Special features shall include the following:

a) multiple high standard water barriers, each of which shall remain watertight when the package is tested in accordance with 15.6.9.11(b), a high degree of quality control in the manufacture, maintenance and repair of packaging, and tests to demonstrate the closure of each package before each shipment; or

b) for packages containing uranium hexafluoride only and a maximum enrichment of 5 %, by mass, of uranium-235

   1) no physical contact between the valve and any other component of the packaging, other than at its original point of attachment, shall occur after the package has been tested in accordance with 15.7.9.11(b). In addition, the valves shall remain leaktight when tested in accordance with the thermal test (see 15.13.3); and

2) a high degree of quality control in the manufacture, maintenance and repair of packaging coupled with tests to demonstrate closure of each package before each shipment.

15.7.9.8 It can be assumed that the confinement system would be closely reflected by at least 200 mm of water. Alternatively, a greater reflection as may additionally be provided by the surrounding material of the packaging can be assumed. However, when it can be demonstrated that the confinement system remains within the packaging when tested in accordance with 15.6.9.11(b), close reflection of the package by at least 200 mm of water can be assumed in 15.7.9.9(c).

15.7.9.9 The package shall be subcritical under the conditions of 15.7.9.7 and 15.7.9.8. The package conditions shall result in the maximum neutron multiplication consistent with

a) routine conditions of transport (incident free),

b) the tests specified in 15.7.9.11(b), or

c) the tests specified in 15.7.9.11(b).

15.7.9.10 A number "N" shall be derived, such that five times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

a) there shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 200 mm of water; and

b) the state of the packages shall be their assessed or demonstrated condition when tested in accordance with 15.11.

15.7.9.11 A number "N" shall be derived, such that two times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

a) hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 200 mm of water;

b) the tests specified in 15.11 followed by whichever of the following is the more limiting:

1) the mechanical (drop) tests specified in 15.13.2(b) and, either 15.13.2(c) for packages of mass not greater than 500 kg and an overall density not greater than 1 000 kg/m3, based on the external dimensions, or 15.13.2(a) for all other packages. Subsequently, the package shall be subjected to the thermal test (see 15.13.3) and the water leakage test (see 15.15) in this sequence; or

2) the water immersion test (see 15.13.4); and

c) where any part of the fissile material escapes from the containment system following the tests given 15.7.9.11(b), it shall be assumed that fissile material escapes from each package in the array. All of the fissile material shall be arranged in the configuration and moderation that result in the maximum neutron multiplication with close reflection by at least 200 mm of water.

15.8 Test procedures and demonstration of compliance

15.8.1 General

15.8.1.1 The tests shall be performed with specimens representing LSA-III material, or special form radioactive material, or low dispersible radioactive material, or with prototypes or samples of the packaging. The contents of the specimen or the packaging used for the tests shall:

a) simulate as closely as practicable the expected range of radioactive contents; and

b) be prepared as presented for transport.

NOTE See DEAS 949:2019 for the descriptions of LSA material, special form radioactive material and low dispersible radioactive material.

15.8.1.2 Reference to previous satisfactory demonstrations of a sufficiently similar nature is acceptable.

15.8.1.3 Tests can be performed with models of appropriate scale, incorporating those features that are significant with respect to the item under investigation, and provided that engineering experience has shown the results of such tests are suitable for design purposes.

15.8.1.4 Calculation, or reasoned argument is acceptable, provided that the calculation procedures and the parameters are generally agreed to be reliable and conservative.

15.8.1.5 After completion of the test(s), appropriate methods of assessment shall be used to assure that the requirements for the test procedure(s) have been fulfilled regarding

a) the performance and acceptance standards for LSA-III material, special form radioactive material and low dispersible radioactive material (see 15.8.2.3), and

b) the design requirements (see 15.7).

15.8.1.6 All the specimens shall be inspected before testing in order to identify and record faults or damage, including:

a) divergence from the design;

b) defects in manufacture;

c) corrosion or other deterioration; and

d) distortion of features.

15.8.1.7 The containment system of the package shall be clearly specified. The external features of the specimen shall be clearly identified so that reference can be made simply and clearly to any part of such a specimen.

15.8.2 Test method for LSA-III material

Immerse a specimen of solid LSA-III material, representative of the entire contents of a package, for 7 d in water at ambient temperature. The water shall have an initial pH value between 6 and 8 and a maximum conductivity of 1 mS/m at 20 °C. The volume of water shall be efficient to ensure that, at the end of the 7 d period, the free volume of water that has not been absorbed or reacted shall be at least 10 % of the volume of the solid test specimen.

Measure the total activity of the free volume of water after 7 d. The activity in the water shall not exceed 0.1 *A*2.

15.8.3 Test methods for special form radioactive material

15.8.3.1 General

15.8.3.1.1 Subject specimens to the impact test (see 15.8.2.2.2), the percussion test (see 15.8.2.2.3), the bending test (see 15.8.2.2.4) and the heat test (see 15.8.2.2.5), or the alternative tests (see 15.8.2.2.6). A different specimen can be used for each of the tests.

15.8.3.1.2 Perform a leaching assessment or a volumetric leakage assessment on the specimen after the completion of each test by means of a method not less sensitive than the methods given for indispersible solid material (see 15.8.2.2.7.1) or encapsulated material (see 15.8.2.2.7.2) respectively.

15.8.3.2 Impact test

Drop the specimen from a height of 9 m onto a rigid, flat, horizontal surface (target). The target shall be of such a nature that any increase in its resistance to displacement or deformation upon impact of the specimen shall not significantly increase damage to the specimen. The specimen shall not break or shatter on impact.

15.8.3.3 Percussion test

15.8.3.3.1 Place the specimen on a lead sheet that is supported by a smooth solid surface. The lead shall be of hardness number 3,5 to 4,5 on the Vickers scale and shall not be more than 25 mm thick. The lead sheet shall cover an area greater than that covered by the specimen to be tested. Use a fresh surface of lead for each impact.

15.8.3.3.2 Strike the specimen with the flat face of a mild steel bar so as to cause an impact equivalent to that resulting from a free drop of 1.4 kg through 1 m. The lower part of the mild steel bar shall be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm. The specimen shall not break or shatter on impact.

15.8.3.4 Bending test

15.8.3.4.1 This test applies to specimens of long slender form with both a minimum length of 10 mm and a length-to-minimum-width ratio of not less than 10.

15.8.3.4.1.2 Clamp the specimen rigidly in a horizontal position so that half its length protrudes from the face of the clamp. Orientate the specimen in such a way that it will suffer maximum damage when the free end is struck with the flat surface of a mild steel bar (see 15.8.2.2.3.2). The specimen shall not break or shatter on impact.

15.8.3.5 Heat test

Heat the specimen in an air-ventilated oven to a temperature of 800 °C and keep at this temperature for 10 min. Leave the specimen to cool. The specimen shall not melt or disperse.

15.8.3.6 Alternative tests

A specimen that comprises or simulates radioactive material enclosed in a sealed capsule can be excepted from:

a) the impact test (see 15.8.2.2.2) and the percussion test (see 15.8.2.2.3), provided that the mass of the specimen is less than 200 g and the specimen is subjected to the class 4 impact test as prescribed in ISO 2919; and

b) the heat test (see 15.8.2.2.5), provided that the specimen is subjected to the class 6 temperature test specified in ISO 2919.

When tested in accordance with the class 4 impact test of ISO 2919, the specimen shall not break or shatter on impact.

When tested in accordance with the class 6 temperature test of ISO 2919, the specimen shall not melt or disperse.

15.8.3.7 Leaching assessment and volumetric leakage assessment

15.8.3.7.1 Subject a specimen that comprises or simulates indispersible solid material to a leaching assessment as follows:

a) immerse the specimen for 7 d in water at ambient temperature. The water shall have an initial pH value between 6 and 8 and a maximum conductivity of 1 mS/m at 20 °C. The volume of water shall be sufficient to ensure that, at the end of the 7 d period, the free volume of water that has not been absorbed or reacted is at least 10 % of the volume of the solid test specimen;

b) at the end of the 7 d period, heat the water with the specimen to a temperature of 50 °C ± 5 °C and maintain at this temperature for 4 h;

c) determine the activity of the water;

d) keep the specimen for at least 7 d in still air at a temperature of not less then 30 °C and a relative humidity of not less then 90 %;

e) immerse the specimen in water of the same specification as in a) above and heat the water and the specimen to a temperature of 50 °C ± 5 °C and maintain at this temperature for 4 h; and

f) determine the activity of the water.

15.8.3.7.2 Subject a specimen that comprises or simulates radioactive material enclosed in a sealed capsule to:

a) the leaching assessment as described in 15.8.2.2.7.1(a) to 15.8.2.2.7.1(d) (inclusive). Subsequently, repeat the steps as given in 15.8.2.2.7.1(a) to 15.8.2.2.7.1(c) (inclusive); or

b) the volumetric leakage assessment as given in any of the tests described in ISO 9978 and which are acceptable to the competent authority.

The activity in the water from the leaching assessment shall not exceed 2 kBq. The leakage rate for the volumetric leakage assessment in accordance with ISO 9978 shall not exceed the applicable threshold acceptable to the competent authority.

15.8.4 Test methods for low dispersible material

Subject a specimen that comprises or simulates low dispersible material to the enhanced thermal test

(see 15.16.3) and the impact test (see 15.16.4). A different specimen can be used for each of the tests. After the completion of each test, subject the specimen to the leach test as for LSA-III material (see 15.8.2).

The following requirements shall be met:

a) the radiation level at a distance of 3 m from the unshielded radioactive material shall not exceed 10 mS/h;

b) diameter shall not exceed 100 *A*2 on completion of the enhanced thermal test and the impact test;

c) the activity in the water shall not exceed 100 *A*2 on completion of the leach test; and

d) the requirements for the integrity of the containment system and shielding, and the evaluation of criticality safety.

15.9 Transport index (TI) and criticality safety index (CSI)

15.9.1 Determination of TI

15.9.1.1 Determine b) the airborne release in gaseous and particulate forms of up to 100 µm aerodynamic equivalent the maximum radiation level in millisieverts per hour (mSv/h) at a distance of one metre from the external surfaces of the package, overpack, unpackaged LSA-I, or unpackaged SCO-I (KS 2324-1,2011). Multiply the value determined by 100 and round off to the first decimal place to find the transport index. For uranium and thorium ores and their concentrates, the maximum radiation level at any point from the external surfaces of the load can be taken as:

- 0.4 mSv/h for ores and physical concentrates of uranium and thorium;
- 0.3 mSv/h for chemical concentrates of thorium; and
- 0.2 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride

NOTE A transport index value of 0,05 or less can be considered as zero.

15.9.1.2 Multiply the value obtained in 15.9.1.1 for unpackaged LSA-I and unpackaged SCO-I (KS 2324-1) by the appropriate factor as given in Table 14.

Table 14 — Multiplication factors for unpackaged

1	2
Size of load[a] m^2	**Multiplication factor**[b]
Size of load ≤ 1	1
1 < size of load ≤ 5	2
5 < size of load ≤ 20	3
Size of load > 20	10
[a] Largest cross-sectional area of the load being measured. [b] The multiplication factors can also be used for tanks and freight containers.	

[a] Largest cross-sectional area of the load being measured.
[b] The multiplication factors can also be used for tanks and freight containers.

15.9.1.3 The transport index for each overpack, freight container or conveyance shall be determined as the sum of the TIs of all the packages contained, or by direct measurement of the radiation level.

However, in the case of non-rigid overpacks the transport index shall be determined only as the sum of the TIs of all the packages.

15.9.2 Determination of CSI

15.9.2.1 The CSI for packages containing fissile material shall be obtained by dividing the number 50 by the smaller of the two values of "N" derived in 15.7.9.10 and 15.7.9.11 (i.e. *CSI* = 50/*N*). The value of the CSI can be zero, provided that an unlimited number of packages are subcritical. In such a case "N" is effectively equal to infinity in both cases.

15.9.2.2 The CSI for each overpack shall be determined as the sum of the CSIs of all the packages contained. The same procedure shall be followed for the determination of the total sum of the CSIs in a consignment or aboard a conveyance.

15.9.3 Limits on TI, CSI and radiation levels for packages and overpacks

15.9.3.1 With the exception of consignments under exclusive use, the transport index of any package or overpack shall not exceed 10, nor shall the CSI of any package exceed 50.

15.9.3.2 Except for packages or overpacks transported under exclusive use (see 3.1.21) by road or by rail, the maximum radiation level at any point on any external surface of a package or an overpack shall not exceed 2 mSv/h.

15.9.3.3 The maximum radiation level at any point on any external surface of a package or an overpack under exclusive use shall not exceed 10 mSv/h.

15.9.3.4 Packages and overpacks shall be assigned to category I-WHITE, II-YELLOW or III-YELLOW in accordance with the conditions specified in table 15 and the following requirements:

a) both the transport index and the surface radiation level conditions shall be taken into account in determining the appropriate category. Where the transport index satisfies the condition of one category but the surface radiation level satisfies the conditions for a different category, the package or overpack shall be assigned to the higher category. For this purpose, category I-WHITE shall be regarded as the lowest category;

b) if the surface radiation level is greater than 2 mS/h, the package or overpack shall be transported under exclusive use. Furthermore, no persons other than the driver and assistants shall be permitted in road vehicles transporting packages, overpacks or freight containers bearing category II-YELLOW or III-YELLOW labels;

c) a package transported under special arrangement shall be assigned to category III-YELLOW, except when otherwise specified in the competent authority approval certificate of the country of origin of the design (see 15.22); and

d) an overpack which contains packages transported under special arrangement shall be assigned to category III-YELLOW except when otherwise specified in the competent authority approval certificate of the country of origin of the design.

Table 15 — Categories of packages and overpacks

1	2	3
Conditions		
Transport index (TI)	**Maximum radiation level at any point on external surface** (RL_m) mSv/h	**Category**
TI = 0[a]	$RL_m \leq 0{,}005$	I-WHITE
$0 < TI \leq 1$[a]	$0{,}005 < RL_m \leq 0{,}5$	II-YELLOW
$1 < TI \leq 10$	$0{,}5 < RL_m \leq 2$	III-YELLOW
$TI > 10$	$2 < RL_m \leq 10$	III-YELLOW[b]
[a] A transport index of not greater than 0,05, can be quoted as zero (see also 15.8.1.1). [b] Shall be transported under exclusive use (see 15.9.3.4(b).		

[a] A transport index of not greater than 0.05, can be quoted as zero (see also 15.8.1.1).
[b] Shall be transported under exclusive use (see 15.9.3.4 b).

15.10 Tests for the integrity of the containment system and shielding, and the evaluation of criticality safety

After each of the applicable tests specified in 15.11 to 15.17 (inclusive)

a) identify and record the faults and damage,

b) determine whether the integrity of the containment system and shielding has been retained to the extent required in 15.7 for the package under test, and

c) determine whether the assumptions and conditions used in the assessments required by 15.7.9 for one or more packages containing fissile material are valid.

15.11 Tests for ability to withstand normal conditions of transport

15.11.1 General

Subject a specimen of the package to the free drop test (see 15.11.3), the stacking test (see 15.11.4) and the penetration test (see 15.11.5). Each of these tests shall be preceded by the water spray test. One specimen can be used for all the tests, provided that the time interval between tests as specified in 15.11.2.2 is adhered to.

15.11.2 Water spray test

15.11.2.1 Subject the specimen to a water spray that simulates exposure to rainfall of approximately 5 cm/h for at least 1 h.

15.11.2.2 The time interval between the conclusion of the water spray test and the succeeding test (see 15.11.1) shall be such that the water has soaked in to the maximum extent, without appreciable drying of the exterior of the specimen. In the absence of any evidence to the contrary, this interval shall be taken to be 2 h if the water spray is applied from four directions simultaneously. No time interval shall elapse, however, if the water spray is applied from each of the four directions consecutively.

15.11.3 Free drop test

15.11.3.1 Drop the specimen onto a rigid, flat, horizontal surface (target) so as to suffer maximum damage in respect of the safety features to be tested. The target shall be of such nature that any increase in its resistance to displacement or deformation upon impact by a specimen shall not significantly increase damage to the specimen.

15.11.3.2 Measure the height of the drop from the lowest point of the specimen to the upper surface of the target. Drop the specimen from the distance specified in table 16 for the applicable mass. Drop the specimen onto the target in such a way that maximum damage is caused.

15.11.3.3 For a rectangular fibreboard or wooden package of mass not exceeding 50 kg, subject a separate specimen to a free drop onto each corner from a height of 0.3 m.

15.11.3.4 For a cylindrical fibreboard package of mass not exceeding 100 kg, subject a separate specimen to a free drop test onto each of the quarters of each rim from a height of 0.3 m.

Table 16 — Free drop distance

1	2
Package mass Kg	**Free drop distance** m
Package mass < 5 000	1,2
5 000 ≤ Package mass < 10 000	0,9
10 000 ≤ Package mass < 15 000	0,6
15 000 ≤ Package mass	0,3

15.11.4 Stacking test

15.11.4.1 Unless the shape of the packaging effectively prevents stacking, subject it for a period of 24 h to a compressive load equal to the greater of the following:

a) the equivalent of 5 times the mass of the actual package; and

b) the equivalent of 13 kPa multiplied by the vertically projected area of the package.

15.11.4.2 Apply the load uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would typically rest.

15.11.5 Penetration test

15.10.5.1 Place the specimen on a rigid, flat, horizontal surface that will not move significantly while the test is being carried out.

15.11.5.2 Drop a bar of 32 mm in diameter with a hemispherical end and of mass 6 kg onto the weakest part of the specimen. The drop height shall be 1 m from the lower end of the bar to the intended point of impact on the upper surface of the specimen.

15.11.5.3 Direct the bar to fall vertically with its longitudinal axis onto the specimen so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance.

15.12 Additional tests for type A packages designed for liquids and gases

15.12.1 General

In addition to the requirements of in 15.7.5.2 and 15.7.5.3, a specimen, or separate specimens, of type A packages designed for liquids and gases shall be subjected to each of the tests given in 15.12.2 and 15.12.3. Where it can be demonstrated that one test is more severe for the specimen in question than the other, one specimen shall be subjected to the more severe test.

15.12.2 Free drop test

Follow the procedure given in 15.11.3 but increase the drop height to 9 m.

15.12.3 Penetration test

Follow the procedure given in 15.11.5 but increase the height of drop to 1.7 m.

15.13 Tests for ability to withstand accident conditions during transport

15.13.1 General

Subject a specimen to the cumulative effects of the mechanical test (see 15.13.2) and the thermal test (see 15.13.3), in this order. Following these tests, subject the same specimen, or a separate specimen, to the effects of the water immersion test(s) as specified in 15.13.4 and, if applicable, to the enhanced water immersion test (see 15.14).

15.13.2 Mechanical test

Subject a specimen to the drop tests specified in 15.7.6.7, 15.7.6.8 or 15.7.9.11(b), as applicable. Subsequently, subject the specimen to the following drop tests in such an order that, on completion of the mechanical test, the specimen has suffered such damage as will lead to maximum damage in the thermal test:

a) **Drop I**

Follow the procedure given in 15.11.3 but increase the drop height to 9 m.

b) **Drop II**

1) Mount a solid mild steel bar of circular section, 15,0 cm ± 0,5 cm cm in diameter and of length 20 cm, perpendicularly on a target (see 15.11.3.1). The upper end of the bar shall be flat and horizontal with its edge rounded off to a radius of not more than 6 mm. If a longer bar would cause greater damage to the specimen, such a bar with sufficient length to cause maximum damage shall be used.

2) Drop the specimen from a height of 1 m measured from the intended point of impact of the specimen to the upper surface of the bar. Drop the specimen in such a way that maximum damage is caused.

c) **Drop III**

Position the specimen on a target (see 15.11.3.1). Drop a solid mild steel plate of dimensions 1 m × 1 m and of mass 500 kg horizontally from a height of 9 m onto the specimen. Measure the height of the drop from the underside of the plate to the highest point of the specimen. Drop the plate in such a way that maximum damage is caused to the specimen.

15.13.3 Thermal test

15.13.3.1 The specimen shall be in thermal equilibrium under conditions of an ambient temperature of 38 °C, subject to the solar insulation conditions specified in table 12 and to the design maximum rate of internal heat generation within the package from the radioactive contents. Alternatively, any of these parameters are allowed to have different values before and during the test, provided that due account is taken of such values in the subsequent assessment of package response.

15.13.3.2 Expose a specimen

a) for a period of 30 min to a thermal environment, which provides a heat flux at least equivalent to that of a hydrocarbon fuel/air fire in sufficiently quiescent (motionless) ambient conditions to give a minimum average flame emissivity coefficient of 0,9 and an average temperature of at least 800 °C. The specimen shall be fully engulfed, with a surface absorptivity coefficient of 0,8 or that value which the package has demonstrated to possess if exposed to the fire, and subsequently

b) to an ambient temperature of 38 °C for a sufficient period of time to ensure that temperatures in the specimen are decreasing or approaching (or both) initial steady state conditions. This is subject to the solar insolation conditions specified in table 12 and the design maximum rate of internal heat generation within the package by the radioactive contents. Alternatively, any of these parameters are allowed to have different values following cessation of heating, provided that due account is taken of such values in the subsequent assessment of package response.

15.13.3.3 During, and following the test, the specimen shall not be artificially cooled and any combustion of materials of the specimen shall be permitted to proceed naturally.

15.13.4 Water immersion test

Immerse the specimen under a head of water of at least 15 m for a period of not less than 8 h. Place the specimen in such a position that will lead to maximum damage. An external gauge pressure of at least 150 kPa shall be considered to meet these conditions.

15.14 Enhanced water immersion test for type B(U) and type B(M) packages containing more than 105 *A*2, and type C packages

Immerse the specimen under a head of water of at least 200 m for a period of not less than 1 h. Place the specimen in such a position that will lead to maximum damage. An external gauge pressure of at least 2 MPa could be considered to meet these conditions.

15.15 Water leakage test for packages designed to contain fissile material

15.15.1 Applicability

The water leakage test is not applicable to packages containing fissile material for which water in leakage or out-leakage to the extent which results in greatest reactivity has been assumed for purposes of assessment when tested in accordance with 15.7.9.7 to 15.7.9.11 (inclusive).

15.15.2 Procedure

15.15.2.1 Subject a specimen to the drop test given in 15.13.2 b), and either the drop test given in 15.12.2 a) or 15.12.2 c), and the thermal test specified in 15.13.3 before carrying out the water leakage test.

15.14.2.2 Subsequently, immerse the specimen under a head of water of at least 0,9 m for a period of not less than eight hours. Place the specimen in such a position that will lead to maximum leakage.

15.16 Tests for type C packages

15.16.1 Sequence of testing

Subject a specimen to each of the following tests in the order specified:

a) the drop tests given in 15.13.2(a) and 15.13.2(c), the puncture/tearing test given in 15.16.2, the enhanced thermal test given in 15.16.3; and

b) the impact test given in 15.16.4.

NOTE Separate specimens are allowed to be used for each of the sequences a) and b).

15.16.2 Puncture/tearing test

15.16.2.1 General

Subject a specimen to the damaging effects of a solid mild steel probe in accordance with the procedures given in 15.16.2.2 or 15.16.2.3, as applicable. Orientate the probe to the surface of the specimen in such a way that maximum damage is caused to the specimen at the conclusion of the test sequence specified in 15.16.1 a).

15.16.2.2 Packages of mass less than 250 kg

15.16.2.2.1 Place a specimen, representing a package of mass less than 250 kg, on a rigid, flat, horizontal surface (target).

15.16.2.2.2 Orientate and drop a solid mild steel probe on the specimen from a height of 3 m above the intended point of impact in such a way that maximum damage be caused at the end of the test sequence given in 15.16.1. The probe shall be a cylindrical bar of mass 250 kg and a diameter of 200 mm. The striking end of the probe shall form a frustum of a right circular cone of height 300 mm and diameter of 25 mm at the top. The edge shall be rounded off to a radius of not more than 6 mm.

15.16.2.3 Packages of mass 250 kg or more

15.16.2.3.1 Place the base of a probe on a rigid, flat, horizontal surface (target). The probe shall have the properties and dimensions as specified in 15.16.2.2.2, except that the length and mass of the probe shall be such as to incur maximum damage to the specimen.

15.16.2.3.2 Drop the specimen, representing a package of mass 250 kg or more, on the probe from a height of 3 m, measured from the point of impact with the specimen to the upper surface of the probe.

15.16.3 Enhanced thermal test

Follow the procedure given in 15.13.3 but change the time of exposure to the thermal environment to a period of 60 min.

15.16.4 Impact test

Subject a specimen to an impact on a rigid, flat surface (target) at a velocity of not less than 90 m/s, and at such an orientation as to suffer maximum damage. The target surface can be at any orientation as long as the surface is normal to the specimen path.

15.17 Tests for packaging designed to contain uranium hexafluoride

Apply an internal hydraulic pressure of at least 1.4 MPa to a specimen that comprises, or simulates, packaging designed to contain at least 0.1 kg of uranium hexafluoride. When the test pressure is less than 2.8 MPa, the design of the packaging shall require multilateral approval. Any other equivalent non-destructive test method can be applied for retesting subject to multilateral approval.

15.18 Application for approval of package design and package material

15.18.1 Packages containing 0.1 kg or more of uranium hexafluoride

15.18.1.1 Each design for packages containing 0,1 kg or more of uranium hexafluoride and that meets

a) the requirements of 15.7.4.4 shall require multilateral approval after 31 December 2000, and

b) the requirements of 15.7.4.1 to 15.7.4.3 shall require unilateral approval by the competent authority of the country of origin of the design after 31 December 2003.

15.18.1.2 An application for approval of the design for a package containing 0.1 kg or more of uranium hexafluoride shall include

a) all information necessary to satisfy the competent authority that the design meets the applicable requirements of 15.7.4.1; and

b) a specification of the applicable quality assurance programmes implemented for the design, manufacture, testing, use and maintenance of the package.

15.18.2 Type B(U) and type C packages

15.18.2.1 Each type B(U) and type C package design shall require unilateral approval by the competent authority of the origin of the design, except that:

a) a package design for fissile material, which has also subject to 15.18.4, shall require multilateral approval; and

b) a type B(U) package design for low dispersible radioactive material shall require multilateral approval.

15.18.2.2 An application for approval of a type B(U) and a type C package design shall include the following:

a) a detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted;

b) a detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture;

c) a statement of the tests which have been done and their results, or evidence based on calculation methods, or other evidence that the design meets the applicable requirements;

d) the proposed operating and maintenance instructions for the use of the packaging;

e) a specification of the materials of manufacture of the containment system, the samples to be taken, and the tests to be made if the package is designed to have a maximum normal operating pressure in excess of 100 kPa gauge;

f) a statement and a justification of any assumption in the safety analysis relating to the characteristics of the fuel where the proposed radioactive contents are irradiated fuel, and a description of any pre-shipment measurement as required by 15.7.9.4(b);

g) any special transport provisions necessary to ensure the safe dissipation of heat from the package considering the various modes of transport to be used, and type of conveyance or freight container;

h) a reproducible illustration, not larger than 210 mm x 300 mm, showing the make-up of the package; and

i) a specification of the applicable quality assurance programmes implemented for the design, manufacture, testing, use and maintenance of the package.

15.18.3 Type B(M) packages

15.18.3.1 Each type B(M) package design, including those for fissile material which are also subject to 15.18.4 and those for low dispersible radioactive material, shall require multilateral approval.

15.18.3.2 In addition to the general information required for approval of a type B(U) package (see 15.18.2.2), an application for approval of a type B(M) package design, shall include the following:

a) a list of the requirements specified in 15.7.5.1.5, 15.7.6.2 and 15.7.6.10 to 15.7.6.17 (inclusive) with which the package does not conform;

b) any proposed supplementary operational controls to be applied during transport not regularly provided for in this standard, but which are necessary to ensure the safety of the package or to compensate for the deficiencies listed in a) above;

c) a statement relative to any restrictions on the mode of transport and to any special loading, carriage, unloading or handling procedures; and

d) the range of ambient conditions (temperature, solar radiation) which are expected to be encountered during transport and which have been taken into account in the design.

15.18.4 Fissile material

15.18.4.1 Each package design for fissile material that is not excepted from the requirements specifically applicable to packages containing fissile material (see 15.7.9.2), shall require multilateral approval.

15.18.4.2 An application for approval of the design of a package for fissile material shall include the following:

a) all information necessary to satisfy the competent authority that the design meets the applicable requirements of 15.7.9.1; and

b) a specification of the applicable quality assurance programmes implemented for the design, manufacture, testing, use and maintenance of the package.

15.18.5 Special form radioactive material

15.18.5.1 The package design for special form radioactive material shall require unilateral approval.

15.18.5.2 An application for approval of design for special form radioactive material shall include the following:

a) a detailed description of the radioactive material. If the material is a capsule, a detailed description of the contents shall be given. Particular reference to both the physical and chemical states of the radioactive material shall be given;

b) a detailed statement of the design of any capsule to be used;

c) a test report, or evidence based on calculations to show that the radioactive material is capable of meeting the performance standards, or other evidence that the special form radioactive material meets the applicable requirements of this standard;

d) a specification of the applicable quality assurance programmes implemented for the design, manufacture, testing, use and maintenance of the package; and

e) any proposed pre-shipment actions for use in the consignment of special form radioactive material.

15.18.6 Low dispersible radioactive material

15.18.6.1 The package design for low dispersible radioactive material shall require multilateral approval.

15.18.6.2 An application for package design approval for low dispersible radioactive material shall comply with the requirements of 15.18.5.2 a) to d) (inclusive).

15.19 Application and approval for the transport of radioactive material

15.19.1 An application for the transport of radioactive shall include the following:

a) the period of time, related to the shipment, for which the approval is required;

b) the actual radioactive contents, the expected modes of transport, the type of conveyance, and the probable or proposed route; and

c) the details of how the precautions and administrative or operational controls, referred to in the package design approval certificates by the competent authority (see 15.22), are to be put into effect.

15.19.2 An application for approval of a shipment under special arrangement shall include all the information necessary to satisfy the competent authority that the overall level of safety in transport is at least equivalent to that which would be provided if all the applicable requirements of this standard had been met. The application shall also include a statement of:

a) the respects in which, and the reasons why, the consignment cannot comply fully with the applicable requirements of this standard; and

b) any special precautions, or special administrative or operational controls which are to be employed during transport to compensate for the failure of meeting the applicable requirements of this standard.

15.20 Shipment approval identification marking for radioactive material

15.20.1 General

15.20.1.1 Each approval certificate (see 15.22) issued by a competent authority shall be assigned an identification mark. The mark shall consist of:

a) the international vehicle registration identification (VRI) code of the country issuing the certificate;

b) a design number, for example "132", that is unique and specific with regard to the particular design or shipment. The shipment approval identification mark shall be clearly related to the design approval identification mark; and

c) the applicable type code (see 15.20.1.2).

15.20.1.2 The following type codes indicate the type of approval certificate issued:

AF Type A package design for fissile material

B(U) Type B(U) package design (B(U)F if for fissile material)

B(M) Type B(M) package design (B(M)F if for fissile material)

C Type C package design (CF if for fissile material)

IF Industrial package design for fissile material

S Special form radioactive material

LD Low dispersible radioactive material

T Shipment

X Special arrangement

15.20.1.3 In the case of package designs for non-fissile or fissile excepted uranium hexafluoride, where none of the codes given in 15.20.1.2 apply, the following type codes shall be used:

H(U) Unilateral approval

H(M) Multilateral approval

15.20.1.4 The symbol "–96" shall be added to the type code for package design and special form radioactive material approval certificates and for low dispersible radioactive material approval certificates, with the exception of those certificates issued under the transitional packaging provisions given in 15.23.2 and 15.23.3.

15.20.2 Marking

15.20.2.1 Each approval certificate and each package for radioactive material of class 7 shall bear the appropriate identification mark as prescribed in 15.20.1. However, the type codes "T" or "X" shall not appear in the identification marking on the package. Where the design approval and shipment approval are combined, the applicable type codes need not to be repeated.

15.20.2.2 Where multilateral approval is effected by validation according to 15.22.6.2, only the identification mark issued by the country of origin of the design or shipment shall be used. For multilateral approval where certificates by successive countries are issued, each certificate shall bear the appropriate identification mark. A package so approved shall bear all the appropriate identification marks, for example, a package originally approved by Kenya and subsequently approved, by separate certificate, by Kenya shall bear the marks

a) KE/132/B(M)F-96, and

b) CH/28/B(M)F-97.

NOTE Additional marks should be tabulated in a similar manner on the package.

15.20.2.3 The revision of a certificate shall be indicated in brackets after the identification mark on the certificate. For example, KE/132/B(M)F (Rev. 2) indicates revision 2 of the Kenya package design approval certificate. The words "(Rev. 0)" for an original issue of an approval certificate are optional and words such as "original issue" can also be used. Only the country that issued the original approval certificate can issue a revision number.

15.20.2.4 The identification mark on packaging need not be altered each time that the design certificate is revised. Re-marking of a package is required only in those cases where revision to the package design certificate involves a change in the letter type code for the package design after the second stroke.

15.20.3 Special marking provisions for radioactive material

15.20.3.1 Each package shall be legibly and durably marked on the outside of the packaging with an identification of either the consignor or the consignee, or both.

15.20.3.2 Each package, other than excepted packages, shall be legibly and durably marked on the outside with the United Nations number preceded by the letters “UN” and the proper shipping name. In the case of excepted packages only the United Nations number, preceded by the letters “UN”, is required.

15.20.3.3 Each package of gross mass exceeding 50 kg shall have its permissible gross mass legibly and durably marked on the outside of the packaging.

15.20.3.4 Each package that conforms to a type IP-1 package, a type IP-2 package, a type IP-3 package or a type A package design shall be legibly and durably marked on the outside of the packaging with:

a) “TYPE IP-1”, “TYPE IP-2”, “TYPE IP-3” or “TYPE A”, as appropriate;

b) the international vehicle registration code (VRI code) of the country of origin of the design;
c) the name of the manufacturer(s); and

d) other identification of the packaging specified by the competent authority.

15.20.3.5 Where LSA-I or SCO-I material is contained in receptacles or wrapping materials and is transported under exclusive use, the outer surface of these receptacles or wrapping material may bear the marking “RADIOACTIVE LSA-I” or “RADIOACTIVE SCO-I”, as appropriate.

15.20.3.6 The outermost receptacle of the packaging that is resistant to the effects of fire and water and that conforms to a type B(U), a type B(M) or a type C package design shall be marked with the trefoil symbol (see Figure 1) by embossing, stamping or other means resistant to the effects of fire and water. The proportions of the basic trefoil symbol shall be based on a central circle of radius "X". The minimum allowable size of "X" is 4 mm.

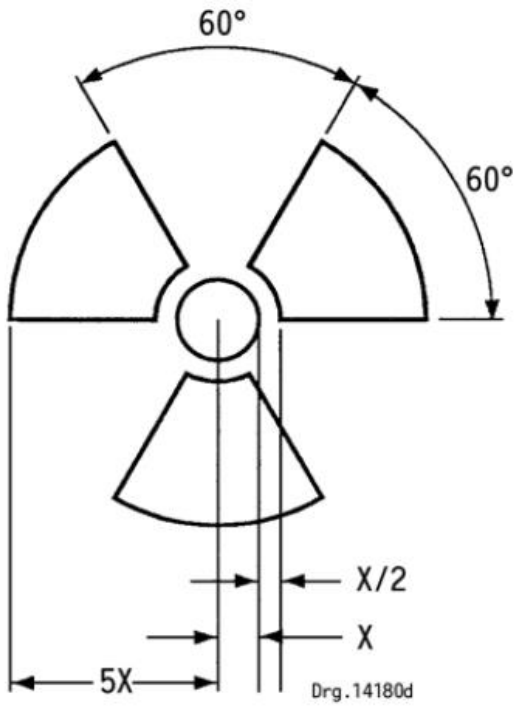

Figure 1 — Basic trefoil symbol

15.21 Special provisions for the labelling of radioactive material of class 7

15.21.1 In addition to the labelling provisions given in 16.3, each package, overpack and freight container that contain radioactive material of category I, II or III shall bear the applicable label on two opposite sides on the outside of the package or on all four sides of the freight container. Each overpack shall bear at least two labels on opposite outside sides.

15.21.2 Each package, overpack and freight container that contain fissile material, other than fissile material excepted under 15.7.9.2, shall bear the class 7 fissile material label (see table 19). Such a label, where applicable, shall be displayed adjacent to other radioactive labels.

15.21.3 The marking specified in 16.2.1 is not applicable to the labels of radioactive material. Labels that do not relate to the contents shall be removed or covered.

15.21.4 A label for radioactive material of category I, II or III shall be completed with the following formation:

a) **contents**: the name of the radionuclide, except for LSA-I material, as listed in KS 2324 together with the applicable chemical symbol. For mixtures of radionuclides, the most restrictive nuclides shall be given to the extent that the space on the label permits. The group

of LSA or SCO shall be shown following the name(s) of the radionuclide(s). The terms LSA-II, LSA-III, SCO-I and SCO-II shall be used for this purpose. In the case of LSA-I material, the name of the radionuclide is not necessary; only the term “LSA-I” shall be used;

b) **activity**: the maximum activity of the radioactive contents during transport, expressed in units of becquerels (Bq). For fissile material, the mass of the fissile material in units of grams (g), or multiples thereof can be used instead of activity; and

c) **transport index**: see 15.9.1. No TI is required for radioactive material of category I-WHITE.

15.21.5 For an overpack or a freight container the “contents” and “activity” entries on the label shall bear the information required in 15.21.4 a) and b) respectively, totalled together for the entire contents. However, such entries on the label of an overpack or a freight container can read “See Transport Documents” in the case of a mixed load comprising different radionuclides.

15.21.6 A label for fissile material shall show the CSI (see 15.9.2) as stated in the certificate of approval for special arrangement, or in the certificate of approval for the package design issued by the competent authority.

15.21.7 The CSI shown on the label of an overpack or a freight container shall bear the information required in 15.21.6 totalled together for the fissile contents.

15.22 Approval certificates issued by the competent authority

15.22.1 General

15.22.1.1 Approval certificates issued by the competent authority are required for:

a) the package designs for

1) special form radioactive material,

2) low dispersible radioactive material,

3) packages containing 0,1 kg or more of uranium hexafluoride,

4) all packages containing fissile material unless excepted by 15.7.9.2,

5) type B(U) packages and type B(M) packages, and

6) type C packages;

b) special arrangements; and

c) certain shipments (see 15.23.2.1).

15.22.1.2 The package design and shipment approval certificates can be combined into a single certificate.

15.22.1.3 The consignor shall be in possession of a copy of each applicable certificate. The consignor shall also have a copy of any instructions with regard to the proper closing of the package and any preparation for shipment before making any shipment under the terms of the certificates.

15.22.1.4 In cases where a certificate by the competent authority is not required for package design, the consignor shall, on request, make available for inspection by the relevant competent authority, documentary evidence of compliance of the package design with all the applicable requirements.

15.22.2 Approval certificates for special form radioactive material and low dispersible radioactive material

Each approval certificate issued by a competent authority for special form radioactive material and low dispersible radioactive material shall include the following information:

a) type of certificate;

b) the competent authority identification mark;

c) the date of issue and the expiry date;

d) list of the applicable national and international regulations, including the edition of the IAEA's *Regulations for the safe transport of radioactive material* under which the special arrangement is approved;

e) the identification of the special form radioactive material or low dispersible radioactive material;

f) a description of the special form radioactive material or low dispersible radioactive material;

g) packaging design specifications for the special form radioactive material or low dispersible radioactive material which may include references to drawings;

h) a specification of the radioactive contents which may include the activities involved and the physical and chemical form;

i) a specification of the applicable quality assurance programmes implemented for the design, manufacture, testing, use and maintenance of the package;

j) reference to information provided by the applicant relating to specific actions to be taken before transport;

k) reference to the identity of the applicant if deemed appropriate by the competent authority; and

l) the signature and identification of the certifying official.

15.22.3 Approval certificates for a special arrangement

Each approval certificate issued by a competent authority for a special arrangement shall include the following information:

a) the type of certificate;

b) the competent authority identification mark;

c) the date of issue and the expiry date;

d) the mode(s) of transport;

e) any restrictions on the mode of transport, type of conveyance, freight container, and any necessary routeing instructions;

f) a list of the applicable national and international regulations, including the edition of the IAEA's *Regulations for the safe transport of radioactive material* under which the special arrangement is approved;

g) the following statement: "This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be transported";

h) reference to certificates for alternative radioactive contents, other competent authority validation, or additional technical data or information, as deemed appropriate by the competent authority;

i) the specification of the design and an illustration of the make-up of the packaging shall be provided. The illustration shall be of dimensions not larger than 21 cm x 30 cm and shall be accompanied by a brief description of the packaging, including materials of manufacture, gross mass, general outside dimensions and appearance;

j) a specification of the authorized radioactive contents, indicating any restrictions which might not be obvious from the nature of the packaging. The specification shall include the physical and chemical form of the radioactive material intended to be transported in the package, the activities involved (including those of the various isotopes, if appropriate), amounts in gram (for fissile material), and whether the contents are special form radioactive material or low dispersible radioactive material, if applicable;

k) additionally, for packages containing fissile material

    1) a detailed description of the authorized radioactive contents,

    2) the value of the CSI,

    3) reference to the documentation that demonstrates the criticality safety of the contents,

    4) any special features, on the basis of which the absence of water from certain void spaces has been assumed in the criticality assessment,

    5) any allowance (based on 15.7.9.4(b)) for a change in neutron multiplication assumed in the criticality assessment as a result of actual irradiation experience, and

    6) the ambient temperature range for which the special arrangement has been approved;

l) a detailed listing of any supplementary operational controls required for preparation, loading, carriage, unloading and handling of the consignment, including any special stowage provisions for the safe dissipation of heat;

m) reasons for the special arrangement if so required by the competent authority;

n) a description of the compensatory measures to be applied as a result of the shipment being under special arrangement;

o) reference to information provided by the applicant relating to the use of the packaging or specific actions to be taken before shipment;

p) a statement regarding the ambient conditions assumed for purposes of design if these are not in accordance with those specified in 15.7.6.3 and 15.7.6.15, as applicable;

q) any emergency arrangements deemed necessary by the competent authority;

r) a specification of the applicable quality assurance programme implemented for the design, manufacture, testing, use and maintenance of the package;

s) the identity of the applicant and the transport company if required by the competent authority; and

t) the signature and identification of the certifying official.

15.22.4 Approval certificates for a shipment

Each approval certificate for a shipment issued by a competent authority shall include the following information:

a) the type of certificate;

b) the competent authority identification mark(s);

c) the date of issue and the expiry date;

d) a list of applicable national and international regulations, including the edition of the IAEA's *Regulations for the safe transport of radioactive material* under which the shipment is approved;

e) any restrictions on the modes of transport, type of conveyance, freight container, and any necessary routeing instructions;

f) the following statement: "This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be transported";

g) a detailed listing of any supplementary operational controls required for preparation, loading, transport, unloading and handling of the consignment, including any special stowage provisions for the safe dissipation of heat or maintenance of criticality safety;

h) reference to information provided by the applicant relating to specific actions to be taken prior to shipment;

i) reference to the applicable design approval certificate(s);

j) a specification of the actual radioactive contents, indicating any restrictions on the radioactive contents which might not be obvious from the nature of the packaging. The specification shall include the physical and chemical form of the radioactive material, the total activities involved (including those of the various isotopes, if appropriate), amounts in gram (for fissile material),and whether the contents are a special form radioactive material or a low dispersible radioactive material, if applicable;

k) any emergency arrangements deemed necessary by the competent authority;

l) a specification of the applicable quality assurance programme implemented for the design, manufacture, testing, use and maintenance of the package;

m) the identity of the applicant and the transport company if required by the competent authority;and

n) the signature and identification of the certifying official.

15.22.5 Approval certificates for package design

Each approval certificate for the design of a package issued by a competent authority shall include the following information:

a) the type of certificate;

b) the competent authority identification mark(s);

c) the date of issue and the expiry date;

d) a list of applicable national and international regulations, including the edition of the IAEA's *Regulations for the safe transport of radioactive material* under which the shipment is approved;

e) any restrictions on the modes of transport, type of conveyance, freight container, and any necessary routeing instructions;

f) the following statement: "This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be transported";

g) references to certificates for alternative radioactive contents, other competent authority validation, or additional technical data or information, as deemed appropriate by the competent authority;

h) a statement authorizing shipment where shipment approval is required (see 15.25.2);

i) identification of the packaging;

j) a description of the design of the packaging or a drawing of the make-up of the packaging shall be provided. The drawing shall be of dimensions not larger than 21 cm x 30 cm and shall be accompanied by a brief description of the packaging, including materials of manufacture, gross mass, general outside dimensions and appearance;

k) a specification of the authorized radioactive contents, indicating any restrictions on the radioactive contents which might not be obvious from the nature of the packaging. The specification shall include the physical and chemical form of the radioactive material, the activities involved (including those of the various isotopes, if appropriate), amounts in gram (for fissile material), and whether the contents are special form radioactive material or low dispersible radioactive material, if applicable;

l) additionally, for packages containing fissile material

1) a detailed description of the authorized radioactive contents,

2) the value of the CSI,

3) reference to the documentation that demonstrates the criticality safety of the contents,

4) any special features, on the basis of which the absence of water from certain void spaces has been assumed in the criticality assessment,

5) any allowance (based on 15.7.9.4(b)) for a change in neutron multiplication assumed in the criticality assessment as a result of actual irradiation experience, and

6) the ambient temperature range for which the special arrangement has been approved; m) for type B(M) packages, a statement specifying the requirements of 15.7.5.1.5, 15.7.6.2 and 15.7.6.10 to 15.7.6.17 (inclusive) with which the package does not conform and any other information that can be useful to other competent authorities;

n) a detailed list of any supplementary operational controls required for preparation, loading,transport, unloading and handling of the consignment, including any special stowage provisions for the safe dissipation of heat;

o) reference to information provided by the applicant relating to the use of the packaging or specific actions to be taken before shipment;

p) a statement regarding the ambient conditions assumed for purposes of design if the conditions are not in accordance with those specified in 15.7.6.2 and 15.7.6.17;

q) a specification of the applicable quality assurance programme implemented for the design, manufacture, testing, use and maintenance of the package;

r) any emergency arrangements deemed necessary by the competent authority;

s) the identity of the applicant if so required by the competent authority; and

t) the signature and identification of the certifying official.

15.22.6 Register of design approvals

15.22.6.1 The competent authority shall be informed of the serial number of each packaging manufactured to a design approved by them. The competent authority shall maintain a register of such serial numbers.

15.22.6.2 Multilateral approval can be obtained by means of validation of the original certificate issued by the competent authority of the country of origin of the design or shipment. Such validation can take the form of an endorsement on the original certificate or the issue of a separate endorsement, annex, supplement, etc., by the competent authority of the country through, or into which the shipment is made.

15.23 Transitional measures for the packaging of radioactive material

15.23.1 Packages not requiring competent authority approval of design under the 1985 (as amended 1990) editions of the IAEA's *Safety series No. 6*

15.23.1.1 An excepted package of type IP-1, type IP-2 and type IP-3, and a type A package not requiring competent authority approval of design under the 1985 (as amended 1990) editions of the IAEA's *Safety series No. 6* can continue to be used subject to:

a) compliance with mandatory quality assurance programmes for the design, manufacture, testing, use and maintenance of the package; and

b) the activity limits and material restriction as required in 15.5.

15.23.1.2 Modified packaging, unless to improve safety, or manufactured after 31 December 2003, shall meet the requirements of this standard. Packages prepared for transport not later than 31 December 2003 under the 1985 (as amended 1990) editions of the IAEA's *Safety series No. 6* can continue in transport. Packages prepared for transport after this date shall meet the requirements of this standard.

15.23.2 Packages approved under the 1973 (as amended), 1985 (as amended 1990) editions of the IAEA's *Safety series No. 6*

15.23.2.1 Packaging manufactured to a package design approved by the competent authority under the provisions of the 1973 (as amended) editions of the IAEA's *Safety series No. 6*, can continue to be used, subject to:

a) multilateral approval of the package design;

b) compliance with mandatory quality assurance programmes for the design, manufacture, testing, use and maintenance of a package; and

c) the activity limits and material restriction as required by 15.5.

15.23.2.2 Changes to the design of packaging or in the nature or quantity of the authorized radioactive contents which, as determined by the competent authority, would significantly affect safety, shall require re-compliance with the requirements of this standard. A serial number shall be assigned and the outside of each packaging marked in accordance with 15.20.3.4.

15.23.2.3 Packaging manufactured to a package design approved by the competent authority under the provisions of the 1985 or 1985 (as amended 1990) Editions of the IAEA's *Safety series No. 6* can continue to be used until 31 December 2003, subject to:

a) compliance with mandatory quality assurance programmes for the design, manufacture, testing, use and maintenance of a package; and

b) the activity limits and material restriction as required by 15.4. Such packaging can continue to be used after 31 December 2003 subject to multilateral competent approval of the package design. Changes to the design of packaging or in the nature or quantity of the authorized radioactive contents, which, as determined by the competent authority, would significantly affect safety, shall require that the provisions of this standard be met in full.

15.23.2.4 Packaging for which manufacture begins after 31 December 2006 shall meet the requirements of this standard.

15.23.3 Special form radioactive material approved under the 1973 (as amended) and 1985 (as amended 1990) editions of the IAEA's *Safety series No. 6*

15.23.3.1 Special form radioactive material manufactured to a design which had received unilateral approval by the competent authority under the 1973 (as amended) and the 1985 (as amended 1990) editions of the IAEA's *Safety series No. 6* can continue to be used when in compliance with mandatory quality assurance programmes for the design, manufacture, testing, use and maintenance of a package.

15.23.3.2 A special form radioactive material manufactured after 31 December 2003 shall meet the requirements of this standard.

15.24 Consignment procedures

15.24.1 Procedures before shipment

15.24.1.1 Before the first shipment of any package, the following requirements shall be fulfilled:

a) if the design pressure of the containment system exceeds 35 kPa (gauge), it shall be ensured that the containment system of each package conforms to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure;

b) for each type B(U), type B(M) and type C package and for each package containing fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to, or specified for the approved design; and

c) for packages that contain fissile material, where, in order to comply with the requirements of 15.7.9.1, neutron poisons are specifically included as components of the package, checks shall be performed to confirm the presence and distribution of those neutron poisons.

15.24.1.2 Before the shipment of any package it shall be ensured that:

a) all the requirements specified in the relevant provisions of this standard have been satisfied;

b) the lifting attachments that do not meet the requirements of 15.7.1.2 have been removed or otherwise rendered incapable of being used for lifting the package in accordance with 15.7.1.3;

c) each type B(U), type B(M) and type C package, and each package containing fissile material have met all the requirements specified in the approval certificates (see 15.22);

d) each type B(U), type B(M) and type C package has approached equilibrium conditions closely enough to demonstrate compliance with the requirements for temperature and pressure, unless an exemption from these requirements has received unilateral approval;

e) for each type B(U), type B(M) and type C package, all closures, valves and other openings of the containment system through which the radioactive contents might escape, are properly closed and, where appropriate, sealed in accordance with the requirements of 15.7.6.5 to 15.7.6.9 and 15.7.6.12;

NOTE The above can be ascertained by inspection or testing (or both).

f) each special form radioactive material has satisfied all the requirements specified in the approval certificate (see 15.22.2) and the relevant provisions of this standard;

g) for each package containing fissile material, the measurement specified in 15.7.9.4(b) and the tests to demonstrate closure of a package as specified in 15.7.9.7 have been performed where applicable; and

h) each low dispersible radioactive material, has satisfied all the requirements specified in the approval certificate (see 15.22.2) and the relevant provisions of this standard.

15.24.2 Shipment approval and notification

15.24.2.1 Shipment approval

15.24.2.1.1 In addition to the approval for package design (see 15.7), multilateral shipment approval is also required for:

a) type B(M) packages not complying with the requirements of 15.7.5.1.5 or designed to allow intermittent venting;

b) type B(M) packages containing radioactive material with an activity greater than 3 000 *A*1 or 3 000 *A*2 , as appropriate, or 1 000 TBq, whichever is the lower; and

c) packages containing fissile material if the sum of the CSIs of the packages exceeds 50.

NOTE A competent authority can authorize transport into, or through, its country without shipment approval by making specific provision in its design approval.

15.24.2.1.2 The competent authority can approve the shipment of a single or a planned series of multiple consignment(s) of radioactive material under special arrangement if the radioactive material does not satisfy all of the applicable requirements of this standard and provided that:

a) the competent authority is satisfied that conformity with the class 7 provisions of this standard is impracticable;

b) the requisite standard of safety established by this standard has been demonstrated through alternative means;

c) the overall level of safety in transport is at least equivalent to that which would be provided if all the applicable requirements had been met; and

d) multilateral approval has been obtained for the international transport of a consignment.

15.24.2.2 Notification

15.24.2.2.1 Before the first shipment of any package requiring competent authority approval, the consignor shall ensure that copies of each applicable competent authority certificate applying to that package design have been submitted to the competent authority of each country through, or into which, the consignment is to be transported. The notification shall reach each competent authority before commencement of the shipment, and preferably at least 7 d in advance. It is not required that the consignor await an acknowledgment from the competent authority, nor is the competent authority required to make such acknowledgment of receipt of the certificate.

15.24.2.2.2 Notification is required for each of the following types of shipment:

a) type B(U) and type C packages containing radioactive material with an activity greater than 3 000 *A*1 or 3 000 *A*2, as appropriate, or 1 000 TBq, whichever is the lower;

b) type B(M) packages; and

c) shipments under special arrangement.

15.24.2.2.3 The consignor is not required to send a separate notification if the required information has been included in the application for shipment approval.

15.24.2.2.4 The consignment notification shall include the following:

a) sufficient information to enable the identification of the package or packages, including all applicable certificate numbers and identification marks;

b) the date of shipment, the expected date of arrival and the proposed routeing;

c) the name(s) of the radioactive material or nuclides;

d) descriptions of the physical and chemical forms of the radioactive material, whether it is a special form radioactive material or a low dispersible radioactive material; and

e) the maximum activity of the radioactive contents during transport, expressed in units of becquerel (Bq). For fissile material, the mass of fissile material in units of gram (g), or multiples thereof, may be used in place of activity.

16 Marking and labelling for transport

16.1 General

16.1.1 Hazard labels shall be in the form of a square, set at an angle of 45° (diamond-shaped), and with minimum dimensions as given in table 19. Labels shall have a line 5 mm inside the edge of the label and running parallel with it in the case of a label of dimensions of 100 mm2. For labels of other sizes, the distance of the line from the edge shall be reduced or increased in proportion to the size of the label. In the upper half the line shall be the same colour as the symbol and in the lower half it shall be the same colour as the class or division number in the bottom corner.

Table 17 — Sizes of hazard labels and subsidiary risk labels

1	2
Net contents of packaging[a]	**Minimum size of label,** mm
≥ 0,5 > 0,5 ≤ 5 > 5 ≤ 20 > 20	5 × 15 20 × 20 30 × 30 100 ×100
[a] Litres in the case of a liquid or gas and kilograms in the case of a solid substance.	

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16.1.2 The hazard labels are divided into halves. With the exception of labels for radioactive material of class 7, divisions 1.4, 1.5 and 1.6, the upper half of the label is reserved for the pictorial symbol and the lower half for the text and for the class or division number and the compatibility group, as appropriate.

16.1.3 The colours of the hazard labels shall visually match colour reference numbers Pantone 151 or NCS S 0570-Y50 (orange), Pantone 192 or NCS S 0580-Y90R (red), Pantone 361 or NCS S 1565-G (green), Pantone 300 or NCSS 2065-B (blue) and Pantone 109 or NCS S 0570-G90Y (yellow). In case of a dispute the NCS colours shall take precedence.

16.1.4 A package containing a substance of class 8 need not bear a subsidiary risk label of division 6.1 (see table 19) if the toxicity arises solely from the destructive effect on tissue.

16.1.5 A package containing a substance of division 4.2 need not bear a subsidiary risk label of division 4.1.

16.1.6 Marking and labels applied to dangerous goods packaging shall, on contact with the contents, remain legible and shall be capable of being immersed in water at ambient temperature for 4 h continuously. If, after immersion and subsequent drying, all printing is still clearly legible, no significant colour change has taken place and the marking or label remains affixed to the packaging, the marking and label shall be deemed to have passed the test.

16.1.7 Indelible marking (see 16.2.1.4) and hazard labels (see table 19) can be printed directly on packaging.

16.2 Marking

16.2.1 General

16.2.1.1 Each packaging of dangerous goods presented for transport shall display the following information marked on its external surfaces:

a) the proper shipping name of the dangerous goods in the packaging (see 3.1.42 and B.2 and Annex C of KS 2324;

NOTE In the case of radioactive material in excepted packages, marking of the proper shipping name is not required (see also 17.2.2).

b) the applicable United Nations number preceded by the letters “UN”, for example UN 2791 (see 3.1.54, and B.2 and Annex C of KS 2324);

c) the applicable hazard label and subsidiary risk label (if any) as indicated in B.2 of DEAS 949:2019);

NOTE For the purposes of this standard, the hazard label and the subsidiary risk label are the same.

d) in the case of goods for delivery within Kenya, the name and address in Kenya of the packer, agent or consignor of the dangerous commodity; and

e) in the case of aerosol dispensers, marking and labeling in accordance with special provision 63 (see B.1 of DEAS 949:2019).

NOTE Provisions concerning compliance markings on packaging are given in clause 10.

16.2.1.2 In the case of unpackaged articles, the marking shall be displayed on the article, on its cradle or on its handling, storage or launching device.

16.2.1.3 For explosives of division 1.4, compatibility group S, the division and compatibility group letter shall also be marked, unless the hazard label for 1.4S is displayed.

16.2.1.4 All package markings shall:

a) be readily visible and legible;

b) be able to withstand open weather exposure without a substantial reduction in effectiveness (see also 16.1.7);

c) be displayed on a background of contrasting colour to the external surface of the package; and

d) not be located with other package markings that could substantially reduce their effectiveness.

16.2.1.5 In addition to the requirements of 16.2.1.1, salvage packaging shall be marked with the word "SALVAGE'".

16.2.1.6 Inner packaging of combination packaging need not be marked or labelled for purposes of transport, but shall bear the label and information leaflet required by legislation, relevant to the contents.

16.2.2 Special marking provisions for class 7

See 15.20.3.

16.2.3 Special marking provisions for environmentally hazardous substances

16.2.3.1 Packages that contain environmentally hazardous substances of UN 3077 and UN 3082 shall be durably marked with the environmentally hazardous substance mark. However, the mark need not be displayed on single packagings and combination packagings that contain inner packagings with

a) liquid contents of 5 L or less, or

b) solids contents of 5 kg or less.

16.2.3.2 The environmentally hazardous mark shall be located adjacent to the markings required by 16.2.1.

16.2.3.3 The environmentally hazardous mark shall be as depicted in figure 2. The symbol (fish and tree) shall be in black on a white or other suitable contrasting background. The mark shall have dimensions of at least 100 mm x 100 mm, except in the case of packaging that, because of its size, can only bear smaller marks. For transport units (see 11.23), the dimensions shall be at least 250 mm x 250 mm.

Figure 2 — Environmentally hazardous mark

16.2.4 Orientation arrows

16.2.4.1 Except as provided in 16.2.4.3,

a) combination packagings with inner packagings that contain liquid dangerous goods,

b) single packagings fitted with vents, and

c) cryogenic receptacles intended for the transport of refrigerated liquefied gases shall be legibly marked with package orientation arrows as depicted in figure 3. The orientation arrows shall appear on two opposite vertical sides of the package with the arrows pointing in the correct upright direction. They shall be rectangular and of a size that is clearly visible, and commensurate with the size of the package. Depiction of the border around the arrows is optional.

16.2.4.2 The orientation label shall depict two black or two red arrows on white, or suitable contrasting, background.

16.2.4.3 Orientation arrows are not required on packages that contain

a) pressure receptacles, with the exception of cryogenic receptacles (see 16.2.4.1(c)),

b) dangerous goods in inner packagings of capacity not more than 120 mL, provided that the packaging contains sufficient absorbent material between the inner and the outer packagings to completely absorb the liquid contents,

c) infectious substances of division 6.2 in primary receptacles of not more than 50 mL,

d) radioactive material of class 7 in type IP-2, type IP-3, type A, type B(U), type B(M) or type C packages, and

e) articles that are leak-tight in all orientations, for example, alcohol or mercury in thermometers and aerosol dispensers.

16.2.4.4 Arrows for purposes other than the indication of package orientation, shall not be displayed on a package marked in accordance with the requirements of this standard.

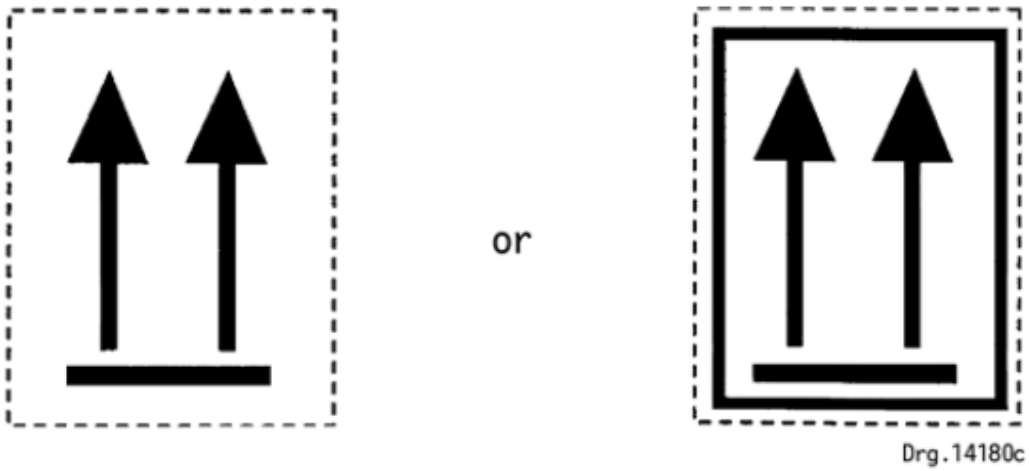


Figure 3 — Orientation arrows

16.3 Labelling

16.3.1 General

16.3.1.1 Hazard labels identifying primary and subsidiary risks shall conform to the depictions in table 19 and shall be of size not less than that specified in table 17, relative to the size of packaging to which they are applied. The label for divisions 1.1, 1.2 and 1.3 shall be used as the “EXPLOSIVE” subsidiary risk label.

16.3.1.2 Were a package is of such an irregular shape or small size that a label cannot be satisfactorily affixed, the label can be attached to the package by a securely affixed tag or other suitable means.

16.3.2 Location of labels

Labels shall be

a) located on the same surface of the package near the proper shipping name marking, if the package dimensions are adequate,

b) so placed on the packaging that they are not covered or obscured by any part or attachment to the packaging or any other label or marking, and

c) displayed next to each other when more than one label is required.

16.3.3 Special labelling provisions

16.3.3.1 Gases with subsidiary risk(s)

16.3.3.1.1 Three separate labels have been provided for class 2, namely one for flammable gases of division 2.1, one for non-flammable, non-toxic gases of division 2.2 and one for toxic gases of division 2.3. The label of a gas of class 2 that possesses single or multiple subsidiary risks shall be in accordance with Table 18.

Table 18 — Labels for class 2 gases with subsidiary risk(s)

1	2	3	4
Classification		**Labels**	
Division	**Subsidiary risk**	**Primary risk label**	**Subsidiary risk label**
2.1	None	2.1	None
2.2	None	2.2	None
	5.1	2.2	5.1
2.3	None	2.3	None
	2.1	2.3	2.1
	5.1	2.3	5.1
	5.1, 8	2.3	5.1, 8
	8	2.3	8
	2.1, 8	2.3	2.1, 8

16.3.3.1.2 On account of their shape, orientation and securing mechanisms for transport, cylinders for gases of class 2 can bear labels which have been reduced in size according to ISO 7225, for display on the non-cylindrical part (shoulder) of such cylinders.

16.3.3.1.3 Labels can overlap to the extent provided for in ISO 7225. However, in all cases, the labels representing the primary risk and the numbers appearing on any label shall remain fully visible and the symbols recognizable.

16.3.3.2 Self-reactive substances

A package containing a self-reactive substance of type B shall display an “EXPLOSIVE” subsidiary risk label. However, the competent authority can permit the label to be dispensed with for a specific packaging when test data have proved that the self-reactive substance in such a packaging does not exhibit explosive behaviour.

16.3.3.3 Organic peroxides

16.3.3.3.1 A package containing organic peroxides of types B, C, D or F (DEAS 949:2019), shall display a division 5.2 label. This label implies that the product might be flammable and therefore no“FLAMMABLE RISK” label is required.

16.3.3.3.2 The following subsidiary risk labels apply to organic peroxides:

a) an “EXPLOSIVE” subsidiary risk label for organic peroxides of type B. However, the competent authority can grant permission for the label to be dispensed with for a specific packaging when test data have proved that the organic peroxide in such a packaging does not exhibit explosive behaviour; and

b) a “CORROSIVE” subsidiary risk label when packing group II or III criteria of class 8 are met.

16.3.3.4 Infectious substances

In addition to the primary risk label, packaging containing infectious substances shall bear any other label required by the nature of the contents.

16.3.3.5 Radioactive material

See 15.20.

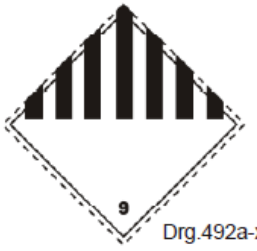
Table 19 — International hazard labels

1	2
Class, division or subsidiary risk	**Hazard label**
1.1, 1.2, or 1.3	 (See NOTES 1 and 2)
1.4	 (See NOTE 2)
1.5	 (See NOTE 2)
1.6	 (See NOTE 2)

Table 19 (*continued*)

1	2
Class, division or subsidiary risk	**Hazard label**
4.3	 
5.1	
5.2	  
6.1	
6.2	
7	

Table 19 (*concluded*)

1	2
Class, division or subsidiary risk	**Hazard label**
7	
7	
7	 Drg.801d
8	
9	 Drg.492a-›

17 Proper shipping name

17.1 General

17.1.1 The proper shipping name is considered to be that portion of the entry that most accurately describes the dangerous goods listed in B.2 of DEAS 949:2019. It is shown in capital letters plus any numbers, Greek letters, "sec-", "tert-", m-, n-, o-, and p-, that form an integral part of the name. An alternative proper shipping name may be shown in brackets following the main proper shipping name, for example ETHANOL (ETHYL ALCOHOL).

NOTE See 19.8 for the proper shipping names to be used for dangerous goods in limited quantities.

17.1.2 Portions of an entry in B.2 DEAS 949:2019 of that appear in lower case need not be considered part of the proper shipping name. When conjunctions such as "and" or "or" are in lower case or when segments of the name are punctuated by commas, the entry need not necessarily be shown in its entirety in the transport documentation or package marking. This is particularly applicable when a combination of several distinct entries are listed under a single substance UN number. Examples of the proper shipping name for such entries are:

a) UN 1057 LIGHTERS or LIGHTER REFILLS — The proper shipping name is the most appropriate of the following possible combinations:

LIGHTERS
LIGHTERS REFILLS

b) UN 2793 FERROUS METAL BORINGS, SHAVINGS, TURNINGS OR CUTTINGS in a form liable to self-heating — The proper shipping is the most appropriate of the following combinations:

FERROUS METAL BORINGS
FERROUS METAL SHAVINGS
FERROUS METAL TURNINGS
FERROUS METAL CUTTINGS

17.1.3 A proper shipping name is given in the transport documentation and package marking to ensure that the substance, material or article is readily identified during transport. This is particularly important in the case of spillage or leakage in order to determine the response actions, the emergency equipment or the antidotes for toxic substances that are required to deal with the incident.

17.1.4 A proper shipping name can be used in the singular or plural, as appropriate. When qualifying words are used as part of the proper shipping name, their sequence on documentation or package marking is optional, for example "DIMETHYLAMINE AQUEOUS SOLUTION" can also be shown as "AQUEOUS SOLUTION OF DIMETHYLAMINE". For explosives of class 1, the dangerous goods description may be supplemented by additional descriptive text to indicate commercial or military names.

17.1.5 Many substances have an entry for both the liquid and the solid state (see the definitions for liquid and solid in 3.1.28 and 3.1.50 respectively), or for the solid and solution, for example:

NITROXYLENES, LIQUID 6.1 UN 1665
NITROXYLENES, SOLID 6.1 UN 3447

17.1.6 If a substance that is a solid in accordance with 3.1.50, is presented for transport in the molten state, the qualifying word "molten" shall be added as part of the proper shipping name, for example ALKYLPHENOL, SOLID, N.O.S., MOLTEN.

17.1.7 With the exception of proper shipping names for self-reactive substances and organic peroxides, and unless it is already included in capital letters, the word “STABILIZED” shall be added as part of the proper shipping of a substance which, without stabilization, would be forbidden from transport due to it reacting dangerously under conditions normally encountered in transport, for example “TOXIC LIQUID, ORGANIC, N.O.S., STABILIZED”.
If the proper shipping name of a substance presented for transport in a liquid state at a temperature equal to or exceeding 100 °C, or in a solid state at a temperature equal to or exceeding 240 °C, does not indicate the elevated temperature condition with words such as "molten" or "elevated temperature", the word "hot" shall immediately precede the proper shipping name on the transport documentation and package marking.

17.1.9 Hydrates can be transported under the proper shipping name for the anhydrous substance.

17.2 Generic or “not otherwise specified” (N.O.S.) names

17.2.1 Practical considerations prohibit the listing of all dangerous goods by name. Therefore, many dangerous goods have to be transported under a generic or N.O.S. entry. However, it is required that these generic or N.O.S. descriptions be supplemented with the technical name or the chemical group name of the substance in parentheses, (unless a national law or an international convention prohibits its disclosure in the case of a controlled substance).

17.2.2 The proper shipping name of an explosive of class 1 can be supplemented by additional descriptive text to indicate commercial or military names.

17.2.3 An appropriate modifier, such as “contains” or “containing”, or other qualifying words such as "solution" or "mixture", and the percentage of the technical constituent can be used as part of the proper shipping name, for example “UN 1993 FLAMMABLE LIQUID, N.O.S. (contains xylene and benzene), 3, PG II”.

17.2.4 The technical name shall be a recognized chemical, or other, name currently used in scientific and technical handbooks, journals and texts. Trade names shall not be used for this purpose. In the case of pesticides, only ISO common name(s), other name(s) in the WHO *Recommended classification of pesticides by hazard and guidelines to classification*, or the chemical name of the active ingredient(s) shall be used.

17.2.5 When a mixture of dangerous goods is described by one of the “N.O.S.” or “generic entries” listed in DEAS 949:2019 not more than the two constituents which most predominantly contribute to the hazard or hazards of the mixture need to be shown (unless a national law or an international convention prohibits its disclosure in the case of a controlled substance). If the mixture contains a substance which compels the use of a subsidiary risk label, one of the two technical names shown in brackets shall be the name of that substance.

17.2.6 Examples illustrating the selection of the proper shipping name supplemented with the technical name are:

UN 2909 PESTICIDE, LIQUID, TOXIC, N.O.S. (draxolon)
UN 3394 ORGANOMETALLIC SUBSTANCE, LIQUID, PYROHORIC, WATER-REACTIVE (trimethylgallium)

18 Transport of samples

18.1 When the hazard class of a substance is uncertain and it is being transported for further testing, a tentative hazard class, proper shipping name and UN number shall be assigned on the basis of the consignor's knowledge of the substance and application and the classification criteria in accordance with DEAS 949:2019. The most severe packing group possible for the proper shipping name chosen shall be used.

18.2 The proper shipping name shall be supplemented with the word "SAMPLE", for example "FLAMMABLE LIQUID, N.O.S. SAMPLE". When an "N.O.S. entry is used to transport a sample, the proper shipping name need not be supplemented with the technical name (see 17.2.1).

18.3 In cases where a specific proper shipping name is provided for a sample of a substance considered to meet certain classification criteria, that proper shipping name shall be used, for example "UN 3167 GAS SAMPLE, NON-PRESSURIZED, FLAMMABLE".

18.4 Samples of substances shall be transported in accordance with the requirements applicable to the tentative assigned proper shipping name, provided that:

a) the substance is not considered to be a substance prohibited for transport (see clause 20);
b) the substance is not considered to meet the criteria for explosives of class 1, infectious substances of division 6.2 or a radioactive material of class 7;

c) the substance is in compliance with the requirements of this standard if it is considered to be a self reactive substance or an organic peroxide;

d) the substance is transported in a combination packaging with a net mass per package not exceeding 2,5 kg; and

e) the sample is not packed together with other goods.

19 Dangerous goods packed in limited quantities

19.1 This clause provides provisions applicable to the transport of dangerous goods of certain classes packed in limited quantities (see B.2 of DEAS 949:2019). All the requirements of this standard apply to the transport of limited quantities except as specifically provided in this clause.

19.2 Dangerous goods in limited quantities shall be packed only in inner packaging placed in suitable outer packaging. However, aerosol dispensers and small receptacles containing gas are exempt from the requirements of inner packaging. The packaging shall be of good quality that is not affected, or significantly weakened, by its contents and shall be so designed that the construction requirements of clause 11 are met. The total gross mass of a package shall not exceed 30 kg.

19.3 Shrink-wrapped or stretch-wrapped trays that are of goods quality and are not affected or significantly weakened by the contents, are acceptable as outer packaging for articles or inner packaging containing dangerous goods transported in accordance with this clause. However, inner packaging that are liable to break or be easily punctured such as those made of glass, porcelain, stoneware or certain plastics, etc., shall not be transported in shrink-wrapped or stretch-wrapped trays. The total gross mass of such a package shall not exceed 20 kg.

19.4 Corrosive liquids of class 8, packing group II in glass, porcelain or stoneware inner packaging shall be enclosed in compatible and rigid intermediate packaging.

19.5 Different dangerous goods packed in limited quantities may be placed in the same outer packaging provided they will not interact dangerously in the event of leakage.

19.6 Packages of dangerous goods transported in accordance with this clause need not be labelled. Any segregation provisions for dangerous goods need not apply within a vehicle or freight container.

19.7 In addition to the provisions for documentation () words “limited quantity” or “LTD QTY” shall be included with the description of the consignment.

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19.8 Packages containing dangerous goods in limited quantities need not be marked with the proper shipping name of the contents. However, the package shall be marked with the UN number of the contents, preceded by the letters “UN”, placed in a diamond. The width of the line forming the diamond shall be at least 2 mm and the height of the number shall be at least 6 mm. Where more than one substance is included in the package and the substances are assigned to different UN numbers, the diamond shall be large enough to include each relevant UN number.

19.9 Limited quantities of dangerous goods for personal or household use, that are packaged and distributed in a form intended, or suitable, for sale through retail agencies, may furthermore be exempted from marking of the UN number on the packaging and from the requirements for a dangerous goods transport document.

20 Dangerous goods packed in excepted quantities

20.1 General

20.1.1 Excepted quantities of dangerous goods of certain classes, other than articles, meeting the provisions of this clause are not subject to any other provisions of this standard except for:

a) the classification procedures and packing group criteria (see DEAS 949:2019; and

b) the packaging requirements of clause 8.

NOTE In the case of radioactive material, the requirements for radioactive material in excepted packages in clause 15.4.1 apply.

20.1.2 Dangerous goods that can be transported as excepted quantities in accordance with the requirements of this clause are identified by means of alphanumeric codes as given in Table 20.

Table 20 — Codes for excepted quantities

1	2	3
Code	**Maximum quantity per inner packaging[a]**	**Maximum quantity per outer packaging[b]**
E0	Not permitted as excepted quantity	
E1	30 g/30 mL	1 kg/1 L
E2	30 g/ 30 mL	500 g/500 mL
E3	30 g/ 30 mL	300 g/300 mL
E4	1 g/1 mL	500 g/500 mL
E5	1 g/1 mL	300 g/300 mL
[a] For gases, the volume indicated for inner packaging refers to the water capacity of the inner receptacle. [b] For gases, the volume indicated for outer packaging refers to the combined water capacity of all inner packaging within a single outer package.		

[a] For gases, the volume indicated for inner packaging refers to the water capacity of the inner receptacle.
[b] For gases, the volume indicated for outer packaging refers to the combined water capacity of all inner packaging within a single outer package.

20.1.3 Where dangerous goods in excepted quantities for which different codes are assigned and that are packed together, the total quantity per outer packaging shall be limited to that corresponding to the most restrictive code.

20.2 Packaging

20.2.1 Each inner packaging intended for the transport of dangerous goods in excepted quantities shall be constructed of

a) plastics material with a wall thickness of not less than 0,2 mm when used for liquids, or

b) glass, porcelain, stoneware, earthenware or metal.

20.2.2 The closure of each inner packaging shall be held securely in place with wire, tape or other positive means. Any receptacle having a neck with moulded screw threads shall have a leakproof headed type cap. The closure shall be resistant to the contents.

20.2.3 Each inner packaging shall be securely packed in an intermediate packaging with cushioning material in such a way that the contents cannot break, puncture or leak under normal conditions of transport. In case of breakage or leakage the intermediate packaging shall be able to completely contain the contents, regardless of package orientation. For liquid dangerous goods, the intermediate packaging shall contain sufficient absorbent material to absorb the entire contents of the inner packaging. In such cases, the absorbent material can be the cushioning material. Dangerous goods shall not react dangerously with the cushioning material, the absorbent material and the packaging material, or reduce the integrity or function of the materials.

20.2.4 The intermediate packaging shall be securely packed in a strong, rigid outer packaging, for example wooden, fibreboard or other equally strong material.

20.2.5 Each type of packaging intended for the transport of dangerous goods in excepted quantities shall comply with the requirements of the tests given in 20.3.

20.2.6 Each package shall be of such a size that there is adequate space to apply all necessary markings.

20.2.7 Overpacks can be used for dangerous goods in excepted quantities. Overpacks can also be used for goods not covered by this standard

20.3 Performance testing of excepted quantity packages

20.3.1 Preparation

For testing purposes, the substances to be transported in the packaging may be replaced by other substances except where this would invalidate the test results. When another substance is used to replace a solid, such substance shall have the same physical characteristics, for example mass and grain size, as the substance intended to be transported. It is permitted to use another substance for the drop test of packaging intended to contain liquids, provided that its relative density and viscosity are similar to those of the substance to be transported.

20.3.2 Drop test

20.3.2.1 Procedure

20.3.2.1.1 Fill the inner packaging to a capacity of at least 95 % for solids and to at least 98 % for liquids.

20.3.2.1.2 Drop the excepted quantity package onto a rigid, non-resilient, flat and horizontal surface from a height of 1,8 m as prescribed in 20.3.2.1.3 and 20.3.2.1.4, as applicable.

20.3.2.1.3 Where the specimen is in the shape of a box, drop it in each of the following orientations:

a) flat on the base;

b) flat on the top;

c) flat on the longest side;

d) flat on the shortest side; and

e) on a corner.

20.3.2.1.4 Where the sample is in the shape of a drum, drop it in each of the following orientations:

a) diagonally on the top chime, with the centre of gravity directly above the point of impact;
b) diagonally on the base chime; and

c) flat on the side.

NOTE Each of the above drops can be performed on different but identical packages.

20.3.2.2 Acceptance criteria

The complete excepted quantity package, as prepared for transport, shall be capable of withstanding the drop test without breakage or leakage of any inner packaging and without significant reduction in effectiveness.

20.3.3 Stack test

20.3.3.1 Procedure

20.3.3.1.1 Subject the top surface of the excepted quantity specimen equivalent to the total mass of identical packages if stacked to a height of 3 m (including the drop sample).

20.3.3.1.2 Apply the stack force for at least 24 h.

20.3.3.2 Acceptance criteria

The test specimen shall show no deformation or leakage.

20.4 Marking of packages

20.4.1 Packages containing excepted quantities of dangerous goods shall be durably and legibly marked as depicted in figure 4. The primary hazard class or division of each of the dangerous goods contained in the package shall be shown in the excepted quantity mark. Where the name of the consignor or consignee is not shown elsewhere on the package this information shall be.

20.4.2 The dimensions of the mark shall be a minimum of 100 mm × 100 mm. The hatching and symbol of the mark shall be of the same colour, black or red, on a white background or on a suitable contrasting background.

20.4.3 An overpack containing dangerous goods in excepted quantities shall display the markings required by 20.4.1, unless such markings on packages within the overpack are clearly visible.

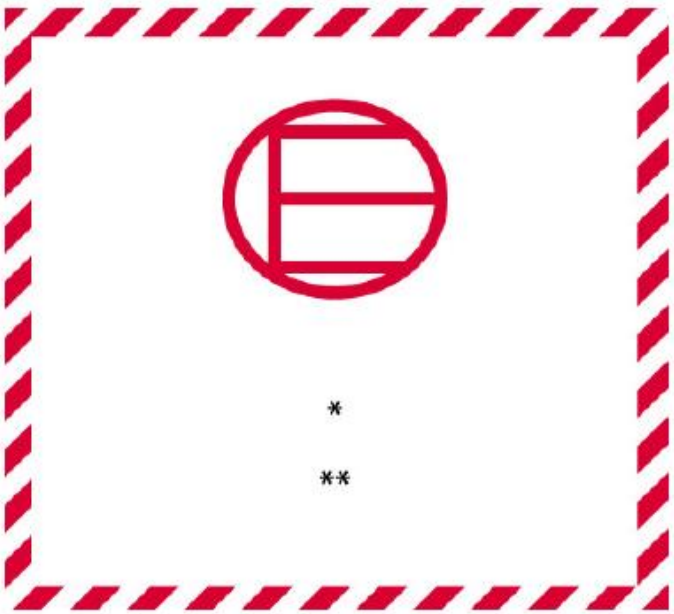

Figure 4 — Excepted quantity mark

20.4.4 The primary hazard class number or division number(s) shall be shown in the location where "*" appears in the excepted quantity mark.

20.4.5 The name of the consignor or of the consignee shall be shown in the location where "**" appears in the excepted quantity mark if it is not shown elsewhere on the package.

20.5 Maximum number of packages to be transported

A maximum number of 1 000 packages of excepted quantities shall be transported in any freight vehicle, railway freight wagon or multimodal freight container.

20.6 Documentation

A transport document that accompanies dangerous goods in excepted quantities shall include the statement "Dangerous Goods in Excepted Quantities" and indicate the number of packages.

21 Dangerous goods forbidden from transport

Unless otherwise provided by this standard, any substance or article is forbidden from transport if, as presented for transport and under normal conditions of transport it

a) is liable to explode,

b) reacts dangerously,

c) produces a flame or dangerous evolution of heat, and

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

