



**WORKING PAPER**

**DANGEROUS GOODS PANEL (DGP)**

**TWENTY-SECOND MEETING**

**Montréal, 5 to 16 October 2009**

**Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2011-2012 Edition**

**DRAFT AMENDMENTS OF THE TECHNICAL INSTRUCTIONS TO ALIGN TO THE UN RECOMMENDATIONS — PART 6**

(Presented by the Secretary)

**SUMMARY**

This working paper contains draft amendments to Part 6 of the Technical Instructions to reflect the decisions taken by the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals at its fourth session (Geneva, 12 December 2008). It also reflects amendments agreed by DGP-WG08 (The Hague, 3 to 7 November 2008) and DGP-WG09 (Auckland, 4 to 8 May 2009).

The DGP is invited to agree to the draft amendments in this working paper.

## Part 6

# PACKAGING NOMENCLATURE, MARKING, REQUIREMENTS AND TESTS

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## Chapter 3

### REQUIREMENTS FOR PACKAGINGS

#### 3.1 REQUIREMENTS FOR PACKAGINGS OTHER THAN INNER PACKAGINGS

##### 3.1.0 General requirements

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

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## Chapter 4

### PACKAGING PERFORMANCE TESTS

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#### 4.3 DROP TEST

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##### 4.3.6 Criteria for passing the test

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4.3.6.3 The packaging or outer packaging of a composite or combination packaging must not exhibit any damage liable to affect safety during transport. Inner receptacles, inner packagings, or articles must remain completely within the outer packaging and there must be no leakage of the filling substance from the inner receptacle or inner packaging(s).

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## Chapter 5

### REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF CYLINDERS AND CLOSED CRYOGENIC RECEPTACLES, AEROSOL DISPENSERS AND SMALL RECEPTACLES CONTAINING GAS (GAS CARTRIDGES) AND FUEL CELL CARTRIDGES CONTAINING LIQUEFIED FLAMMABLE GAS

Note 1.— Aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas are not subject to the requirements of 6:5.1 to 6:5.3.

Note 2.— For open cryogenic receptacles the requirements of Packing Instruction 202 must be met.

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## 5.1 GENERAL REQUIREMENTS

~~# Note 1.— For aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas see 5.4.~~

~~— Note 2.— For open cryogenic receptacles the requirements of Packing Instruction 202 must be met.~~

### 5.1.1 Design and construction

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5.1.1.5 The test pressure of cylinders must be in accordance with Packing Instruction 200. The test pressure for closed cryogenic receptacles must be in accordance with Packing Instruction 202. The test pressure of a metal hydride storage system must be in accordance with Packing Instruction 214.

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### 5.1.3 Service equipment

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5.1.3.4 Individual cylinders and closed cryogenic receptacles must be equipped with pressure relief devices as specified in Packing Instruction 200(1), 214 or 202, or 5.1.3.6.4 and 5.1.3.6.5. Pressure-relief devices must be designed to prevent the entry of foreign matter, the leakage of gas and the development of any dangerous excess pressure.

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### 5.1.5 Initial inspection and testing

5.1.5.1 New cylinders other than closed cryogenic receptacles and metal hydride storage systems, must be subjected to inspection and testing during and after manufacture in accordance with the applicable design standards including the following:

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5.1.5.3 For metal hydride storage systems, it must be verified that the inspections and tests specified in 5.1.5.1 a), b), c), d), e) if applicable, f), g), h) and i) have been performed on an adequate sample of the receptacles used in the metal hydride storage system. In addition, on an adequate sample of metal hydride storage systems, the inspections and tests specified in 5.1.5.1 c) and f) must be performed, as well as 5.1.5.1 e), if applicable, and inspection of the external conditions of the metal hydride storage system. Additionally, all metal hydride storage systems must undergo the initial inspections and tests specified in 5.1.5.1 h) and i), as well as a leakproofness test and a test of the satisfactory operation of the service equipment.

### 5.1.6 Periodic inspection and testing

5.1.6.1 Refillable cylinders must be subjected to periodic inspections and tests by a body authorized by the appropriate national authority, in accordance with the following:

- a) check of the external conditions of the cylinder and verification of the equipment and the external markings;
- b) check of the internal conditions of the cylinder (e.g. internal inspection, verification of minimum wall thickness);
- c) check of the threads if there is evidence of corrosion or if the fittings are removed;
- d) a hydraulic pressure test and, if necessary, verification of the characteristics of the material by suitable tests;

*Note 1.— With the agreement of the appropriate national authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.*

*Note 2.— With the agreement of the appropriate national authority, the hydraulic pressure test of cylinders may*

be replaced by an equivalent method based on acoustic emission testing, ~~ultrasonic examination~~ or a combination of acoustic emission testing and ultrasound examination. ISO 16148:2006 may be used as a guide for acoustic emission testing procedures.

Note 3.— The hydraulic pressure test may be replaced by ultrasonic examination carried out in accordance with ISO 10461:2005+A1:2006 for seamless aluminium alloy gas cylinders and in accordance with ISO 6406:2005 for seamless steel gas cylinders.

- e) check of service equipment, other accessories and pressure-relief devices, if to be reintroduced into service.

Note.— For the periodic inspection and test frequencies, see Packing Instruction 200.

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## 5.2 REQUIREMENTS FOR UN CYLINDERS AND CLOSED CRYOGENIC RECEPTACLES

In addition to the general requirements of 5.1, UN cylinders and closed cryogenic receptacles must comply with the requirements of this section, including the standards, as applicable.

*Note.— With the agreement of the appropriate national authority, more recently published versions of the standards, if available, may be used.*

### 5.2.1 Design, construction and initial inspection and testing

5.2.1.1 The following standards apply for the design, construction and initial inspection and test of UN cylinders, except that inspection requirements related to the conformity assessment system and approval must be in accordance with 5.2.5:

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ISO 7866:1999 Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing.

*Note.— The note concerning the F factor in section 7.2 of this standard must not be applied for UN cylinders. Aluminium alloy 6351A — T6 or equivalent must not be authorized.*

ISO 4706:2008 Gas cylinders – Refillable welded steel cylinders – Test pressure 60 bar and below

ISO 18172-1:2007 Gas cylinders – Refillable welded stainless steel cylinders – Part 1: Test pressure 6 MPa and below

ISO 20703:2006 Gas cylinders – Refillable welded aluminium-alloy cylinders – Design, construction and testing

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*Editorial Note.— Indent removed before Note below.*

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Note 1.— In the above referenced standards composite cylinders must be designed for unlimited service life.

*Note 2.— After the first 15 years of service, composite cylinders manufactured according to these standards, may be approved for extended service by the appropriate national authority which was responsible for the original approval of the cylinders and which will base its decision on the test information supplied by the manufacturer or owner or user.*

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5.2.1.5 The following standards apply for the design, construction, and initial inspection and test of UN metal hydride storage systems, except that inspection requirements related to the conformity assessment system and approval must be in accordance with 5.2.5:

ISO 16111:2008 Transportable gas storage devices — Hydrogen absorbed in reversible metal hydride.

### 5.2.2 Materials

In addition to the material requirements specified in the cylinder and closed cryogenic receptacle design and construction standards, and any restrictions specified in the applicable Packing Instruction for the gas(es) to be transported (e.g. Packing

Instruction 200—~~or~~ Packing Instruction 202 or Packing Instruction 214), the following standards apply to material compatibility:

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### 5.2.3 Service equipment

The following standards apply to closures and their protection:

ISO 11117:1998 Gas cylinders — Valve protection caps and valve guards for industrial and medical gas cylinders — Design, construction and tests.

ISO 10297:~~1999~~2006 Gas cylinders — Refillable gas cylinder valves — Specification and type testing.

For UN metal hydride storage systems, the requirements specified in the following standard apply to closures and their protection:

ISO 16111:2008 Transportable gas storage devices — Hydrogen absorbed in reversible metal hydride.

### 5.2.4 Periodic inspection and test

The following standards apply to the periodic inspection and testing of UN cylinders and UN metal hydride storage systems:

≠ ISO 6406:2005 Seamless steel gas cylinders — Periodic inspection and testing.

≠ ISO 10461:2005/A1:2006 Seamless aluminium-alloy gas cylinders — Periodic inspection and testing.

≠ ISO 10462:2005 Transportable cylinders for dissolved acetylene — Periodic inspection and maintenance.

SO 11623:2002 Transportable gas cylinders — Periodic inspection and testing of composite gas cylinders.

ISO 16111:2008 Transportable gas storage devices — Hydrogen absorbed in reversible metal hydride.

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### 5.2.7 Marking of UN refillable cylinders and closed cryogenic receptacles

Note.— Marking requirements for UN metal hydride storage systems are given in 5.2.9.

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### 5.2.9 Marking of UN metal hydride storage systems

5.2.9.1 UN metal hydride storage systems must be marked clearly and legibly with the marks listed below. These marks must be permanently affixed (e.g. stamped, engraved, or etched) on the metal hydride storage system. The marks must be on the shoulder, top end or neck of the metal hydride storage system or on a permanently affixed component of the metal hydride storage system. Except for the United Nations packaging symbol, the minimum size of the marks must be 5 mm for metal hydride storage systems with a smallest overall dimension greater than or equal to 140 mm and 2.5 mm for metal hydride storage systems with a smallest overall dimension less than 140 mm. The minimum size of the United Nations packaging symbol must be 10 mm for metal hydride storage systems with a smallest overall dimension greater than or equal to 140 mm and 5 mm for metal hydride storage systems with a smallest overall dimension less than 140 mm.

5.2.9.2 The following marks must be applied:

a) The UN packaging symbol 

This symbol must not be used for any purpose other than certifying that a packaging complies with the relevant requirements in Chapters 1 to 6;

b) "ISO 16111" (the technical standard used for design, manufacture and testing);

- c) The character(s) identifying the country of approval, as indicated by the distinguishing signs of motor vehicles in international traffic;
- d) The identity mark or stamp of the inspection body that is registered with the appropriate national authority of the country authorizing the marking;
- e) The date of the initial inspection, the year (four digits) followed by the month (two digits) separated by a slash (i.e. "/");
- f) The test pressure of the cylinder in bar, preceded by the letters "PH" and followed by the letters "BAR";
- g) The rated charging pressure of the metal hydride storage system in bar, preceded by the letters "RCP" and followed by the letters "BAR";
- h) The manufacturer's mark registered by the appropriate national authority. When the country of manufacture is not the same as the country of approval, then the manufacturer's mark must be preceded by the character(s) identifying the country of manufacture as indicated by the distinguishing signs of motor vehicles in international traffic. The country mark and the manufacturer's mark must be separated by a space or slash;
- i) The serial number assigned by the manufacturer;
- j) In the case of steel cylinders and composite cylinders with steel liner, the letter "H" showing compatibility of the steel (see ISO 11114-1:1997); and,
- k) In the case of metal hydride storage systems having limited life, the date of expiry, denoted by the letters "FINAL" followed by the year (four digits) followed by the month (two digits) separated by a slash (i.e. "/").

The certification marks specified in a) to e) above must appear consecutively in the sequence given. The test pressure f) must be immediately preceded by the rated charging pressure g). The manufacturing marks specified in h) to k) above must appear consecutively in the sequence given.

5.2.9.3 Other marks are allowed in areas other than the side wall, provided they are made in low stress areas and are not of a size and depth that will create harmful stress concentrations. Such marks must not conflict with required marks.

5.2.9.4 In addition to the preceding marks, each metal hydride storage system that meets the periodic inspection and test requirements of 5.2.4 must be marked indicating:

- a) The character(s) identifying the country authorizing the body performing the periodic inspection and test, as indicated by the distinguishing sign of motor vehicles in international traffic. This marking is not required if this body is approved by the appropriate national authority of the country approving manufacture;
- b) The registered mark of the body authorised by the appropriate national authority for performing periodic inspection and test;
- c) The date of the periodic inspection and test, the year (two digits) followed by the month (two digits) separated by a slash (i.e. "/" ). Four digits may be used to indicate the year.

The above marks must appear consecutively in the sequence given.

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#### **5.4 REQUIREMENTS FOR AEROSOL DISPENSERS, SMALL RECEPTACLES CONTAINING GAS (GAS CARTRIDGES) AND FUEL CELL CARTRIDGES CONTAINING LIQUEFIED FLAMMABLE GAS**

##### **5.4.1 Small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas**

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## 5.4.2 Aerosol dispensers

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5.4.3 With the approval of the appropriate national authority, aerosols and receptacles, small, ~~containing pharmaceutical products and non flammable gases which are required to be sterile, but may be adversely affected by water bath testing,~~ are not subject to 5.4.1 and 5.4.2 if: they are required to be sterile but may be adversely affected by water bath testing, provided:

- a) they contain a non-flammable gas and either:
  - i) contain other substances that are constituent parts of pharmaceutical products for medical, veterinary or similar purposes;
  - ii) contain other substances used in the production process for pharmaceutical products; or
  - iii) are used in medical, veterinary or similar applications;
- ~~a) they are manufactured under the authority of a national health administration and, if required by the appropriate national authority, follow the principles of Good Manufacturing Practice (GMP) established by the World Health Organization (WHO); and~~
- b) an equivalent level of safety is achieved by the manufacturer's use of alternative methods for leak detection and pressure resistance, such as helium detection and water bathing a statistical sample of at least 1 in 2 000 from each production batch; and
- c) for pharmaceutical products according to a) i) and iii) above, they are manufactured under the authority of a national health administration. If required by the appropriate national authority, the principles of Good Manufacturing Practice (GMP) established by the World Health Organization (WHO) must be followed.

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## Chapter 6

### PACKAGINGS FOR INFECTIOUS SUBSTANCES OF CATEGORY A

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#### 6.5 TEST REQUIREMENTS FOR PACKAGINGS

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##### 6.5.4 Puncture test

###### 6.5.4.1 Packagings with a gross mass of 7 kg or less

Samples must be placed on a level, hard surface. A cylindrical steel rod with a mass of at least 7 kg, a diameter of 38 mm and the impact end edges of a radius not exceeding 6 mm (see Figure 6-1) must be dropped in a vertical free fall from a height of one metre measured from the impact end to the impact surface of the sample. One sample must be placed on its base. A second sample must be placed in an orientation perpendicular to that used for the first sample. In each instance, the steel rod must be aimed to impact the primary receptacle. Following each impact, penetration of the secondary packaging is acceptable, provided that there is no leakage from the primary receptacle(s).

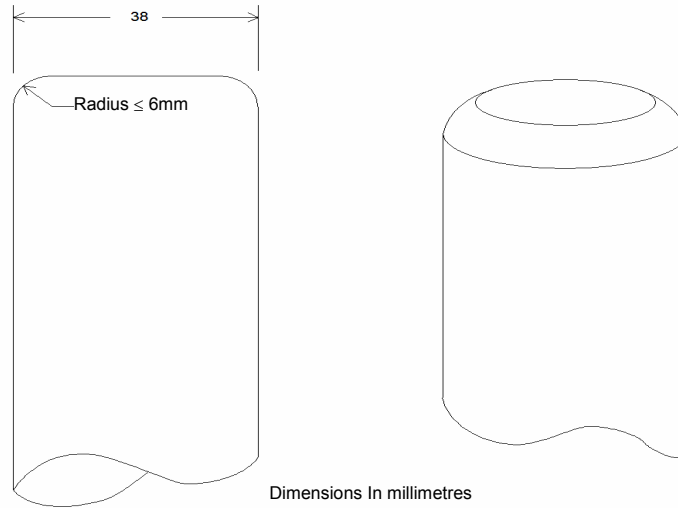
###### 6.5.4.2 Packagings with a gross mass exceeding 7 kg

Samples are dropped onto the end of a cylindrical steel rod. The rod must be set vertically on a level, hard surface. It must have a diameter of 38 mm with the upper end edges of a radius not exceeding 6 mm (see Figure 6-1). The rod must protrude from the surface a distance at least equal to the distance between the centre of the primary receptacle(s) and the outer surface of the outer packaging, with a minimum protrusion of 200 mm. One sample is dropped with its top face lowermost in a vertical free fall from a height of 1 m, measured from the top of the steel rod. A second sample is dropped from the same height in an orientation perpendicular to that used for the first sample. In each instance, the packaging must be so orientated that the steel rod would be capable of penetrating the primary receptacle(s). Following each impact, penetration of the secondary packaging is acceptable provided that there is no leakage from the primary receptacle(s).

\* WHO Publication: Quality assurance of pharmaceuticals. A compendium of guidelines and related materials. Volume 2: Good manufacturing practices and inspection.

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Insert new Figure 6-1:



**Figure 6-1. Cylindrical steel rod used for puncture test**

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## Chapter 7

### REQUIREMENTS FOR THE CONSTRUCTION, TESTING AND APPROVAL OF PACKAGES AND MATERIAL OF CLASS 7

*Parts of this Chapter are affected by State Variations CA 1, CA 3, CA 4, DE 2, DK 1, JP 8, JP 26, US 10; see Table A-1*

#### 7.1 GENERAL REQUIREMENTS

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7.1.9 All valves through which the radioactive contents could otherwise escape must be protected against unauthorized operation.

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## 7.4 REQUIREMENTS FOR INDUSTRIAL PACKAGES

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### 7.4.4 Alternative requirements for industrial packages Types 2 and 3 (Types IP-2 and IP-3)

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7.4.4.2 Freight containers ~~of a~~ with the characteristics of a permanent enclosed ~~ure~~ character may also be used as Industrial package Types 2 or 3 (Types IP-2 or IP-3), provided that:

- a) the radioactive contents are restricted to solid materials;
- b) they satisfy the requirements of 7.4.1; and
- c) they are designed to conform to ISO 1496-1:1990: "Series 1 freight containers — Specification and testing — Part 1: General cargo containers" and subsequent amendments 1:1993, 2:1998, 3:2005, 4:2006 and 5:2006, excluding dimensions and ratings. They must be designed so that, if subjected to the tests prescribed in that document and to the accelerations occurring during routine conditions of transport, they would prevent:
  - i) loss or dispersal of the radioactive contents; and
  - ii) more than a 20 per cent increase in the maximum radiation level at any external surface of the freight containers.

## 7.5 REQUIREMENTS FOR PACKAGES CONTAINING URANIUM HEXAFLUORIDE

7.5.1 Packages designed to contain uranium hexafluoride must meet the requirements prescribed elsewhere in these Instructions which pertain to the radioactive and fissile properties of the material. Except as allowed in 7.5.4, uranium hexafluoride in quantities of 0.1 kg or more must also be packaged and transported in accordance with the provisions of ISO 7195:1993 2005: "Nuclear Energy — Packaging of uranium hexafluoride (UF<sub>6</sub>) for transport", and the requirements of 7.5.2 and 7.5.3. The package must also meet the requirements prescribed elsewhere in these Instructions, which pertain to the radioactive and fissile properties of the material.

7.5.2 Each package designed to contain 0.1 kg or more of uranium hexafluoride must be designed so that it would meet the following requirements:

- a) withstand, without leakage and without unacceptable stress, as specified in ISO 7195:1993 2005, the structural test as specified in 7.20;
- b) withstand, without loss or dispersal of the uranium hexafluoride, the free drop test specified in 7.14.4; and
- c) withstand, without rupture of the containment system, the thermal test specified in 7.16.3.

7.5.3 Packages designed to contain 0.1 kg or more of uranium hexafluoride must not be provided with pressure relief devices.

7.5.4 Subject to the approval of the competent authority, packages designed to contain 0.1 kg or more of uranium hexafluoride may be transported if:

- a) the packages are designed to international or national standards other than ISO 7195:1993 2005 provided an equivalent level of safety is maintained;
- b) the packages are designed to withstand, without leakage and without unacceptable stress, a test pressure of less than 2.76 MPa, as specified in 7.20;
- c) for packages designed to contain 9 000 kg or more of uranium hexafluoride, the packages do not meet the requirement of 7.5.2 c).

In all other respects, the requirements specified in 7.5.1 to 7.5.3 must be satisfied.

## 7.6 REQUIREMENTS FOR TYPE A PACKAGES

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### 7.6.16 Type A packages to contain liquids

A Type A package designed to contain liquid radioactive material must, in addition:

- a) be adequate to meet the conditions specified in 7.6.14 a) if the package is subjected to the tests specified in 7.15; and
- b) either:
  - i) be provided with sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material must be suitably positioned so as to contact the liquid in the event of leakage; or
  - ii) be provided with a containment system composed of primary inner and secondary outer containment components, designed to ~~ensure retention of the~~ enclose the liquid contents completely and ensure their retention within the secondary outer containment components, even if the primary inner components leak.

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## 7.10 REQUIREMENTS FOR PACKAGES CONTAINING FISSILE MATERIAL

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7.10.5 The package, after being subjected to the tests specified in 7.14, must:

- a) preserve the minimum overall outside dimensions of the package to at least 10 cm; and
- b) prevent the entry of a 10-cm cube.

7.10.6 The package must be designed for an ambient temperature range of  $-40^{\circ}\text{C}$  to  $+38^{\circ}\text{C}$  unless the competent authority specifies otherwise in the certificate of approval for the package design.

7.10.7 For a package in isolation, it must be assumed that water can leak into or out of all void spaces of the package, including those within the containment system. However, if the design incorporates special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage may be assumed in respect of those void spaces. Special features must include the following:

- a) multiple high standard water barriers, ~~each of which~~ not less than two of which would remain watertight if the package were subject to the tests prescribed in 7.10.12 b), a high degree of quality control in the manufacture, maintenance and repair of packagings and tests to demonstrate the closure of each package before each shipment; or

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## 7.12 TESTING THE INTEGRITY OF THE CONTAINMENT SYSTEM AND SHIELDING AND EVALUATING CRITICALITY SAFETY

After each of the applicable tests specified in 7.14 to 7.20:

- a) faults and damages must be identified and recorded;
- b) it must be determined whether the integrity of the containment system and shielding has been retained to the extent required in 7.1 to 7.10 for the package under test; and
- c) it must be determined, for packages containing fissile material, whether the assumptions and conditions used in the assessments required by 7.10.1 to 7.10.4 ~~2~~ 13 for one or more packages are valid.

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**7.14 TESTS FOR DEMONSTRATING ABILITY  
TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT**

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7.14.5 Stacking test: unless the shape of the packaging effectively prevents stacking, the specimen must be subjected, for a period of 24 hours, to a compressive load equal to the greater of the following:

- a) ~~the equivalent of 5 times the mass of the actual package~~ a total weight equal to five times the maximum weight of the package; and
- b) the equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load must be applied uniformly to two opposite sides of the specimen, one of which must be the base on which the package would typically rest.

— END —