# PART 6

# Requirements for the construction and testing of packagings, intermediate bulk containers (IBCs), large packagings and tanks

## CHAPTER 6.1

## REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF PACKAGINGS

### 6.1.1 General

6.1.1.1 The requirements of this Chapter do not apply to:

(a) Packages containing radioactive material of Class 7, unless otherwise provided (see 4.1.9);

(b) Packages containing infectious substances of Class 6.2, unless otherwise provided (see Chapter 6.3, Note and packing instruction P621 of 4.1.4.1);

(c) Receptacles containing gases of Class 2;

(d) Packages whose net mass exceeds 400 kg;

(e) Packagings with a capacity exceeding 450 litres.

6.1.1.2 The requirements 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 6.1.1.3 and 6.1.5. Methods of testing other than those described in this Chapter are acceptable, provided they are equivalent, and are recognized by the competent authority.

6.1.1.3 Every packaging intended to contain liquids shall successfully undergo a suitable leakproofness test, and be capable of meeting the appropriate test level indicated in 6.1.5.4.3:

(a) before it is first used for carriage;

(b) after remanufacturing or reconditioning, before it is re-used for carriage;

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

The inner receptacle of composite packagings may be tested without the outer packaging provided the test results are not affected.

This test is not necessary for:

- inner packagings of combination packagings;

- inner receptacles of composite packagings (glass, porcelain or stoneware), marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii);

- light gauge metal packagings, marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii).

6.1.1.4 Packagings shall be manufactured and tested under a quality assurance programme which satisfies the competent authority in order to ensure that each manufactured packaging meets the requirements of this Chapter.

**6.1.2 Code for designating types of packagings**

6.1.2.1 The code consists of:

(a) an Arabic numeral indicating the kind of packaging, e.g. drum, jerrican, etc., followed by;

(b) a capital letter(s) in Latin characters indicating the nature of the material, e.g. steel, wood, etc., followed where necessary by;

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

6.1.2.2 In the case of composite packagings, two capital letters in Latin characters are 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 and infectious substances packagings marked in accordance with 6.3.1.1, only the code number for the outer packaging is 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 requirements of 6.1.5.1.11. The letter "V" signifies a special packaging conforming to the requirements of 6.1.5.1.7. The letter "W" signifies that the packaging, although of the same type indicated by the code, is manufactured to a specification different to that in 6.1.4 and is considered equivalent under the requirements of 6.1.1.2.

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

1. Drum
2. Wooden barrel
3. Jerrican
4. Box
5. Bag
6. Composite packaging
7. (reserved)
0. Light gauge metal packagings

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

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 sub-sections to be consulted for the appropriate requirements:

| Kind | Material | Category | Code | Sub-section |
|---|---|---|---|---|
| 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. Barrels | C. Wooden | bung type | 2C1 | 6.1.4.6 |
| | | removable head | 2C | |
| 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 | |
| 5. Bags | H. Woven plastics | without inner liner 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 liner 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 | |

| Kind | Material | Category | Code | Sub-section |
|---|---|---|---|---|
| 6. Composite packagings | H. Plastics receptacle | with outer steel drum | 6HA1 | 6.1.4.19 |
| | | with outer steel crate or box | 6HA2 | 6.1.4.19 |
| | | with outer aluminium drum | 6HB1 | 6.1.4.19 |
| | | with outer aluminium crate or box | 6HB2 | 6.1.4.19 |
| | | with outer wooden box | 6HC | 6.1.4.19 |
| | | with outer plywood drum | 6HD1 | 6.1.4.19 |
| | | with outer plywood box | 6HD2 | 6.1.4.19 |
| | | with outer fibre drum | 6HG1 | 6.1.4.19 |
| | | with outer fibreboard box | 6HG2 | 6.1.4.19 |
| | | with outer plastics drum | 6HH1 | 6.1.4.19 |
| | | with outer solid plastics box | 6HH2 | 6.1.4.19 |
| | P. Glass, porcelain or stoneware receptacle | with outer steel drum | 6PA1 | 6.1.4.20 |
| | | with outer steel crate or box | 6PA2 | 6.1.4.20 |
| | | with outer aluminium drum | 6PB1 | 6.1.4.20 |
| | | with outer aluminium crate or box | 6PB2 | 6.1.4.20 |
| | | with outer wooden box | 6PC | 6.1.4.20 |
| | | with outer plywood drum | 6PD1 | 6.1.4.20 |
| | | with outer wickerwork hamper | 6PD2 | 6.1.4.20 |
| | | with outer fibre drum | 6PG1 | 6.1.4.20 |
| | | with outer fibreboard box | 6PG2 | 6.1.4.20 |
| | | with outer expanded plastics packaging | 6PH1 | 6.1.4.20 |
| | | with outer solid plastics packaging | 6PH2 | 6.1.4.20 |
| 0. Light gauge metal packagings | A. Steel | non-removable head | 0A1 | 6.1.4.22 |
| | | removable head | 0A2 | |

**6.1.3 Marking**

***NOTE 1:*** *The marking indicates that the packaging which bears it corresponds to a successfully tested design type and that it complies with the requirements of this Chapter which are related to the manufacture, but not to the use, of the packaging. In itself, therefore, the mark does not necessarily confirm that the packaging may be used for any substance: generally the type of packaging (e.g. steel drum), its maximum capacity and/or mass, and any special requirements are specified for each substance in Table A of Chapter 3.2.*

***NOTE 2:*** *The marking is 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 marking is a means for its manufacturer(s) to identify the type and to indicate those performance test regulations that have been met.*

***NOTE 3:*** *The marking does not always provide full details of the test levels, etc., and these may need to be taken further into account, e.g. by reference to a test certificate, to test reports or to a register of successfully tested packagings. For example, a packaging having an X or Y marking 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 [1] determined by taking into account the factor 1.5 or 2.25 indicated in the packaging test requirements in 6.1.5 as appropriate, i.e. Group I packaging tested for products of relative density 1.2 could be used as a Group II packaging for products of relative density 1.8 or a Group III packaging for products of relative density 2.7, provided of course that all the performance criteria can still be met with the higher relative density product.*

6.1.3.1 Each packaging intended for use according to the ADR shall bear markings which are durable, legible and placed in 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 markings 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 litres or 30 kg capacity or less, when they shall be at least 6 mm in height and for packagings of 5 litres or 5 kg or less when they shall be of an appropriate size.

The marking shall show:

(a) (i) The United Nations packaging symbol

This shall not be used for any purpose other than certifying that a packaging complies with the relevant requirements in this Chapter. For embossed metal packagings the capital letters "UN" may be applied instead of the symbol; or

(ii) The symbol "RID/ADR" for packagings approved for rail transport as well as road transport.

For composite packagings (glass, porcelain or stoneware) and light gauge metal packagings, conforming to simplified conditions (see 6.1.1.3, 6.1.5.3.1 (e), 6.1.5.3.4 (c), 6.1.5.4, 6.1.5.5.1 and 6.1.5.6);

(b) The code designating the type of packaging according to 6.1.2;

[1] *Relative density (d) is considered to be synonymous with Specific Gravity (SG) and is used throughout this text.*

(c) A code in two parts:

(i) a letter designating the packing group(s) 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.

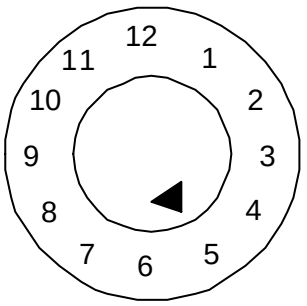
For light-gauge metal packagings, marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii) intended to contain liquids having a viscosity at 23 °C exceeding 200 $mm^2/s$, the maximum gross mass in kg;

(d) Either the letter "S" denoting that the packaging is intended for the carriage 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 kPa rounded down to the nearest 10 kPa.

For light-gauge metal packagings, marked with the symbol "RID/ADR, according to 6.1.3.1(a) (ii) intended to contain liquids having a viscosity at 23 °C exceeding 200 $mm^2/s$, the letter "S";

***NOTE**: The requirements of subparagraph (d) do not apply to packagings intended for the carriage of substances classified under UN Nos. 2814 or 2900 of Class 6.2.*

(e) The last two digits of the year during which the packaging was manufactured. Packagings of types lH 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 marking. An appropriate method is:




(f) The State authorizing the allocation of the mark, indicated by the distinguishing sign for motor vehicles in international traffic [2];

(g) The name of the manufacturer or other identification of the packaging specified by the competent authority.

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[2] *Distinguishing sign for motor vehicles in international traffic prescribed in Vienna Convention on Road Traffic (1968).*

6.1.3.2 Every reusable packaging liable to undergo a reconditioning process which might obliterate the packaging markings 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 litres, these permanent marks may replace the corresponding durable markings prescribed in 6.1.3.1.

6.1.3.2.1 In addition to the durable markings prescribed in 6.1.3.1, every new metal drum of a capacity greater than 100 litres 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 mm, to 0.1 mm), in permanent form (e.g. 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 (e.g. embossed), for example "1.0-1.2-1.0" or "0.9-1.0-1.0". Nominal thickness of metal shall be determined according to the appropriate ISO standard, for example ISO 3574:1999 for steel. The marks indicated in 6.1.3.1 (f) and (g) shall not be applied in a permanent form except as provided in 6.1.3.2.3.

6.1.3.2.2 For remanufactured metal drums, if there is no change to the packaging type and no replacement or removal of integral structural components, the required markings need not be permanent. Every other remanufactured metal drum shall bear the markings in 6.1.3.1 (a) to (e) in a permanent form (e.g. embossed) on the top head or side.

6.1.3.2.3 Metal drums made from materials (e.g. stainless steel) designed to be reused repeatedly may bear the markings indicated in 6.1.3.1 (f) and (g) in a permanent form (e.g. embossed).

6.1.3.2.4 The marking in accordance with 6.1.3.1 is valid for only one design type or series of design types. Different surface treatments may fall within the same design type.

A "series of design types" means packagings of the same structural design, wall thickness, material and cross-section, which differ only in their lesser design heights from the design type approved.

The closures of receptacles shall be identifiable as those referred to in the test report.

6.1.3.3 Marking shall be applied in the sequence of the subparagraphs in 6.1.3.l; for examples, see 6.1.3.7. Any additional markings authorized by a competent authority shall still enable the parts of the mark to be correctly identified with reference to 6.1.3.l.

6.1.3.4 After reconditioning a packaging, the reconditioner shall apply to it a durable marking showing, in the following sequence:

(h) The State in which the reconditioning was carried out, indicated by the distinguishing sign for motor vehicles in international traffic [2];

(i) The name or authorized symbol of the reconditioner;

(j) The year of reconditioning; the letter "R"; and, for every packaging successfully passing the leakproofness test in 6.1.1.3, the additional letter "L".

6.1.3.5 When, after reconditioning, the markings 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 also shall apply them in a durable form followed by 6.1.3.4 (h), (i) and (j). These markings shall not identify a greater performance capability than that for which the original design type had been tested and marked.

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[2] *Distinguishing sign for motor vehicles in international traffic prescribed in Vienna Convention on Road Traffic (1968).*

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 mark prescribed in 6.1.3.1.

**6.1.3.7** ***Examples of markings for NEW packagings***

| | | |
|---|---|---|
|  4G/Y145/S/83 NL/VL823 | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a new fibreboard box |
|  1A1/Y1.4/150/83 NL/VL824 | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a new steel drum to contain liquids |
|  1A2/Y150/S/83 NL/VL825 | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a new steel drum to contain solids, or inner packagings |
|  4HW/Y136/S/83 NL/VL826 | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a new plastics box of equivalent specification |
|  lA2/Y/100/91 USA/MM5 | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a remanufactured steel drum to contain liquids |
| RID/ADR/0A1/100/83 NL/VL123 | as in 6.1.3.1 (a) (ii), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a new light gauge metal packaging, non-removable head |
| RID/ADR/0A2/Y20/S/83 NL/VL124 | as in 6.1.3.1 (a) (ii), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) | For a new light gauge metal packaging, removable head, intended to contain solids, or liquids with a viscosity at 23 °C exceeding 200 $mm^2/s$. |

**6.1.3.8** ***Examples of markings for RECONDITIONED packagings***

| | |
|---|---|
|  1A1/Y1.4/150/83 NL/RB/85 RL | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.4 (h), (i) and (j) |
|  1A2/Y150/S/83 USA/RB/85 R | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.4 (h), (i) and (j) |

**6.1.3.9** ***Example of marking for SALVAGE packagings***

| | |
|---|---|
|  1A2T/Y300/S/94 USA/abc | as in 6.1.3.1 (a) (i), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g) |

***NOTE:*** *The markings, for which examples are given in 6.1.3.7, 6.1.3.8 and 6.1.3.9 may be applied in a single line or in multiple lines provided the correct sequence is respected.*

**6.1.3.10** ***Certification***

By affixing marking in accordance with 6.1.3.1, it is certified that mass-produced packagings correspond to the approved design type and that the requirements referred to in the approval have been met.

**6.1.4** **Requirements for packagings**

**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 a suitable type and of adequate thickness in relation to the capacity of the drum and to its intended use.

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

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 litres 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 non-removable head (1A1) drums 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 carriage. 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 (1A2) drums shall be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of carriage. 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 carried, suitable internal protective coatings or treatments shall be applied. These coatings or treatments shall retain their protective properties under normal conditions of carriage.

6.1.4.1.8 Maximum capacity of drum: 450 litres.

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 base alloy. Material shall be of a suitable type and of adequate thickness in relation to the capacity of the drum and to its intended use.

6.1.4.2.2 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 litres 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 non-removable head (1B1) drums 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 carriage. 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 (1B2) drums shall be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of carriage. Gaskets or other sealing elements shall be used with all removable heads.

6.1.4.2.6 Maximum capacity of drum: 450 litres.

6.1.4.2.7 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 a metal or of a 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, solded, 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 litres 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 carriage. Closure flanges shall be joined in place (welded, solded, 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 (1N2) drums shall be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of carriage. Gaskets or other sealing elements shall be used with all removable heads.

6.1.4.3.6 Maximum capacity of drum: 450 litres.

6.1.4.3.7 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 base 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 litres of liquid shall be welded. Body seams of steel jerricans intended to contain 40 litres 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 non-removable head 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 carriage. 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 carried, suitable internal protective coatings or treatments shall be applied. These coatings or treatments shall retain their protective properties under normal conditions of carriage.

6.1.4.4.5 Maximum capacity of jerrican: 60 litres.

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 to 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 litres.

6.1.4.5.6 Maximum net mass: 400 kg.

**6.1.4.6** ***Wooden barrels***

2C1 bung type
2C2 removable head

6.1.4.6.1 The wood used shall be of good quality, straight grained, well seasoned and free from knots, bark, rotten wood, sapwood or other defects likely to lessen the effectiveness of the barrel for the purpose intended.

6.1.4.6.2 The body and heads shall be of a design appropriate to the capacity of the barrel and to its intended use.

6.1.4.6.3 Staves and heads shall be sawn or cleft with the grain so that no annual ring extends over more than half the thickness of a stave or head.

6.1.4.6.4 Barrel hoops shall be of steel or iron of good quality. The hoops of removable head (2C2) barrels may be of a suitable hardwood.

6.1.4.6.5 Wooden barrels 2C1: the diameter of the bunghole shall not exceed half the width of the stave in which it is placed.

6.1.4.6.6 Wooden barrels 2C2: heads shall fit tightly into the crozes.

6.1.4.6.7 Maximum capacity of barrel: 250 litres.

6.1.4.6.8 Maximum net mass: 400 kg.

**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 to 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 carriage.

6.1.4.7.5 Maximum capacity of drum: 450 litres.

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 either by the substance contained or by ultra-violet radiation. Any permeation of the substance contained in the package, or recycled plastics material used to produce new packaging, shall not constitute a danger under normal conditions of carriage.

6.1.4.8.2 If protection against ultra-violet 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 ultra-violet radiation is not limited.

6.1.4.8.3 Additives serving purposes other than protection against ultra-violet 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 carriage. 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 (1H2 and 3H2) shall be so designed and applied that they will remain secure and leakproof under normal conditions of carriage. 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 The maximum permissible permeability for flammable liquids shall be 0.008 g/l.h at 23 °C (see 6.1.5.8).

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

6.1.4.8.9 Maximum capacity of drums and jerricans: 1H1, 1H2: 450 litres
3H1, 3H2: 60 litres.

6.1.4.8.10 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 carriage. End grain nailing 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 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 3-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 to 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:l991. 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 ultra-violet 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 ultra-violet 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 ultra-violet radiation is not limited.

6.1.4.13.5 Additives serving purposes other than protection against ultra-violet radiation may be included in the composition of the plastics material provided that they do not adversely affect the chemical or 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 so designed as to prevent the box from unintentional opening.

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

6.1.4.13.8 Maximum net mass 4H1: 60 kg
4H2: 400 kg.

**6.1.4.14** ***Steel or aluminium boxes***

4A steel
4B aluminium

6.1.4.14.l 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 carriage.

6.1.4.14.4 Maximum net mass: 400 kg.

**6.1.4.15** ***Textile bags***

5L1 without inner liner 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 to 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:

(a) paper bonded to the inner surface of the bag by 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 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:

(a) separate inner liners of water resistant paper (e.g. waxed kraft paper, tarred paper or plastics-coated kraft paper); or

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

(c) 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 to 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:

(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 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:

(a) separate inner liners of water resistant paper (e.g. waxed kraft paper, double-tarred kraft paper or plastics-coated kraft paper); or

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

(c) 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 to its intended use. Joins and closures shall withstand pressures and impacts liable to occur under normal conditions of carriage.

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 strength of the paper and the construction of the bags shall be appropriate to the capacity of the bag and to 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*

6.1.4.19.1.1 The requirements of 6.1.4.8.1 and 6.1.4.8.4 to 6.1.4.8.7 apply to plastics inner receptacles.

6.1.4.19.1.2 The plastics inner receptacle shall fit snugly inside the outer packaging, which shall be free of any projection that might abrade the plastics material.

6.1.4.19.1.3 Maximum capacity of inner receptacle:

| | |
|---|---|
| 6HA1, 6HB1, 6HD1, 6HG1, 6HH1: | 250 litres |
| 6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2: | 60 litres. |

6.1.4.19.1.4 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*

6.1.4.19.2.1 Plastics receptacle with outer steel or aluminium drum 6HA1 or 6HB1; the relevant requirements of 6.1.4.1 or 6.1.4.2, as appropriate, apply to the construction of the outer packaging.

6.1.4.19.2.2 Plastics receptacle with outer steel or aluminium crate or box 6HA2 or 6HB2; the relevant requirements of 6.1.4.14 apply to the construction of the outer packaging.

6.1.4.19.2.3 Plastics receptacle with outer wooden box 6HC; the relevant requirements of 6.1.4.9 apply to the construction of the outer packaging.

6.1.4.19.2.4 Plastics receptacle with outer plywood drum 6HD1; the relevant requirements of 6.1.4.5 apply to the construction of the outer packaging.

6.1.4.19.2.5 Plastics receptacle with outer plywood box 6HD2; the relevant requirements of 6.1.4.10 apply to the construction of the outer packaging.

6.1.4.19.2.6 Plastics receptacle with outer fibre drum 6HG1; the requirements of 6.1.4.7.1 to 6.1.4.7.4 apply to the construction of the outer packaging.

6.1.4.19.2.7 Plastics receptacle with outer fibreboard box 6HG2; the relevant requirements of 6.1.4.12 apply to the construction of the outer packaging.

6.1.4.19.2.8 Plastics receptacle with outer plastics drum 6HH1; the requirements of 6.1.4.8.1 to 6.1.4.8.6 apply to the construction of the outer packaging.

6.1.4.19.2.9 Plastics receptacles with outer solid plastics box (including corrugated plastics material) 6HH2; the requirements of 6.1.4.13.1 and 6.1.4.13.4 to 6.1.4.13.6 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*

6.1.4.20.1.1 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 and free from internal stresses.

6.1.4.20.1.2 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 carriage. If vented closures are necessary, they shall comply with 4.1.1.8.

6.1.4.20.1.3 The receptacle shall be firmly secured in the outer packaging by means of cushioning and/or absorbent materials.

6.1.4.20.1.4 Maximum capacity of receptacle: 60 litres.

6.1.4.20.1.5 Maximum net mass: 75 kg.

6.1.4.20.2 *Outer packaging*

6.1.4.20.2.1 Receptacle with outer steel drum 6PA1; the relevant requirements of 6.1.4.1 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.

6.1.4.20.2.2 Receptacle with outer steel crate or box 6PA2; the relevant requirements of 6.1.4.14 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).

6.1.4.20.2.3 Receptacle with outer aluminium drum 6PB1; the relevant requirements of 6.1.4.2 apply to the construction of the outer packaging.

6.1.4.20.2.4 Receptacle with outer aluminium crate or box 6PB2; the relevant requirements of 6.1.4.14 apply to the construction of the outer packaging.

6.1.4.20.2.5 Receptacle with outer wooden box 6PC; the relevant requirements of 6.1.4.9 apply to the construction of the outer packaging.

6.1.4.20.2.6 Receptacle with outer plywood drum 6PD1; the relevant requirements of 6.1.4.5 apply to the construction of the outer packaging.

6.1.4.20.2.7 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.

6.1.4.20.2.8 Receptacle with outer fibre drum 6PG1; the relevant requirements of 6.1.4.7.1 to 6.1.4.7.4 apply to the construction of the outer packaging.

6.1.4.20.2.9 Receptacle with outer fibreboard box 6PG2; the relevant requirements of 6.1.4.12 apply to the construction of the outer packaging.

6.1.4.20.2.10 Receptacle with outer expanded plastics or solid plastics packaging (6PH1 or 6PH2); the materials of both outer packagings shall meet the relevant requirements of 6.1.4.13. Outer 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.

**6.1.4.21** ***Combination packagings***

The relevant requirements of section 6.1.4 for the outer packagings to be used, are applicable.

***NOTE***: *For the inner and outer packagings to be used, see the relevant packing instructions in Chapter 4.1.*

**6.1.4.22** ***Light gauge metal packagings***

0A1 non-removable-head
0A2 removable-head

6.1.4.22.1 The sheet metal for the body and ends shall be of suitable steel, and of a gauge appropriate to the capacity and intended use of the packaging.

6.1.4.22.2 The joints shall be welded, at least double-seamed by welting or produced by a method ensuring a similar degree of strength and leakproofness.

6.1.4.22.3 Inner coatings of zinc, tin, lacquer, etc. shall be tough and shall adhere to the steel at every point, including the closures.

6.1.4.22.4 Openings for filling, emptying and venting in the bodies or heads of non-removable head (0A1) packagings shall not exceed 7 cm in diameter. Packagings with larger openings shall be considered to be of the removable-head type (0A2).

6.1.4.22.5 The closures of non-removable-head packagings (0A1) shall either be of the screw-threaded type or be capable of being secured by a screwable device or a device at least equally effective. The closures of removable-head packagings (0A2) shall be so designed and fitted that they stay firmly closed and the packagings remain leakproof in normal conditions of carriage.

6.1.4.22.6 Maximum capacity of packagings: 40 litres.

6.1.4.22.7 Maximum net mass: 50 kg.

**6.1.5 Test requirements 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 6.1.5 in accordance with procedures established and approved by the competent authority.

6.1.5.1.2 Tests shall be successfully performed on each packaging design type before such packaging is 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 requirements 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, e.g. 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 dimension(s).

6.1.5.1.6 Where an outer packaging of a combination packaging has been successfully tested with different types of inner packagings, a variety of such different inner packagings may also be assembled in this outer packaging. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

(a) Inner packagings of equivalent or smaller size may be used provided:

(i) the inner packagings are of similar design to the tested inner packagings (e.g. shape - round, rectangular, etc.);

(ii) the material of construction of the inner packagings (glass, plastics, metal, etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging;

(iii) the inner packagings have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc.);

(iv) sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and

(v) inner packagings are oriented within the outer packaging in the same manner as in the tested package.

(b) A lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in (a) above, may be used provided sufficient cushioning is added to fill the void space(s) and to prevent significant movement of the inner packagings.

6.1.5.1.7 Articles or inner packagings of any type for solids or liquids may be assembled and carried without testing in an outer packaging under the following conditions:

(a) The outer packaging shall have been successfully tested in accordance with 6.1.5.3 with fragile (e.g. glass) inner packagings containing liquids using the packing group I drop height;

(b) 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 (a) above;

(c) The thickness of 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 if a single inner packaging was used in the original test, the thicknesses of 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. If 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;

(d) The outer packaging shall have passed successfully 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 for the drop test in (a) above;

(e) 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;

(f) If 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 siftproof, 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 (e) above shall be placed inside the means of containing the liquid contents;

(g) Packagings shall be marked in accordance with 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 (a) above. Such a package mark shall also contain a 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 requirements of the design type tests. For verification purposes records of such tests shall be maintained.

6.1.5.1.9 If an inner treatment or coating is required for safety reasons, it shall retain its protective properties even 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*

Salvage packagings (see 1.2.1) shall be tested and marked in accordance with the requirements applicable to packing group II packagings intended for the carriage of solids or inner packagings, except as follows:

(a) 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 so that the test results are not affected. Alternatively, in performing the drop test, the drop height may be varied in accordance with 6.1.5.3.4(b);

(b) 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 6.1.5.9; and

(c) 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 carriage including, with respect to combination packagings, the inner packagings used. Inner or single receptacles or packagings shall be filled to not less than 98% of their maximum capacity for liquids or 95% for solids. For combination packagings where the inner packaging is designed to carry liquids and solids, separate testing is required for both liquid and solid contents. The substances or articles to be carried 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 carried. Water may also be used for the liquid drop test under the conditions in 6.1.5.3.4.

6.1.5.2.3 Paper or fibreboard packagings shall be conditioned for at least 24 hours in an atmosphere having a controlled temperature and relative humidity (r.h.). There are three options, one of which shall be chosen. The preferred atmosphere is 23 ± 2 °C and 50% ± 2% r.h. The two other options are 20 ± 2 °C and 65% ± 2% r.h. or 27 ± 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 Bung-type barrels made of natural wood shall be left filled with water for at least 24 hours before the tests.

6.1.5.2.5 To check that their chemical compatibility with the liquids is sufficient, plastics drums and jerricans in accordance with 6.1.4.8 and if necessary composite packagings (plastics material) in accordance with 6.1.4.19 shall be subjected to storage at ambient temperature for six months, during which time the test samples shall be kept filled with the goods they are intended to carry.

For the first and last 24 hours of storage, the test samples shall be placed with the closure downwards. However, packagings fitted with a vent shall be so placed on each occasion for five minutes only. After this storage the test samples shall undergo the tests prescribed in 6.1.5.3 to 6.1.5.6.

When it is known that the strength properties of the plastics material of the inner receptacles of composite packagings (plastics material) are not significantly altered by the action of the filling substance, it shall not be necessary to check that the chemical compatibility is sufficient.

A significant alteration in strength properties means:

(a) distinct embrittlement; or

(b) a considerable decrease in elasticity, unless related to a not less than proportionate increase in the elongation under load.

Where the behaviour of the plastics material has been established by other means, the above compatibility test may be dispensed with. Such procedures shall be at least equivalent to the above compatibility test and be recognized by the competent authority.

***NOTE****: For plastics drums and jerricans and composite packagings (plastics material) made of high or average molecular mass polyethylene, see also 6.1.5.2.6 below.*

6.1.5.2.6 For high molecular mass polyethylene drums and jerricans in accordance with 6.1.4.8 and if necessary composite packagings of high molecular mass polyethylene in accordance with 6.1.4.19, conforming to the following specifications:

- relative density at 23 °C after thermal conditioning for one hour at 100 °C $ 0.940, in accordance with ISO Standard 1183,

- melt flow rate at 190 °C/21.6 kg load # 12 g/10 min, in accordance with ISO Standard 1133,

for jerricans in accordance with 6.1.4.8 of packing groups II and III and, if necessary, for composite packagings in accordance with 6.1.4.19 in average molecular mass polyethylene meeting the following specifications:

- relative density at 23 °C after thermal conditioning for one hour at 100 °C $ 0.940, in accordance with ISO Standard 1183,

- melt flow rate at 190 °C/2.160 kg load # 0.5 g/10 min and $ 0.1 g/10 min, in accordance with ISO Standard 1133,

- melt flow rate at 190 °C/5 kg load # 3 g/10 min and $ 0.5 g/10 min, in accordance with ISO Standard 1133,

chemical compatibility with the liquids listed in 6.1.6.2 may be verified as follows with standard liquids (see 6.1.6.1).

The sufficient chemical compatibility of these packagings may be verified by storage for three weeks at 40 °C with the appropriate standard liquid; where this standard liquid is water, proof of chemical compatibility is not required.

For the first and last 24 hours of storage, the test samples shall be placed with the closure downwards. However, packagings fitted with a vent shall be so placed on each occasion for five minutes only. After this storage, the test samples shall undergo the tests prescribed in 6.1.5.3 to 6.1.5.6.

When a packaging design-type has satisfied the approval tests with a standard liquid, the comparable filling substances listed in 6.1.6.2 may be accepted for carriage without further testing, subject to the following conditions:

- the relative densities of the filling substances shall not exceed that used to determine the height for the drop test and the mass for the stacking test;

- the vapour pressures of the filling substances at 50 °C or 55 °C shall not exceed that used to determine the pressure for the internal pressure test.

The compatibility test for tert-Butyl hydroperoxide with more than 40% peroxide content and peroxyacetic acids of Class 5.2, shall not be carried out using standard liquids. For these substances, proof of sufficient chemical compatibility of the test samples shall be provided during a storage period of six months at ambient temperature with the substances they are intended to carry.

The procedure in accordance with this paragraph also applies to high density, high or average molecular mass polyethylene packagings, the internal surface of which is fluorinated.

6.1.5.2.7 For drums and jerricans conforming to 6.1.4.8, and where necessary composite packagings conforming to 6.1.4.19, made of high or average molecular mass polyethylene, which have passed the test in 6.1.5.2.6, filling substances other than those listed in 6.1.6.2 may also be approved. Such approval shall be based on laboratory tests proving that the effect of such filling substances on the test specimens is less than that of the standard liquids. The processes of deterioration to be taken into account shall be the following: softening through swelling, cracking under stress and molecular degradation. The same conditions as those set out in 6.1.5.2.6 above shall apply with respect to relative density and vapour pressure.

6.1.5.2.8 Provided that the strength properties of the plastics inner packagings of a combination packaging are not significantly altered by the action of the filling substance, proof of chemical compatibility is not necessary. A significant alteration in strength properties means:

(a) distinct embrittlement;

(b) a considerable decrease in elasticity, unless related to a not less than proportionate increase in elastic elongation.

**6.1.5.3** ***Drop test*** [3]

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.

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.

| **Packaging** | **No. of test samples** | **Drop orientation** |
|---|---|---|
| (a) Steel drums<br>Aluminium drums<br>Drums of metal other than steel or aluminium<br>Steel jerricans<br>Aluminium jerricans<br>Plywood drums<br>Wooden barrels<br>Fibre drums<br>Plastics drums and jerricans<br>Composite packagings which are in the shape of a drum<br>Light gauge metal packagings | Six<br>(three for each drop) | First drop (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.<br><br>Second drop (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 drum body |
| (b) Boxes of natural wood<br>Plywood boxes<br>Reconstituted wood boxes<br>Fibreboard boxes<br>Plastics boxes<br>Steel or aluminium boxes<br>Composite packagings which are in the shape of a box | Five<br>(one for each drop) | First drop: flat on the bottom<br>Second drop: flat on the top<br>Third drop: flat on the long side<br>Fourth drop: flat on the short side<br>Fifth drop: on a corner |
| (c) Bags - single-ply with a side seam | Three<br>(three drops per bag) | First drop: flat on a wide face<br>Second drop: flat on a narrow face<br>Third drop: on an end of the bag |
| (d) Bags - single-ply without a side seam, or multi-ply | Three<br>(two drops per bag) | First drop: flat on a wide face<br>Second drop: on an end of the bag |
| (e) Composite packagings (glass, stoneware or porcelain), marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii) and which are in the shape of a drum or box | Three<br>(one for each drop) | Diagonally on the bottom chime, or, if there is no chime, on a circumferential seam or the bottom edge |

[3] *See ISO Standard 2248.*

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:

(a) plastics drums (see 6.1.4.8);

(b) plastics jerricans (see 6.1.4.8);

(c) plastics boxes other than expanded plastics boxes (see 6.1.4.13);

(d) composite packagings (plastics material) (see 6.1.4.19) and;

(e) combination packagings with plastics inner packagings, other than plastics bags intended to contain solids or articles.

Where 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 *Target*

The target shall be a rigid, non-resilient, flat and horizontal surface.

6.1.5.3.4 *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 if the test is performed with water:

(a) where the substances to be carried 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 carried 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 × 1.5 (m) | d × 1.0 (m) | d × 0.67 (m) |

(c) for light-gauge metal packagings, marked with symbol "RID/ADR" according to 6.1.3.1(a) (ii) intended for the carriage of substances having a viscosity at 23 °C greater than 200 $mm^2/s$ (corresponding to a flow time of 30 seconds with an ISO flow

cup having a jet orifice of 6 mm diameter in accordance with ISO Standard 2431:1993)

(i) if the relative density does not exceed 1.2:

| Packing group II | Packing group III |
|---|---|
| 0.6 m | 0.4 m |

(ii) where the substances to be carried have a relative density (d) 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 place, as follows:

| Packing group II | Packing group III |
|---|---|
| d × 0.5 m | d × 0.33 m |

6.1.5.3.5 *Criteria for passing the test*

6.1.5.3.5.1 Each packaging containing liquid shall be leakproof when equilibrium has been reached between the internal and external pressures, however for inner packagings of combination packagings and except for inner receptacles of composite packagings (glass, porcelain or stoneware), marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii) it is not necessary that the pressures be equalized.

6.1.5.3.5.2 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 (e.g. a plastics bag), even if the closure is no longer sift-proof.

6.1.5.3.5.3 The packaging or outer packaging of a composite or combination packaging shall not exhibit any damage liable to affect safety during carriage. There shall be no leakage of the filling substance from the inner receptacle or inner packaging(s).

6.1.5.3.5.4 Neither the outermost ply of a bag nor an outer packaging may exhibit any damage liable to affect safety during carriage.

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

6.1.5.3.5.6 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***

The leakproofness test shall be performed on all design types of packagings intended to contain liquids; however, this test is not required for

- inner packagings of combination packagings;

- inner receptacles of composite packagings (glass, porcelain or stoneware), marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii);

- light gauge metal packagings, marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii) intended for substances with a viscosity at 23 °C exceeding 200 $mm^2/s$.

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

6.1.5.4.2 *Special preparation of test samples for the test*: either vented closures shall be replaced by similar non-vented closures or the vent shall be sealed.

6.1.5.4.3 *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 effective may be used.

6.1.5.4.4 *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;

- inner receptacles of composite packagings (glass, porcelain or stoneware), marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii);

- light gauge metal packagings, marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii) intended for substances with a viscosity at 23 °C exceeding 200 $mm^2/s$.

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

6.1.5.5.3 *Special preparation of packagings for testing*: either vented closures shall 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 marking 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:

(a) not less than the total gauge pressure measured in the packaging (i.e. the vapour pressure of the filling substance 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; or

(b) not less than 1.75 times the vapour pressure at 50 °C of the substance to be carried, minus 100 kPa but with a minimum test pressure of 100 kPa; or

(c) not less than 1.5 times the vapour pressure at 55 °C of the substance to be carried, minus 100 kPa but with a minimum test pressure of 100 kPa.

6.1.5.5.5 In addition, packagings intended to contain substances 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 may leak.

**6.1.5.6** ***Stacking test***

All design types of packagings other than bags and other than non-stackable composite packagings (glass, porcelain, or stoneware), marked with the symbol "RID/ADR" according to 6.1.3.1 (a) (ii) 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 weight of identical packages which might be stacked on it during carriage; where the contents of the test sample are non-dangerous liquids with relative density different from that of the liquid to be carried, the force shall be calculated in relation to the latter. The minimum height of the stack including the test sample shall be 3 metres. 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.

For the test in accordance with 6.1.5.2.5, the original filling substance shall be used. For the test in accordance with 6.1.5.2.6, a stacking test shall be carried out with a standard liquid.

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** ***Cooperage test for bung type wooden barrels***

6.1.5.7.1 *Number of samples*: one barrel.

6.1.5.7.2 *Method of testing*: remove all hoops above the bilge of an empty barrel at least two days old.

6.1.5.7.3 *Criterion for passing test*: the diameter of the cross session of the upper part of the barrel shall not increase by more than 10 %.

**6.1.5.8** ***Supplementary permeability test for plastics drums and jerricans in accordance with 6.1.4.8 and for composite packagings (plastics material) in accordance with 6.1.4.19 intended for the carriage of liquids having a flash-point # 61 °C, other than 6HA1 packagings***

Polyethylene packagings need be subjected to this test only if they are to be approved for the carriage of benzene, toluene, xylene or mixtures and preparations containing those substances.

6.1.5.8.1 *Number of test samples:* three packagings per design type and manufacturer.

6.1.5.8.2 *Special preparation of the test sample for the test:* the test samples are to be pre-stored with the original filling substance in accordance with 6.1.5.2.5, or, for high molecular mass polyethylene packagings, with the standard liquid mixture of hydrocarbons (white spirit) in accordance with 6.1.5.2.6.

6.1.5.8.3 *Test method:* the test samples filled with the substance for which the packaging is to be approved shall be weighed before and after storage for 28 days at 23 °C and 50 % relative atmospheric humidity. For high molecular mass polyethylene packagings, the test may be carried out with the standard liquid mixture of hydrocarbons (white spirit) in place of benzene, toluene or xylene.

6.1.5.8.4 *Criterion for passing the test:* permeability shall not exceed 0.008 g/l.h.

**6.1.5.9** ***Test Report***

6.1.5.9.1 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 appropriate);
3. A unique test report identification;
4. Date of the test report;
5. Manufacturer of the packaging;
6. Description of the packaging design type (e.g. dimensions, materials, closures, thickness, etc.), including method of manufacture (e.g. blow moulding) and which may include drawing(s) and/or photograph(s);
7. Maximum capacity;
8. Characteristics of test contents, e.g. viscosity and relative density for liquids and particle size for solids;
9. Test descriptions and results;
10. The test report shall be signed with the name and status of the signatory.

6.1.5.9.2 The test report shall contain statements that the packaging prepared as for carriage was tested in accordance with the appropriate requirements of this section 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.

**6.1.6 Standard liquids for verifying the chemical compatibility of high or average molecular mass polyethylene packagings in accordance with 6.1.5.2.6 and list of substances to which the standard liquids may be regarded as equivalents**

**6.1.6.1** ***Standard liquids for verifying the chemical compatibility of high or average molecular mass polyethylene packagings in accordance with 6.1.5.2.6***

The following standard liquids shall be used for this plastics material.

(a) ***Wetting Solution*** for substances causing severe cracking in polyethylene under stress, in particular for all solutions and preparations containing wetting agents.

An aqueous solution of 1 to 10 % of a wetting agent shall be used. The surface tension of this solution shall be 31 to 35 mN/m at 23 °C.

The stacking test shall be carried out on the basis of a relative density of not less than 1.20.

A compatibility test with acetic acid is not required if adequate chemical compatibility is proved with a wetting solution.

For filling substances causing cracking in polyethylene under stress which is resistant to the wetting solution, adequate chemical compatibility may be proved after preliminary storing for three weeks at 40 °C in accordance with 6.1.5.2.6, but with the original filling matter.

(b) ***Acetic acid*** for substances and preparations causing cracking in polyethylene under stress, in particular for monocarboxylic acids and monovalent alcohols.

Acetic acid in 98 to 100 % concentration shall be used.
Relative density = 1.05.

The stacking test shall be carried out on the basis of a relative density not less than 1.1.

In the case of filling substances causing polyethylene to swell more than acetic acid and to such an extent that the polyethylene mass is increased by up to 4 %, adequate chemical compatibility may be proved after preliminary storing for three weeks at 40 °C, in accordance with 6.1.5.2.6 but with the original filling matter.

(c) ***Normal butyl acetate/normal butyl acetate-saturated wetting solution*** for substances and preparations causing polyethylene to swell to such an extent that the polyethylene mass is increased by about 4 % and at the same time causing cracking under stress, in particular for phyto-sanitary products, liquid paints and esters. Normal butyl acetate in 98 to 100 % concentration shall be used for preliminary storage in accordance with 6.1.5.2.6.

For the stacking test in accordance with 6.1.5.6, a test liquid consisting of a 1 to 10 % aqueous wetting solution mixed with 2% normal butyl acetate conforming to (a) above shall be used.
The stacking test shall be carried out on the basis of a relative density not less than 1.0.

In the case of filling substances causing polyethylene to swell more than normal butyl acetate and to such an extent that the polyethylene mass is increased by up to 7.5 %,

adequate chemical compatibility may be proved after preliminary storing for three weeks at 40 °C, in accordance with 6.1.5.2.6 but with the original filling matter.

(d) ***Mixture of hydrocarbons (white spirit)*** for substances and preparations causing polyethylene to swell, in particular for hydrocarbons, esters and ketones.

A mixture of hydrocarbons having a boiling range 160 °C to 220 °C, relative density 0.78-0.80, flash-point > 50 °C and an aromatic content 16 % to 21 % shall be used.

The stacking test shall be carried out on the basis of a relative density not less than 1.0.

In the case of filling substances causing polyethylene to swell to such an extent that the polyethylene mass is increased by more than 7.5 %, adequate chemical compatibility may be proved after preliminary storing for three weeks at 40 °C, in accordance with 6.1.5.2.6 but with the original filling matter.

(e) ***Nitric acid*** for all substances and preparations having an oxidizing effect on polyethylene and causing molecular degradation identical to or less than 55 % nitric acid.

Nitric acid in a concentration of not less than 55 % shall be used.

The stacking test shall be carried out on the basis of a relative density of not less than 1.4.

In the case of filling substances more strongly oxidizing than 55 % nitric acid or causing degradation of the molecular mass proceed in accordance with 6.1.5.2.5.

The period of use shall be determined in such cases by observing the degree of damage (e.g. two years for nitric acid in not less than 55 % concentration).

(f) ***Water*** for substances which do not attack polyethylene in any of the cases referred to under (a) to (e), in particular for inorganic acids and lyes, aqueous saline solutions, polyvalent alcohols and organic substances in aqueous solution.

The stacking test shall be carried out on the basis of a relative density of not less than 1.2.

**6.1.6.2** ***List of substances to which the standard liquids may be regarded as equivalents for the purposes of 6.1.5.2.6***

***Class 3***

| Substance | Standard Liquid |
|---|---|
| **Flammable liquids of packing group II, without subsidiary risk (classification code F1, packing group II)** | |
| Substances having a vapour pressure at 50 °C of not more than 110 kPa (1.1 bar) | |
| - Crude petroleum and other crude oils | Mixture of hydrocarbons |
| - Hydrocarbons | Mixture of hydrocarbons |
| - Halogenated substances | Mixture of hydrocarbons |
| - Alcohols | Acetic acid |
| - Ethers | Mixture of hydrocarbons |
| - Aldehydes | Mixture of hydrocarbons |
| - Ketones | Mixture of hydrocarbons |
| - Esters | Normal butyl acetate where the swelling effect is up to 4% (mass): other cases, mixture of hydrocarbons |
| Mixtures of above-mentioned substances having a boiling point or initial boiling point exceeding 35 °C, containing not more than 55 % nitrocellulose with a nitrogen content not exceeding 12.6 % (UN No. 2059). | Normal butyl acetate/normal butyl acetate-saturated wetting solution and mixture of hydrocarbons |
| Viscous substances that meet the classification criteria of 2.2.3.1.4 | Mixture of hydrocarbons |
| **Flammable liquids of packing group II, toxic (classification code FT1, packing group II)** | |
| Methanol (UN No.1230) | Acetic acid |
| **Flammable liquids of packing group III, without subsidiary risk (classification code F1, packing group III)** | |
| - Petroleum, solvent naphtha | Mixture of hydrocarbons |
| - White spirit (turpentine substitute) | Mixture of hydrocarbons |
| - Hydrocarbons | Mixture of hydrocarbons |
| - Halogenated substances | Mixture of hydrocarbons |
| - Alcohols | Acetic acid |
| - Ethers | Mixture of hydrocarbons |
| - Aldehydes | Mixture of hydrocarbons |
| - Ketones | Mixture of hydrocarbons |
| - Esters | Normal butyl acetate where the swelling effect is up to 4% (mass): other cases, mixture of hydrocarbons |
| - Nitrogenous substances | Mixture of hydrocarbons |
| Mixtures of above-mentioned substances containing not more than 55 % nitrocellulose with a nitrogen content not exceeding 12.6 % (UN No. 2059). | Normal butyl acetate/normal butyl acetate-saturated wetting solution and mixture of hydrocarbons |

***Class 5.1***

| | |
|---|---|
| **Oxidizing liquids, corrosive (classification code OC1)** | |
| Hydrogen peroxides, aqueous solutions with not less than 20 % but not more than 60 % hydrogen peroxide (UN No. 2014) [4] | Water |
| Perchloric acid with more than 50 % but not more than 72 % acid (mass) (UN No. 1873) [4] | Nitric acid |
| **Oxidizing liquids, without subsidiary risk (classification code O1)** | |
| Hydrogen peroxide, aqueous solutions with not less than 8 % but less than 20% hydrogen peroxide (UN No. 2984) [4] | Water |
| Calcium chlorate solution (UN No.2429)<br>Potassium chlorate solution (UN No. 2427)<br>Sodium chlorate solution (UN No. 2428) | Water<br>Water<br>Water |

***Class 5.2***

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|---|---|
| **NOTE:** *tert-butyl hydroperoxide with more than 40 % peroxide content and peroxyacetic acids are excluded.* | |
| All organic peroxides in a technically pure form or in solution in solvents which, as far as their compatibility is concerned, are covered by the standard liquid "mixture of hydrocarbons" in this list (UN Nos. 3101, 3103, 3105, 3107, 3109, 3111, 3113, 3115, 3117, 3119) | Normal butyl acetate/ wetting solution with 2% normal butyl acetate and mixture of hydrocarbons and nitric acid at 55% |
| Compatibility of vents and gaskets with organic peroxides may be verified, also independently of the design type test, by laboratory tests with nitric acid. | |

***Class 6.1***

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|---|---|
| **Toxic organic liquids without subsidiary risk (classification code T1)** | |
| Aniline (UN No.1547) | Acetic acid |
| Furfuryl alcohol (UN No. 2874) | Acetic acid |
| Phenol solution (UN No. 2821, packing group III) | Acetic acid |
| **Toxic organic liquids, corrosive (classification code TC1)** | |
| Cresols (UN No. 2076) or cresylic acid (UN No. 2022) | Acetic acid |

***Class 6.2***

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| All infectious substances (UN Nos. 2814 and 2900, risk group 2, and UN No.3291) considered to be liquids in accordance with 2.1.2.6 | Water |

[4] *Test to be performed only with a vent.*

*Class 8*

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|---|---|
| **Corrosive acid inorganic liquids, without subsidiary risk (classification code C1)** | |
| Sulphuric acid (UN Nos. 1830 and 2796) | Water |
| Sulphuric acid, spent (UN No. 1832) | Water |
| Nitric acid (UN No. 2031) with not more than 55 % acid | Nitric acid |
| Perchloric acid with not more than 50 % acid, by mass in aqueous solution (UN No. 1802) | Nitric acid |
| Hydrochloric acid (UN No. 1789) with not more than 36 % pure acid<br>Hydrobromic acid (UN No. 1788)<br>Hydriodic acid (UN No. 1787) | Water |
| Hydrofluoric acid (UN No. 1790) with not more than 60 % hydrogen fluoride 5[5] | Water |
| Fluoroboric acid (UN No. 1775) with not more than 50 % pure acid | Water |
| Fluorosilicic acid (UN No. 1778) | Water |
| Chromic acid solution (UN No. 1755) with not more than 30 % pure acid | Nitric acid |
| Phosphoric acid (UN No. 1805) | Water |
| **Corrosive acid organic liquids (classification code C3)** | |
| Acrylic acid (UN No. 2218),<br>formic acid (UN No. 1779),<br>acetic acid (UN Nos. 2789 and 2790),<br>thioglycolic acid (UN No. 1940) | Acetic acid |
| Methacrylic acid (UN No. 2531),<br>propionic acid (UN No. 1848) | Acetic acid |
| Alkylphenols, liquid, n.o.s. (UN No. 3145, packing group III) | Acetic acid |
| **Corrosive basic inorganic liquids, without subsidiary risk (classification code C5)** | |
| Sodium hydroxide solution (UN No. 1824),<br>potassium hydroxide solution<br>(UN No. 1814) | Water |
| Ammonia solution (UN No. 2672) | Water |
| Hydrazine, aqueous solutions with not more than 64 % hydrazine, by mass<br>(UN No. 2030) | Water |
| **Other corrosive liquids (classification code C9)** | |
| Chlorite solution (UN No. 1906) and hypochlorite solution [6] (UN No. 1791, packing group III) | Nitric acid |
| Formaldehyde solutions (UN No. 2209) | Water |

[5] *Maximum 60 litres; permissible period of use two years.*

[6] *Test to be carried out only with vent. If the test is carried out with nitric acid as the standard liquid, an acid-resistant vent and gasket shall be used. For hypochlorite solutions, vents and gaskets of the same design type, resistant to hypochlorite (e.g. of silicone rubber) but not resistant to nitric acid, are also permitted.*