

Chapter 6.1

Provisions for the construction and testing of packagings

6.1.1 Applicability and general provisions

6.1.1.1 Applicability

The provisions in this chapter do not apply to:

- .1 pressure receptacles;
- .2 packages containing radioactive material, which shall comply with the Regulations of the International Atomic Energy Agency (IAEA), except that:
 - (i) radioactive material possessing other dangerous properties (subsidiary hazards) shall also comply with special provision 172 in chapter 3.3; and
 - (ii) low specific activity (LSA) material and surface contaminated objects (SCO) may be carried in certain packagings defined in this Code provided that the supplementary provisions set out in the IAEA Regulations are also met;
- .3 packages whose net mass exceeds 400 kg;
- .4 packagings for liquids, other than combination packagings, with capacity exceeding 450 L; and
- △ .5 packagings for class 6.2 infectious substances of Category A except for UN 3549.

6.1.1.2 General provisions

6.1.1.2.1 The provisions for packagings in 6.1.4 are based on packagings currently used. In order to take into account progress in science and technology, there is no objection to the use of packagings having specifications different from those in 6.1.4, provided that they are equally effective, acceptable to the competent authority and able successfully to withstand the tests described in 6.1.1.2 and 6.1.5. Methods of testing other than those described in this chapter are acceptable, provided that they are equivalent.

6.1.1.2.2 Every packaging intended to contain liquids shall successfully undergo a suitable leakproofness test. This test is part of a quality assurance programme as stipulated in 6.1.1.3 which shows the capability of meeting the appropriate test level indicated in 6.1.5.4.4:

- .1 before it is first used for transport;
- .2 after remanufacturing or reconditioning, before it is re-used for transport.

For this test, packagings need not have their own closures fitted.

The inner receptacle of a composite packaging may be tested without the outer packaging provided the test results are not affected. This test is not necessary for an inner packaging of a combination packaging.

6.1.1.2.3 Receptacles, parts of receptacles and closures (stoppers) made of plastics which may be directly in contact with a dangerous substance shall be resistant to it and shall not incorporate materials which may react dangerously or form hazardous compounds or lead to softening, weakening or failure of the receptacle or closure.

6.1.1.2.4 Plastics packagings shall be adequately resistant to ageing and to degradation caused either by the substance contained or by ultraviolet radiation. Any permeation of the substance contained shall not constitute a danger under normal conditions of transport.

6.1.1.3 Packagings shall be manufactured, reconditioned and tested under a quality-assurance programme which satisfies the competent authority in order to ensure that each packaging meets the provisions of this chapter.

Note: ISO 16106:2006, *Packaging – Transport packages for dangerous goods – Dangerous goods packagings, intermediate bulk containers (IBCs) and large packagings – Guidelines for the application of ISO 9001*, provides acceptable guidance on procedures which may be followed.

6.1.1.4 Manufacturers and subsequent distributors of packagings 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 packages as presented for transport are capable of passing the applicable performance tests of this chapter.

6.1.2 Code for designating types of packagings

6.1.2.1 The code consists of:

- .1 an Arabic numeral indicating the kind of packaging, such as drum, jerrican, etc., followed by
- .2 one or more capital letters in Latin characters indicating the nature of the material, such as steel, wood, etc., followed where necessary by
- .3 an Arabic numeral indicating the category of packaging within the type to which the packaging belongs.

6.1.2.2 In the case of composite packagings, two capital letters in Latin characters shall be used in sequence in the second position of the code. The first indicates the material of the inner receptacle and the second that of the outer packaging.

6.1.2.3 In the case of combination packagings, only the code number for the outer packaging shall be used.

6.1.2.4 The letters 'T', 'V' or 'W' may follow the packaging code. The letter 'T' signifies a salvage packaging conforming to the provisions of 6.1.5.1.11. The letter 'V' signifies a special packaging conforming to the provisions of 6.1.5.1.7. The letter 'W' signifies that the packaging, although of the same type as that indicated by the code, is manufactured to a specification different to that in 6.1.4 but is considered equivalent under the provisions of 6.1.1.2.

6.1.2.5 The following numerals shall be used for the kinds of packaging:

- 1 Drum
- 2 [Reserved]
- 3 Jerrican
- 4 Box
- 5 Bag
- 6 Composite packaging

6.1.2.6 The following capital letters shall be used for the types of material:

- A Steel (all types and surface treatments)
- B Aluminium
- C Natural wood
- D Plywood
- F Reconstituted wood
- G Fibreboard
- H Plastics material
- L Textile
- M Paper, multiwall
- N Metal (other than steel or aluminium)
- P Glass, porcelain or stoneware

Note: "Plastics material" is taken to include other polymeric materials such as rubber.

6.1.2.7 The following table indicates the codes to be used for designating types of packagings depending on the kind of packagings, the material used for their construction and their category; it also refers to the paragraphs to be consulted for the appropriate provisions:

Kind	Material	Category	Code	Paragraph
1 Drums	A Steel	non-removable head	1A1	6.1.4.1
		removable head	1A2	
	B Aluminium	non-removable head	1B1	6.1.4.2
		removable head	1B2	
	D Plywood	–	1D	6.1.4.5
	G Fibre	–	1G	6.1.4.7
	H Plastics	non-removable head	1H1	6.1.4.8
		removable head	1H2	
	N Metal, other than steel or aluminium	non-removable head	1N1	6.1.4.3
		removable head	1N2	
2 [Reserved]				

Kind	Material	Category	Code	Paragraph
3 Jerricans	A Steel	non-removable head	3A1	6.1.4.4
		removable head	3A2	
	B Aluminium	non-removable head	3B1	6.1.4.4
		removable head	3B2	
	H Plastics	non-removable head	3H1	6.1.4.8
		removable head	3H2	
4 Boxes	A Steel	–	4A	6.1.4.14
	B Aluminium	–	4B	6.1.4.14
	C Natural wood	ordinary	4C1	6.1.4.9
		with sift-proof walls	4C2	
	D Plywood	–	4D	6.1.4.10
	F Reconstituted wood	–	4F	6.1.4.11
	G Fibreboard	–	4G	6.1.4.12
	H Plastics	expanded	4H1	6.1.4.13
		solid	4H2	
N Metal, other than steel or aluminium	–	4N	6.1.4.14	
5 Bags	H Woven plastics	without inner lining or coating	5H1	6.1.4.16
		sift-proof	5H2	
		water-resistant	5H3	
	H Plastics film	–	5H4	6.1.4.17
	L Textile	without inner lining or coating	5L1	6.1.4.15
		sift-proof	5L2	
		water-resistant	5L3	
	M Paper	multiwall	5M1	6.1.4.18
		multiwall, water-resistant	5M2	
	6 Composite packagings	H Plastics receptacle	in steel drum	6HA1
in steel crate or box			6HA2	6.1.4.19
in aluminium drum			6HB1	6.1.4.19
in aluminium crate or box			6HB2	6.1.4.19
in wooden box			6HC	6.1.4.19
in plywood drum			6HD1	6.1.4.19
in plywood box			6HD2	6.1.4.19
in fibre drum			6HG1	6.1.4.19
in fibreboard box			6HG2	6.1.4.19
in plastics drum			6HH1	6.1.4.19
in solid plastics box		6HH2	6.1.4.19	
P Glass, porcelain or stoneware receptacle		in steel drum	6PA1	6.1.4.20
		in steel crate or box	6PA2	6.1.4.20
		in aluminium drum	6PB1	6.1.4.20
		in aluminium crate or box	6PB2	6.1.4.20
		in wooden box	6PC	6.1.4.20
		in plywood drum	6PD1	6.1.4.20
		in wickerwork hamper	6PD2	6.1.4.20
		in fibre drum	6PG1	6.1.4.20
		in fibreboard box	6PG2	6.1.4.20
	in expanded plastics packaging	6PH1	6.1.4.20	
in solid plastics packaging	6PH2	6.1.4.20		

6.1.3 Marking

Note 1: The marks indicate that the packaging which bears them correspond to a successfully tested design type and that it complies with the provisions of this chapter which are related to the manufacture, but not to the use, of the packaging. In itself, therefore, the marks do not necessarily confirm that the packaging may be used for any substance. The type of packaging (such as steel drum), its maximum capacity or mass, and any special provisions are specified for each substance or article in part 3 of this Code.

Note 2: The marks are intended to be of assistance to packaging manufacturers, reconditioners, packaging users, carriers and regulatory authorities. In relation to the use of a new packaging, the original marks are a means for its manufacturer to identify the type and to indicate those performance test provisions that have been met.

Note 3: The marks do not always provide full details of the test levels, etc., and these may need to be taken further into account, such as by reference to a test certificate, test reports or register of successfully tested packagings. For example, a packaging having an X or Y mark may be used for substances to which a packing group having a lesser degree of danger has been assigned, with the relevant maximum permissible value of the relative density* determined by taking into account the factor 1.5 or 2.25 indicated in the packaging test provisions in 6.1.5 as appropriate, i.e. packing group I packaging tested for products of relative density 1.2 could be used as a packing group II packaging for products of relative density 1.8 or packing group III packaging of relative density 2.7, provided, of course, that all the performance criteria can still be met with the product having the higher relative density.

△ 6.1.3.1

Each packaging intended for use according to this Code shall bear marks which are durable, legible and placed in such a location and of such a size relative to the packaging as to be readily visible. For packages with a gross mass of more than 30 kg, the marks or a duplicate thereof shall appear on the top or on a side of the packaging. Letters, numerals and symbols shall be at least 12 mm high, except for packagings of 30 L capacity or less or of 30 kg maximum net mass, when they shall be at least 6 mm in height and except for packagings of 5 L capacity or less or of 5 kg maximum net mass when they shall be of an appropriate size.

The marks shall show:

- (a) The United Nations packaging symbol:

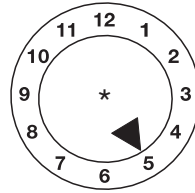


This symbol shall not be used for any purpose other than certifying that a packaging, a flexible bulk container, a portable tank or a MEGC complies with the relevant requirements in chapters 6.1, 6.2, 6.3, 6.5, 6.6, 6.7 or 6.9. For embossed metal packagings the capital letters “UN” may be applied as the symbol.

- (b) The code designating the type of packaging according to 6.1.2.
- (c) A code in two parts:
- (i) a letter designating the packing group or groups for which the design type has been successfully tested:
 - “X” for packing groups I, II and III
 - “Y” for packing groups II and III
 - “Z” for packing group III only;
 - (ii) the relative density, rounded off to the first decimal, for which the design type has been tested for packagings, without inner packagings, intended to contain liquids; this may be omitted when the relative density does not exceed 1.2. For packagings intended to contain solids or inner packagings, the maximum gross mass in kilograms.
- (d) Either a letter “S”, denoting that the packaging is intended for the transport of solids or inner packagings, or, for packagings (other than combination packagings) intended to contain liquids, the hydraulic test pressure which the packaging was shown to withstand in kilopascals, rounded down to the nearest 10 kPa.

* Relative density (*d*) is considered to be synonymous with specific gravity (SG) and will be used throughout this text.

- (e) The last two digits of the year during which the packaging was manufactured. Packagings of types 1H and 3H shall also be appropriately marked with the month of manufacture; this may be marked on the packaging in a different place from the remainder of the marks. An appropriate method is:








- △ * The last two digits of the year of manufacture may be displayed at that place. In such a case and when the clock is placed adjacent to the UN design type mark, the indication of the year in the mark may be waived. However, when the clock is not placed adjacent to the UN design type mark, the two digits of the year in the mark and in the clock shall be identical.

Note: Other methods that provide the minimum required information in a durable, visible and legible form are also acceptable.

- (f) The State authorizing the allocation of the mark, indicated by the distinguishing sign used on vehicles in international road traffic.*
- (g) The name of the manufacturer or other identification of the packaging specified by the competent authority.
- 6.1.3.2** In addition to the durable marks prescribed in 6.1.3.1, every new metal drum of a capacity greater than 100 L shall bear the marks described in 6.1.3.1 (a) to (e) on the bottom, with an indication of the nominal thickness of at least the metal used in the body (in millimetres, to 0.1 mm), in permanent form (such as embossed). When the nominal thickness of either head of a metal drum is thinner than that of the body, the nominal thickness of the top head, body and bottom head shall be marked on the bottom in permanent form (such as embossed), for example '1.0 – 1.2 – 1.0' or '0.9 – 1.0 – 1.0'. Nominal thicknesses of metal shall be determined according to the appropriate ISO standard, e.g. ISO 3574:1999 for steel. The marks indicated in 6.1.3.1 (f) and (g) shall not be applied in a permanent form (such as embossed) except as provided in 6.1.3.5.
- 6.1.3.3** Every packaging other than those referred to in 6.1.3.2 liable to undergo a reconditioning process shall bear the marks indicated in 6.1.3.1 (a) to (e) in a permanent form. Marks are permanent if they are able to withstand the reconditioning process (e.g. embossed). For packagings other than metal drums of a capacity greater than 100 L, these permanent marks may replace the corresponding durable markings prescribed in 6.1.3.1.
- 6.1.3.4** For remanufactured metal drums, if there is no change to the packaging type and no replacement or removal of integral structural components, the required marks need not be permanent (such as embossed). Every other remanufactured metal drum shall bear the marks in 6.1.3.1 (a) to (e) in a permanent form (such as embossed) on the top head or side.
- 6.1.3.5** Metal drums made from materials (such as stainless steel) designed to be re-used repeatedly may bear the marks indicated in 6.1.3.1 (f) and (g) in a permanent (such as embossed) form.
- 6.1.3.6** Packagings manufactured with recycled plastics material as defined in 1.2.1 shall be marked "REC". This mark shall be placed near the marks prescribed in 6.1.3.1.
- 6.1.3.7** Marks shall be applied in the sequence of the subparagraphs in 6.1.3.1; each mark required in these subparagraphs and when appropriate subparagraphs (h) to (j) of 6.1.3.8 shall be clearly separated, e.g. by a slash or space, so as to be easily identifiable. For examples, see 6.1.3.10. Any additional marks authorized by a competent authority shall still enable the other marks required in 6.1.3.1 to be correctly identified.
- 6.1.3.8** After reconditioning a packaging, the reconditioner shall apply to it, in sequence, durable marks showing:
- (h) the State in which the reconditioning was carried out, indicated by the distinguishing sign used on vehicles in international road traffic;*
 - (i) the name of the reconditioner or other identification of the packaging specified by the competent authority;
 - (j) the year of reconditioning; the letter "R"; and, for every packaging successfully passing the leakproofness test in 6.1.1.2.2, the additional letter "L".
- 6.1.3.9** When, after reconditioning, the marks required by 6.1.3.1 (a) to (d) no longer appear on the top head or the side of a metal drum, the reconditioner shall apply them in a durable form followed by those required by 6.1.3.8 (h), (i) and (j). These marks shall not identify a greater performance capability than that for which the original design type has been tested and marked.



* Distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, e.g. in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

6.1.3.10 Examples for marking for NEW packagings


	4G/Y145/S/02	as in 6.1.3.1 (a), (b), (c), (d) and (e)	For a new fibreboard box
	NL/VL823	as in 6.1.3.1 (f) and (g)	
	1A1/Y1.4/150/98	as in 6.1.3.1 (a), (b), (c), (d) and (e)	For a new steel drum to contain liquids
	NL/VL824	as in 6.1.3.1 (f) and (g)	
	1A2/Y150/S/01	as in 6.1.3.1 (a), (b), (c), (d) and (e)	For a new steel drum to contain solids or inner packagings
	NL/VL825	as in 6.1.3.1 (f) and (g)	
	4HW/Y136/S/98	as in 6.1.3.1 (a), (b), (c), (d) and (e)	For a new plastics box of a specification equivalent to that indicated by the packaging code
	NL/VL826	as in 6.1.3.1 (f) and (g)	
	1A2/Y/100/01	as in 6.1.3.1 (a), (b), (c), (d) and (e)	For a remanufactured steel drum to contain liquids of relative density not exceeding 1.2
	USA/MM5	as in 6.1.3.1 (f) and (g)	

Note: For liquids, the marking of relative density not exceeding 1.2 is optional; see 6.1.3.1 (c)(ii)

6.1.3.11 Examples for marking for RECONDITIONED packagings

	1A1/Y1.4/150/97	as in 6.1.3.1 (a), (b), (c), (d) and (e)
	NL/RB/01 RL	as in 6.1.3.8 (h), (i) and (j)
	1A2/Y150/S/99	as in 6.1.3.1 (a), (b), (c), (d) and (e)
	USA/RB/00 R	as in 6.1.3.8 (h), (i) and (j)

6.1.3.12 Examples for marking for SALVAGE packagings

	1A2T/Y300/S/01	as in 6.1.3.1 (a), (b), (c), (d) and (e)
	USA/abc	as in 6.1.3.1 (f) and (g)

Note: The marking, for which examples are given in 6.1.3.10, 6.1.3.11 and 6.1.3.12, may be applied in a single line or in multiple lines provided the correct sequence is respected.

- 6.1.3.13 Where a packaging conforms to one or more than one tested packaging design type, including one or more than one tested IBC or large packaging design type, the packaging may bear more than one mark to indicate the relevant performance test requirements that have been met. Where more than one mark appears on a packaging, the marks shall appear in close proximity to one another and each mark shall appear in its entirety.

6.1.4 Provisions for packagings

6.1.4.0 General provisions

Any permeation of the substance contained in the packaging shall not constitute a danger under normal conditions of transport.

6.1.4.1 Steel drums

1A1 non-removable head

1A2 removable head

6.1.4.1.1 Body and heads shall be constructed of steel sheet of suitable type and adequate thickness in relation to the capacity of the drum and the intended use.

Note: For carbon steel drums, “suitable” steels are identified in ISO 3573:1999, *Hot rolled carbon steel sheet of commercial and drawing qualities*, and ISO 3574:1999, *Cold-reduced carbon steel sheet of commercial and drawing qualities*.

For carbon steel drums below 100 L, “suitable” steels in addition to the above standards are also identified in ISO 11949:1995, *Cold-reduced electrolytic tinplate*, ISO 11950:1995, *Cold-reduced electrolytic chromium/chromium oxide-coated steel*, and ISO 11951:1995, *Cold-reduced blackplate in coil form for the production of tinplate or electrolytic chromium/chromium oxide-coated steel*.

6.1.4.1.2 Body seams of drums intended to contain more than 40 L of liquid shall be welded. Body seams of drums intended to contain solids or 40 L or less of liquids shall be mechanically seamed or welded.

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

6.1.4.1.4 The body of a drum of a capacity greater than 60 L shall, in general, have at least two expanded rolling hoops or, alternatively, at least two separate rolling hoops. If there are separate rolling hoops, they shall be fitted tightly on the body and so secured that they cannot shift. Rolling hoops shall not be spot-welded.

6.1.4.1.5 Openings for filling, emptying and venting in the bodies or heads of drums with a non-removable head (1A1) shall not exceed 7 cm in diameter. Drums with larger openings are considered to be of the removable-head type (1A2). Closures for openings in the bodies and heads of drums shall be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges may be mechanically seamed or welded in place. Gaskets or other sealing elements shall be used with closures, unless the closure is inherently leakproof.

6.1.4.1.6 Closure devices for removable-head drums shall be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used with all removable heads.

6.1.4.1.7 If materials used for body, 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 properties under normal conditions of transport.

6.1.4.1.8 Maximum capacity of drum: 450 L.

6.1.4.1.9 Maximum net mass: 400 kg.

6.1.4.2 Aluminium drums

1B1 non-removable head

1B2 removable head

6.1.4.2.1 Body and heads shall be constructed of aluminium at least 99% pure or of an aluminium-based alloy. Material shall be of a suitable type and of adequate thickness in relation to the capacity of the drum and the intended use.

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

6.1.4.2.3 The body of a drum of a capacity greater than 60 L shall, in general, have at least two expanded rolling hoops or, alternatively, at least two separate rolling hoops. If there are separate rolling hoops, they shall be fitted tightly on the body and so secured that they cannot shift. Rolling hoops shall not be spot-welded.

6.1.4.2.4 Openings for filling, emptying and venting in the bodies or heads of drums with a non-removable head (1B1) shall not exceed 7 cm in diameter. Drums with larger openings are considered to be of the removable-head type (1B2). Closures for openings in the bodies and heads of drums shall be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges shall be welded in place so that the weld provides a leakproof seam. Gaskets or other sealing elements shall be used with closures, unless the closure is inherently leakproof.

- 6.1.4.2.5 Closure devices for removable-head drums shall be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used with all removable heads.
- 6.1.4.2.6 If materials used for body, 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.
- △ 6.1.4.2.7 Maximum capacity of drum: 450 L.
- △ 6.1.4.2.8 Maximum net mass: 400 kg.
- 6.1.4.3 Drums of metal other than aluminium or steel**
- 1N1 non-removable head
1N2 removable head
- 6.1.4.3.1 The body and heads shall be constructed of metal or metal alloy other than steel or aluminium. Material shall be of a suitable type and of adequate thickness in relation to the capacity of the drum and to its intended use.
- 6.1.4.3.2 Chime seams, if any, shall be reinforced by the application of separate reinforcing rings. All seams, if any, shall be joined (welded, soldered, etc.) in accordance with the technical state of the art for the used metal or metal alloy.
- 6.1.4.3.3 The body of a drum of a capacity greater than 60 L shall, in general, have at least two expanded rolling hoops or, alternatively, at least two separate rolling hoops. If there are separate rolling hoops, they shall be fitted tightly on the body and so secured that they cannot shift. Rolling hoops shall not be spot-welded.
- 6.1.4.3.4 Openings for filling, emptying and venting in the bodies or heads of non-removable-head (1N1) drums shall not exceed 7 cm in diameter. Drums with larger openings are considered to be of the removable-head type (1N2). Closures for openings in the bodies and heads of drums shall be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges shall be joined in place (welded, soldered, etc.) in accordance with the technical state of the art for the used metal or metal alloy so that the seam join is leakproof. Gaskets or other sealing elements shall be used with closures, unless the closure is inherently leakproof.
- 6.1.4.3.5 Closure devices for removable-head drums shall be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used with all removable heads.
- 6.1.4.3.6 If materials used for body, 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.
- △ 6.1.4.3.7 Maximum capacity of drum: 450 L.
- △ 6.1.4.3.8 Maximum net mass: 400 kg.
- 6.1.4.4 Steel or aluminium jerricans**
- 3A1 steel, non-removable head
3A2 steel, removable head
3B1 aluminium, non-removable head
3B2 aluminium, removable head
- 6.1.4.4.1 Body and heads shall be constructed of steel sheet, of aluminium at least 99% pure or of an aluminium-based alloy. Material shall be of a suitable type and of adequate thickness in relation to the capacity of the jerrican and to its intended use.
- 6.1.4.4.2 Chimes of steel jerricans shall be mechanically seamed or welded. Body seams of steel jerricans intended to contain more than 40 L of liquid shall be welded. Body seams of steel jerricans intended to contain 40 L or less shall be mechanically seamed or welded. For aluminium jerricans, all seams shall be welded. Chime seams, if any, shall be reinforced by the application of a separate reinforcing ring.
- 6.1.4.4.3 Openings in jerricans (3A1 and 3B1) shall not exceed 7 cm in diameter. Jerricans with larger openings are considered to be of the removable-head type (3A2 and 3B2). Closures shall be so designed that they will remain secure and leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used with closures, unless the closure is inherently leakproof.
- 6.1.4.4.4 If materials used for body, 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.

- 6.1.4.4.5 Maximum capacity of jerrican: 60 L.
- 6.1.4.4.6 Maximum net mass: 120 kg.
- 6.1.4.5 Plywood drums**
1D
- 6.1.4.5.1 The wood used shall be well seasoned, commercially dry and free from any defect likely to lessen the effectiveness of the drum for the purpose intended. If a material other than plywood is used for the manufacture of the heads, it shall be of a quality equivalent to the plywood.
- 6.1.4.5.2 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 grain crosswise.
- 6.1.4.5.3 The body and heads of the drum and their joins shall be of a design appropriate to the capacity of the drum and its intended use.
- 6.1.4.5.4 In order to prevent sifting of the contents, lids shall be lined with kraft paper or some other equivalent material, which shall be securely fastened to the lid and extend to the outside along its full circumference.
- 6.1.4.5.5 Maximum capacity of drum: 250 L.
- 6.1.4.5.6 Maximum net mass: 400 kg.
- 6.1.4.6 [Reserved]
- 6.1.4.7 Fibre drums**
1G
- 6.1.4.7.1 The body of the 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.
- 6.1.4.7.2 Heads 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.
- 6.1.4.7.3 The body and heads of the drum and their joins shall be of a design appropriate to the capacity of the drum and its intended use.
- 6.1.4.7.4 The assembled packaging shall be sufficiently water-resistant so as not to delaminate under normal conditions of transport.
- 6.1.4.7.5 Maximum capacity of drum: 450 L.
- 6.1.4.7.6 Maximum net mass: 400 kg.
- 6.1.4.8 Plastics drums and jerricans**
1H1 drums, non-removable head
1H2 drums, removable head
3H1 jerricans, non-removable head
3H2 jerricans, removable head
- 6.1.4.8.1 The packaging shall be manufactured from suitable plastics material and be of adequate strength in relation to its capacity and intended use. Except for *recycled plastics material* as defined in 1.2.1, no used material other than production residues or regrind from the same manufacturing process may be used. The packaging shall be adequately resistant to ageing and to degradation caused by the substance contained or by ultraviolet radiation.
- 6.1.4.8.2 If protection against ultraviolet radiation is required, it shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the contents and remain effective throughout the life of the packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, retesting may be waived if the carbon black content does not exceed 2% by mass or if the pigment content does not exceed 3% by mass; the content of inhibitors of ultraviolet radiation is not limited.
- 6.1.4.8.3 Additives serving 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 of the packaging. In such circumstances, retesting may be waived.

- 6.1.4.8.4 The wall thickness at every point of the packaging shall be appropriate to its capacity and intended use, taking into account the stresses to which each point is liable to be exposed.
- 6.1.4.8.5 Openings for filling, emptying and venting in the bodies or heads of non-removable-head drums (1H1) and jerricans (3H1) shall not exceed 7 cm in diameter. Drums and jerricans with larger openings are considered to be of the removable-head type (1H2 and 3H2). Closures for openings in the bodies or heads of drums and jerricans shall be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Gaskets or other sealing elements shall be used with closures, unless the closure is inherently leakproof.
- 6.1.4.8.6 Closure devices for removable-head drums and jerricans shall be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Gaskets shall be used with all removable heads unless the drum or jerrican design is such that, where the removable head is properly secured, the drum or jerrican is inherently leakproof.
- 6.1.4.8.7 Maximum capacity of drums and jerricans: 1H1, 1H2: 450 L
3H1, 3H2: 60 L
- 6.1.4.8.8 Maximum net mass: 1H1, 1H2: 400 kg
3H1, 3H2: 120 kg
- 6.1.4.9 **Boxes of natural wood**
- 4C1 ordinary
- 4C2 with sift-proof walls
- 6.1.4.9.1 The wood used shall be well seasoned, commercially dry and free from defects that would materially lessen 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 intended use of the box. The tops and bottoms may be made of water-resistant reconstituted wood such as hardboard, particle board or other suitable type.
- 6.1.4.9.2 Fastenings shall be resistant to vibration experienced under normal conditions of transport. Nailing into the end shall be avoided whenever practicable. Joins which are likely to be highly stressed shall be made using clenched or annular ring nails or equivalent fastenings.
- 6.1.4.9.3 Box 4C2: each part shall consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when one of the following methods of glued assembly is used: Lindermann joint, tongue and groove joint, ship lap or rabbet joint or butt joint, all with at least two corrugated metal fasteners at each joint.
- 6.1.4.9.4 Maximum net mass: 400 kg.
- 6.1.4.10 **Plywood boxes**
- 4D
- 6.1.4.10.1 Plywood used shall be at least three-ply. It shall be made from well-seasoned rotary-cut, sliced or sawn veneer, commercially dry and free from defects that would materially lessen the strength of the box. The strength of the material used and the method of construction shall be appropriate to the capacity and intended use of the box. All adjacent plies shall be glued with water-resistant adhesive. Other suitable materials may be used together with plywood in the construction of boxes. Boxes shall be firmly nailed or secured to corner posts or ends or be assembled by equally suitable devices.
- 6.1.4.10.2 Maximum net mass: 400 kg.
- 6.1.4.11 **Reconstituted wood boxes**
- 4F
- 6.1.4.11.1 The walls of boxes shall be made of water-resistant reconstituted wood such as hardboard, particle board or other suitable type. The strength of the material used and the method of construction shall be appropriate to the capacity of the boxes and their intended use.
- 6.1.4.11.2 Other parts of the boxes may be made of other suitable material.
- 6.1.4.11.3 Boxes shall be securely assembled by means of suitable devices.
- 6.1.4.11.4 Maximum net mass: 400 kg.
- 6.1.4.12 **Fibreboard boxes**
- 4G
- 6.1.4.12.1 Strong and good-quality solid or double-faced corrugated fibreboard (single or multiwall) shall be used, appropriate to the capacity of the box and to its intended use. The water resistance of the outer surface shall

be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m^2 – see ISO 535:1991. It shall have proper bending qualities. Fibreboard shall be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting of corrugated fibreboard shall be firmly glued to the facings.

- 6.1.4.12.2 The ends of boxes may have a wooden frame or be entirely of wood or other suitable material. Reinforcements of wooden battens or other suitable material may be used.
- 6.1.4.12.3 Manufacturing joins in the body of boxes shall be taped, lapped and glued or lapped and stitched with metal staples. Lapped joins shall have an appropriate overlap.
- 6.1.4.12.4 Where closing is effected by gluing or taping, a water-resistant adhesive shall be used.
- 6.1.4.12.5 Boxes shall be designed so as to provide a good fit to the contents.
- 6.1.4.12.6 Maximum net mass: 400 kg.
- 6.1.4.13 Plastics boxes**
- 4H1 expanded plastics boxes
4H2 solid plastics boxes
- 6.1.4.13.1 The box shall be manufactured from suitable plastics material and be of adequate strength in relation to its capacity and intended use. The box shall be adequately resistant to ageing and to degradation caused either by the substance contained or by ultraviolet radiation.
- 6.1.4.13.2 An expanded plastics box shall comprise two parts made of a moulded expanded plastics material, a bottom section containing cavities for the inner packagings and a top section covering and interlocking with the bottom section. The top and bottom sections shall be designed so that the inner packagings fit snugly. The closure cap for any inner packaging shall not be in contact with the inside of the top section of this box.
- 6.1.4.13.3 For dispatch, an expanded plastics box shall be closed with a self-adhesive tape having sufficient tensile strength to prevent the box from opening. The adhesive tape shall be weather-resistant and its adhesive compatible with the expanded plastics material of the box. Other closing devices at least equally effective may be used.
- 6.1.4.13.4 For solid plastics boxes, protection against ultraviolet radiation, if required, shall be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives shall be compatible with the contents and remain effective throughout the life of the box. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, retesting may be waived if the carbon black content does not exceed 2% by mass or if the pigment content does not exceed 3% by mass; the content of inhibitors of ultraviolet radiation is not limited.
- 6.1.4.13.5 Additives serving 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 of the box. In such circumstances, retesting may be waived.
- 6.1.4.13.6 Solid plastics boxes shall have closure devices made of a suitable material of adequate strength and be so designed as to prevent the box from unintentional opening.
- 6.1.4.13.7 Maximum net mass: 4H1: 60 kg
4H2: 400 kg
- 6.1.4.14 Steel, aluminium or other metal boxes**
- 4A steel boxes
4B aluminium boxes
4N metal, other than steel or aluminium, boxes
- 6.1.4.14.1 The strength of the metal and the construction of the box shall be appropriate to the capacity of the box and to its intended use.
- 6.1.4.14.2 Boxes shall be lined with fibreboard or felt packing pieces or shall have an inner liner or coating of suitable material, as required. If a double-seamed metal liner is used, steps shall be taken to prevent the ingress of substances, particularly explosives, into the recesses of the seams.
- 6.1.4.14.3 Closures may be of any suitable type; they shall remain secured under normal conditions of transport.
- 6.1.4.14.4 Maximum net mass: 400 kg.

6.1.4.15 Textile bags

- 5L1 without inner lining or coating
- 5L2 sift-proof
- 5L3 water-resistant

6.1.4.15.1 The textiles used shall be of good quality. The strength of the fabric and the construction of the bag shall be appropriate to the capacity of the bag and its intended use.

6.1.4.15.2 Bags, sift-proof, 5L2: the bag shall be made sift-proof, for example by the use of:

- .1 paper bonded to the inner surface of the bag by a water-resistant adhesive such as bitumen; or
- .2 plastics film bonded to the inner surface of the bag; or
- .3 one or more inner liners made of paper or plastics material.

6.1.4.15.3 Bags, water-resistant, 5L3: to prevent the entry of moisture, the bag shall be made waterproof, for example by the use of:

- .1 separate inner liners of water-resistant paper (such as waxed kraft paper, tarred paper or plastics-coated kraft paper); or
- .2 plastics film bonded to the inner surface of the bag; or
- .3 one or more inner liners made of plastics material.

6.1.4.15.4 Maximum net mass: 50 kg.

6.1.4.16 Woven plastics bags

- 5H1 without inner liner or coating
- 5H2 sift-proof
- 5H3 water-resistant

6.1.4.16.1 Bags 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 of the bag and its intended use.

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

6.1.4.16.3 Bags, sift-proof, 5H2: the bag shall be made sift-proof, for example by means of:

- .1 paper or a plastics film bonded to the inner surface of the bag; or
- .2 one or more separate inner liners made of paper or plastics material.

6.1.4.16.4 Bags, water-resistant, 5H3: to prevent the entry of moisture, the bag shall be made waterproof, for example by means of:

- .1 separate inner liners of water-resistant paper (such as waxed kraft paper, double-tarred kraft paper or plastics-coated kraft paper); or
- .2 plastics film bonded to the inner or outer surface of the bag; or
- .3 one or more inner plastics liners.

6.1.4.16.5 Maximum net mass: 50 kg.

6.1.4.17 Plastics film bags

- 5H4

6.1.4.17.1 Bags shall be made of a suitable plastics material. The strength of the material used and the construction of the bag shall be appropriate to the capacity of the bag and its intended use. Joins and closures shall withstand pressures and impacts liable to occur under normal conditions of transport.

6.1.4.17.2 Maximum net mass: 50 kg.

6.1.4.18 Paper bags

- 5M1 multiwall
- 5M2 multiwall, water-resistant

6.1.4.18.1 Bags shall be made of a suitable kraft paper or of an equivalent paper with at least three plies, the middle ply of which may be net-cloth with adhesive bonding to the outermost ply. The strength of the paper and the construction of the bags shall be appropriate to the capacity of the bag and its intended use. Joins and closures shall be sift-proof.

6.1.4.18.2 Bags 5M2: to prevent the entry of moisture, a bag of four plies or more shall be made waterproof by the use of 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 bag of three plies shall be made waterproof by the use of a water-resistant ply as the outermost ply. Where there is a danger of the substance contained reacting with moisture or where it is packed damp, a waterproof ply or barrier, such as double-tarred kraft paper, plastics-coated kraft paper, plastics film bonded to the inner surface of the bag, or one or more inner plastics liners, shall also be placed next to the substance. Joins and closures shall be waterproof.

6.1.4.18.3 Maximum net mass: 50 kg.

6.1.4.19 Composite packagings (plastics material)

6HA1	plastics receptacle with outer steel drum
6HA2	plastics receptacle with outer steel crate or box
6HB1	plastics receptacle with outer aluminium drum
6HB2	plastics receptacle with outer aluminium crate or box
6HC	plastics receptacle with outer wooden box
6HD1	plastics receptacle with outer plywood drum
6HD2	plastics receptacle with outer plywood box
6HG1	plastics receptacle with outer fibre drum
6HG2	plastics receptacle with outer fibreboard box
6HH1	plastics receptacle with outer plastics drum
6HH2	plastics receptacle with outer solid plastics box

6.1.4.19.1 Inner receptacle

- .1 The provisions of 6.1.4.8.1 and 6.1.4.8.3 to 6.1.4.8.6 shall apply to inner plastics receptacles.
- .2 The inner plastics receptacle shall fit snugly inside the outer packaging, which shall be free of any projection that might abrade the plastics material.
- .3 Maximum capacity of inner receptacle:

6HA1, 6HB1, 6HD1, 6HG1, 6HH1	250 L
6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2	60 L
- .4 Maximum net mass:

6HA1, 6HB1, 6HD1, 6HG1, 6HH1	400 kg
6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2	75 kg

6.1.4.19.2 Outer packaging

- .1 Plastics receptacle with outer steel or aluminium drum (6HA1 or 6HB1): the relevant provisions of 6.1.4.1 or 6.1.4.2, as appropriate, shall apply to the construction of the outer packaging.
- .2 Plastics receptacle with outer steel or aluminium crate or box (6HA2 or 6HB2): the relevant provisions of 6.1.4.14 shall apply to the construction of the outer packaging.
- .3 Plastics receptacle with outer wooden box 6HC: the relevant provisions of 6.1.4.9 shall apply to the construction of the outer packaging.
- .4 Plastics receptacle with outer plywood drum 6HD1: the relevant provisions of 6.1.4.5 shall apply to the construction of the outer packaging.
- .5 Plastics receptacle with outer plywood box 6HD2: the relevant provisions of 6.1.4.10 shall apply to the construction of the outer packaging.
- .6 Plastics receptacle with outer fibre drum 6HG1: the provisions of 6.1.4.7.1 to 6.1.4.7.4 shall apply to the construction of the outer packaging.
- .7 Plastics receptacle with outer fibreboard box 6HG2: the relevant provisions of 6.1.4.12 shall apply to the construction of the outer packaging.
- .8 Plastics receptacle with outer plastics drum 6HH1: the provisions of 6.1.4.8.1 and 6.1.4.8.2 to 6.1.4.8.6 shall apply to the construction of the outer packaging.
- .9 Plastics receptacle with outer solid plastics box (including corrugated plastics material) 6HH2: the provisions of 6.1.4.13.1 and 6.1.4.13.4 to 6.1.4.13.6 shall apply to the construction of the outer packaging.

6.1.4.20 Composite packagings (glass, porcelain or stoneware)

6PA1	receptacle with outer steel drum
6PA2	receptacle with outer steel crate or box

6PB1	receptacle with outer aluminium drum
6PB2	receptacle with outer aluminium crate or box
6PC	receptacle with outer wooden box
6PD1	receptacle with outer plywood drum
6PD2	receptacle with outer wickerwork hamper
6PG1	receptacle with outer fibre drum
6PG2	receptacle with outer fibreboard box
6PH1	receptacle with outer expanded plastics packaging
6PH2	receptacle with outer solid plastics packaging

6.1.4.20.1 *Inner receptacle*

- .1 Receptacles shall be of a suitable form (cylindrical or pear-shaped) and be made of good-quality material free from any defect that could impair their strength. The walls shall be sufficiently thick at every point.
- .2 Screw-threaded plastics closures, ground glass stoppers or closures at least equally effective shall be used as closures for receptacles. Any part of the closure likely to come into contact with the contents of the receptacle shall be resistant to those contents. Care shall be taken to ensure that the closures are so fitted as to be leakproof and are suitably secured to prevent any loosening during transport. If vented closures are necessary, they shall comply with 4.1.1.8.
- .3 The receptacle shall be firmly secured in the outer packaging by means of cushioning and/or absorbent materials.
- .4 Maximum capacity of receptacle: 60 L.
- .5 Maximum net mass: 75 kg.

6.1.4.20.2 *Outer packaging*

- .1 Receptacle with outer steel drum 6PA1: the relevant provisions of 6.1.4.1 shall apply to the construction of the outer packaging. The removable lid required for this type of packaging may nevertheless be in the form of a cap.
- .2 Receptacle with outer steel crate or box 6PA2: the relevant provisions of 6.1.4.14 shall apply to the construction of the outer packaging. For cylindrical receptacles, the outer packaging shall, when upright, rise above the receptacle and its closure. If the crate surrounds a pear-shaped receptacle and is of matching shape, the outer packaging shall be fitted with a protective cover (cap).
- .3 Receptacle with outer aluminium drum 6PB1: the relevant provisions of 6.1.4.2 shall apply to the construction of the outer packaging.
- .4 Receptacle with outer aluminium crate or box 6PB2: the relevant provisions of 6.1.4.14 shall apply to the construction of the outer packaging.
- .5 Receptacle with outer wooden box 6PC: the relevant provisions of 6.1.4.9 shall apply to the construction of the outer packaging.
- .6 Receptacle with outer plywood drum 6PD1: the relevant provisions of 6.1.4.5 shall apply to the construction of the outer packaging.
- .7 Receptacle with outer wickerwork hamper 6PD2: the wickerwork hamper shall be properly made with material of good quality. It shall be fitted with a protective cover (cap) so as to prevent damage to the receptacle.
- .8 Receptacle with outer fibre drum 6PG1: the relevant provisions of 6.1.4.7.1 to 6.1.4.7.4 shall apply to the body of the outer packaging.
- .9 Receptacle with outer fibreboard box 6PG2: the relevant provisions of 6.1.4.12 shall apply to the construction of the outer packaging.
- .10 Receptacle with outer expanded plastics or solid plastics packaging (6PH1 or 6PH2): the materials of both outer packagings shall meet the relevant provisions of 6.1.4.13. 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 nevertheless be in the form of a cap.

6.1.5 Test provisions for packagings

6.1.5.1 Performance and frequency of tests

6.1.5.1.1 The design type of each packaging shall be tested as provided in this section, in accordance with procedures established by the competent authority.

6.1.5.1.2 Each packaging design type shall successfully pass the tests prescribed in this chapter before being used. A packaging design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes packagings which differ from the design type only in their lesser design height.

- 6.1.5.1.3 Tests shall be repeated on production samples at intervals established by the competent authority. For such tests on paper or fibreboard packagings, preparation at ambient conditions is considered equivalent to the provisions of 6.1.5.2.3.
- 6.1.5.1.4 Tests shall also be repeated after each modification which alters the design, material or manner of construction of a packaging.
- 6.1.5.1.5 The competent authority may permit the selective testing of packagings that differ only in minor respects from a tested type, such as smaller sizes of inner packagings or inner packagings of lower net mass; and packagings such as drums, bags and boxes which are produced with small reductions in external dimensions.
- 6.1.5.1.6 [Reserved]
- Note:** For the conditions for using different inner packagings in an outer packaging and permissible variations in inner packagings, see 4.1.1.5.1. These conditions do not limit the use of inner packagings when applying 6.1.5.1.7.
- 6.1.5.1.7 Articles or inner packagings of any type for solids or liquids may be assembled and transported without testing in an outer packaging under the following conditions:
- .1 The outer packaging shall have been successfully tested in accordance with 6.1.5.3 with fragile (such as glass) inner packagings containing liquids, using the drop height for packing group I.
 - .2 The total combined gross mass of inner packagings shall not exceed one half the gross mass of inner packagings used for the drop test in .1 above.
 - .3 The thickness of the cushioning material between inner packagings and between inner packagings and the outside of the packaging shall not be reduced below the corresponding thicknesses in the originally tested packaging; and when a single inner packaging was used in the original test, the thicknesses of the cushioning between inner packagings shall not be less than the thickness of cushioning between the outside of the packaging and the inner packaging in the original test. When either fewer or smaller inner packagings are used (as compared to the inner packagings used in the drop test), sufficient additional cushioning material shall be used to take up void spaces.
 - .4 The outer packaging shall have successfully passed the stacking test in 6.1.5.6 while empty. The total mass of identical packages shall be based on the combined mass of inner packagings used in the drop test in .1 above.
 - .5 Inner packagings containing liquids shall be completely surrounded with a sufficient quantity of absorbent material to absorb the entire liquid contents of the inner packagings.
 - .6 When the outer packaging is intended to contain inner packagings for liquids and is not leakproof, or is intended to contain inner packagings for solids and is not sift-proof, a means of containing any liquid or solid contents in the event of leakage shall be provided in the form of a leakproof liner, plastics bag or other equally efficient means of containment. For packagings containing liquids, the absorbent material required in .5 above shall be placed inside the means of containing the liquid contents.
 - .7 Packagings shall be marked in accordance with section 6.1.3 as having been tested to packing group I performance for combination packagings. 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(s) as used for the drop test referred to in .1 above. Such a packaging mark shall also contain the letter 'V' as described in 6.1.2.4.
- 6.1.5.1.8 The competent authority may at any time require proof, by tests in accordance with this section, that serially produced packagings meet the provisions of the design type tests.
- 6.1.5.1.9 If an inner treatment or coating is required for safety reasons, it shall retain its protective properties after the tests.
- 6.1.5.1.10 Provided the validity of the test results is not affected, and with the approval of the competent authority, several tests may be made on one sample.
- 6.1.5.1.11 **Salvage packagings**
- 6.1.5.1.11.1 Salvage packagings (see 1.2.1) shall be tested and marked in accordance with the provisions applicable to packing group II packagings intended for the transport of solids or inner packagings, except as follows:
- .1 The test substance used in performing the tests shall be water and the packagings shall be filled to not less than 98% of their maximum capacity. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass so long as they are placed in such a way that the test results are not affected. Alternatively, in performing the drop test, the drop height may be varied in accordance with 6.1.5.3.5(b);
 - .2 Packagings shall, in addition, have been successfully subjected to the leakproofness test at 30 kPa, with the results of this test reflected in the test report required by 6.1.5.7; and
 - .3 Packagings shall be marked with the letter 'T' as described in 6.1.2.4.

6.1.5.2 Preparation of packagings for testing

6.1.5.2.1 Tests shall be carried out on packagings prepared as for transport, including, with respect to combination packagings, the inner packagings used. Inner or single receptacles or packagings, other than bags, shall be filled to not less than 98% of their maximum capacity for liquids or 95% for solids. Bags shall be filled to the maximum mass at which they may be used. For combination packagings where the inner packaging is designed to carry liquids and solids, separate testing is required for both solid and liquid contents. The substances or articles to be transported in the packagings may be replaced by other substances or articles except where this would invalidate the results of the tests. For solids, when another substance is used, it shall have the same physical characteristics (mass, grain size, etc.) as the substance to be carried. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not affected.

6.1.5.2.2 In the drop tests for liquids, when another substance is used, it shall be of similar relative density and viscosity to those of the substance being transported. Water may also be used for the liquid drop test under the conditions in 6.1.5.3.5.

6.1.5.2.3 Paper or fibreboard packagings shall be conditioned for at least 24 hours in an atmosphere having controlled temperature and relative humidity (r.h.). There are three options, one of which shall be chosen. The preferred atmosphere is 23°C ± 2°C and 50% ± 2% r.h. The two other options are 20°C ± 2°C and 65% ± 2% r.h. or 27°C ± 2°C and 65% ± 2% r.h.

Note: Average values shall fall within these limits. Short-term fluctuations and measurement limitations may cause individual measurements to vary by up to ±5% relative humidity without significant impairment of test reproducibility.

6.1.5.2.4 Additional steps shall be taken to ascertain that the plastics material used in the manufacture of plastics drums, plastics jerricans and composite packagings (plastics material) intended to contain liquids complies with the provisions in 6.1.1.2, 6.1.4.8.1 and 6.1.4.8.3. This may be done, for example, by submitting sample receptacles or packagings to a preliminary test extending over a long period, for example six months, during which the samples would remain filled with the substances they are intended to contain and after which the samples shall be submitted to the applicable tests listed in 6.1.5.3, 6.1.5.4, 6.1.5.5, and 6.1.5.6. For substances which may cause stress cracking or weakening in plastics drums or jerricans, the sample, filled with the substance or another substance that is known to have at least as severe stress cracking influence on the plastics materials in question, shall be subjected to a superimposed load equivalent to the total mass of identical packages which might be stacked on it during transport. The minimum height of the stack including the test sample shall be 3 m.

6.1.5.3 Drop test

6.1.5.3.1 Number of test samples (per design type and manufacturer) and drop orientation

For other than flat drops, the centre of gravity shall be vertically over the point of impact.

Packaging	Number of test samples	Drop orientation
Steel drums Aluminium drums Metal drums, other than steel or aluminium drums Steel jerricans Aluminium jerricans Plywood drums Fibre drums Plastics drums and jerricans Composite packagings which are in the shape of a drum	Six (three for each drop)	<i>First drop</i> (using three samples): the packaging shall strike the target diagonally on the chime or, if the packaging has no chime, on a circumferential seam or an edge <i>Second drop</i> (using the other three samples): the packaging shall strike the target on the weakest part not tested by the first drop, for example a closure or, for some cylindrical drums, the welded longitudinal seam of the body
Boxes of natural wood Plywood boxes Reconstituted wood boxes Fibreboard boxes Plastics boxes Steel or aluminium boxes Composite packagings which are in the shape of a box	Five (one for each drop)	<i>First drop:</i> flat on the bottom <i>Second drop:</i> flat on the top <i>Third drop:</i> flat on the long side <i>Fourth drop:</i> flat on the short side <i>Fifth drop:</i> on a corner



Packaging	Number of test samples	Drop orientation
Bags – single-ply with a side seam	Three (three drops per bag)	<i>First drop:</i> flat on a wide face <i>Second drop:</i> flat on a narrow face <i>Third drop:</i> on the end of the bag
Bags – single-ply without a side seam or multi-ply	Three (two drops per bag)	<i>First drop:</i> flat on a wide face <i>Second drop:</i> on an end of the bag

Where more than one orientation is possible for a given drop test, the orientation most likely to result in failure of the packaging shall be used.

6.1.5.3.2 *Special preparation of test samples for the drop test*

The temperature of the test sample and its contents shall be reduced to -18°C or lower for the following packagings:

- .1 plastics drums (see 6.1.4.8);
- .2 plastics jerricans (see 6.1.4.8);
- .3 plastics boxes other than expanded plastics boxes (see 6.1.4.13);
- .4 composite packagings (plastics material) (see 6.1.4.19); and
- .5 combination packagings with plastics inner packagings, other than plastics bags intended to contain solids or articles.

Where the test samples are prepared in this way, the conditioning in 6.1.5.2.3 may be waived. Test liquids shall be kept in the liquid state by the addition of anti-freeze if necessary.

6.1.5.3.3 Removable head packagings for liquids shall not be dropped until at least 24 h after filling and closing to allow for any possible gasket relaxation.

6.1.5.3.4 *Target*

The target shall be a non-resilient and horizontal surface and shall be:

- .1 integral and massive enough to be immovable;
- .2 flat with a surface kept free from local defects capable of influencing the test results;
- .3 rigid enough to be non-deformable under test conditions and not liable to become damaged by the tests; and
- .4 sufficiently large to ensure that the test package falls entirely upon the surface.

6.1.5.3.5 *Drop height*

For solids and liquids, if the test is performed with the solid or liquid to be carried or with another substance having essentially the same physical characteristics:

Packing group I	Packing group II	Packing group III
1.8 m	1.2 m	0.8 m

For liquids in single packagings and for inner packagings of combination packagings, if the test is performed with water:

Note: The term “water” includes water/antifreeze solutions with a minimum specific gravity of 0.95 for testing at -18°C .

(a) where the substances to be transported have a relative density not exceeding 1.2:

Packing group I	Packing group II	Packing group III
1.8 m	1.2 m	0.8 m

(b) where the substances to be transported have a relative density exceeding 1.2, the drop height shall be calculated on the basis of the relative density (*d*) of the substance to be carried, rounded up to the first decimal, as follows:

Packing group I	Packing group II	Packing group III
$d \times 1.5$ m	$d \times 1.0$ m	$d \times 0.67$ m

6.1.5.3.6 Criteria for passing the test

- .1 Each packaging containing liquid shall be leakproof when equilibrium has been reached between the internal and external pressures, except for inner packagings of combination packagings, when it is not necessary that the pressures be equalized.
- .2 Where a packaging for solids undergoes a drop test and its upper face strikes the target, the test sample passes the test if the entire contents are retained by an inner packaging or inner receptacle (such as a plastics bag), even if the closure, while retaining its containment function, is no longer sift-proof.
- .3 The packaging or outer packaging of a composite or combination packaging shall not exhibit any damage liable to affect safety during transport. Inner receptacles, inner packagings, or articles shall remain completely within the outer packaging and there shall be no leakage of the filling substance from the inner receptacles or inner packaging(s).
- .4 Neither the outermost ply of a bag nor an outer packaging shall exhibit any damage liable to affect safety during transport.
- .5 A slight discharge from the closures upon impact shall not be considered to be a failure of the packaging provided that no further leakage occurs.
- .6 No rupture is permitted in packagings for goods of class 1 which would permit the spillage of loose explosive substances or articles from the outer packaging.

6.1.5.4 Leakproofness test

- 6.1.5.4.1** The leakproofness test shall be performed on all design types of packagings intended to contain liquids; however, this test is not required for the inner packagings of combination packagings.
- 6.1.5.4.2** Number of test samples: three test samples per design type and manufacturer.
- 6.1.5.4.3** Special preparation of test samples for the test: vented closures shall either be replaced by similar non-vented closures or the vent shall be sealed.
- 6.1.5.4.4** Test method and pressure to be applied: the packagings, including their closures, shall be restrained under water for 5 minutes while an internal air pressure is applied. The method of restraint shall not affect the results of the test.

The air pressure (gauge) to be applied shall be:

Packing group I	Packing group II	Packing group III
Not less than 30 kPa (0.3 bar)	Not less than 20 kPa (0.2 bar)	Not less than 20 kPa (0.2 bar)

Other methods at least equally as effective may be used.

- 6.1.5.4.5** Criterion for passing the test: there shall be no leakage.

6.1.5.5 Internal pressure (hydraulic) test

- 6.1.5.5.1** Packagings to be tested: the internal pressure (hydraulic) test shall be carried out on all design types of metal, plastics and composite packagings intended to contain liquids. This test is not required for inner packagings of combination packagings.
- 6.1.5.5.2** Number of test samples: three test samples per design type and manufacture.
- 6.1.5.5.3** Special preparation of packagings for testing: vented closures shall either be replaced by similar non-vented closures or the vent shall be sealed.
- 6.1.5.5.4** Test method and pressure to be applied: metal packagings and composite packagings (glass, porcelain or stoneware), including their closures, shall be subjected to the test pressure for 5 minutes. Plastics packagings and composite packagings (plastics material), including their closures, shall be subjected to the test pressure for 30 minutes. This pressure is the one to be included in the mark required by 6.1.3.1(d). The manner in which the packagings are supported shall not invalidate the test. The test pressure shall be applied continuously



and evenly; it shall be kept constant throughout the test period. The hydraulic pressure (gauge) applied, as determined by any one of the following methods, shall be:

- .1 not less than the total gauge pressure measured in the packaging (i.e. the vapour pressure of the filling liquid and the partial pressure of the air or other inert gases, minus 100 kPa) at 55°C, multiplied by a safety factor of 1.5; this total gauge pressure shall be determined on the basis of a maximum degree of filling in accordance with 4.1.1.4 and a filling temperature of 15°C;
- .2 not less than 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;
- .3 not less than 1.5 times the vapour pressure at 55°C of the liquid to be transported minus 100 kPa, but with a minimum test pressure of 100 kPa.

6.1.5.5.5 In addition, packagings intended to contain liquids of packing group I shall be tested to a minimum test pressure of 250 kPa (gauge) for a test period of 5 or 30 minutes, depending upon the material of construction of the packaging.

6.1.5.5.6 Criterion for passing the test: no packaging shall leak.

6.1.5.6 Stacking test

All design types of packagings other than bags shall be subjected to a stacking test.

6.1.5.6.1 Number of test samples: three test samples per design type and manufacturer.

6.1.5.6.2 Test method: the test sample shall be subjected to a force applied to the top surface of the test sample equivalent to the total mass of identical packages which might be stacked on it during transport: where the contents of the test sample are liquids with relative density different from that of the liquid to be transported, the force shall be calculated in relation to the latter. The minimum height of the stack including the test sample shall be 3 m. The duration of the test shall be 24 hours except that plastics drums, jerricans, and composite packagings 6HH1 and 6HH2 intended for liquids shall be subjected to the stacking test for a period of 28 days at a temperature of not less than 40°C.

6.1.5.6.3 Criteria for passing the test: no test sample shall leak. In composite packagings or combination packagings, there shall be no leakage of the filling substance from the inner receptacle or inner packaging. No test sample shall show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages. Plastics packagings shall be cooled to ambient temperature before the assessment.

6.1.5.7 Test report

6.1.5.7.1 A test report containing at least the following particulars shall be drawn up and shall be available to the users of the packaging:

- .1 name and address of the test facility;
- .2 name and address of applicant (where applicable);
- .3 a unique test report identification;
- .4 date of the test report;
- .5 manufacturer of the packaging;
- .6 description of the packaging design type (such as dimensions, materials, closures, thickness, etc.), including method of manufacture (such as blow-moulding), and which may include drawing(s) and/or photograph(s);
- .7 maximum capacity;
- .8 characteristics of test contents, such as viscosity and relative density for liquids and particle size for solids. For plastics packagings subject to the internal pressure test in 6.1.5.5, the temperature of the water used;
- .9 test descriptions and results;
- .10 signature, with the name and status of the signatory.

6.1.5.7.2 The test report shall contain statements that the packaging prepared as for transport was tested in accordance with the appropriate provisions of this chapter and that the use of other packaging methods or components may render it invalid. A copy of the test report shall be available to the competent authority.