



WORKING PAPER

**DANGEROUS GOODS PANEL (DGP)
MEETING OF THE WORKING GROUP OF THE WHOLE**

Memphis, 30 April to 4 May 2007

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 2009/2010 Edition

2.6: Part 6 — Packaging Nomenclature, Marking, Requirements and Tests

**DRAFT AMENDMENTS TO 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 (Chapters 1, 2, 4, 5, 6 and 7) 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 third session (Geneva, 15 December 2006).

The DGP-WG 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 1

APPLICABILITY, NOMENCLATURE AND CODES

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1.2 CODES FOR DESIGNATING TYPES OF PACKAGINGS

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1.2.6 The following capital letters must 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. Plastic material
- L. Textile
- M. Paper, multiwall
- N. Metal (other than steel or aluminium)
- P. Glass, porcelain or stoneware (not used in these Instructions).

Note.— Plastics materials, is taken to include other polymeric materials such as rubber.

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Chapter 2

MARKING OF PACKAGINGS OTHER THAN INNER PACKAGINGS

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2.1 MARKING REQUIREMENTS FOR PACKAGINGS OTHER THAN INNER PACKAGINGS

2.1.1 Each packaging intended for use according to these Instructions must 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, must appear on the top or on a side of the packaging. Letters, numerals and symbols must be at least 12 mm high, except for packagings of 30 L or 30 kg capacity or less, when they must be at least 6 mm in height and for packagings of 5 L or 5 kg or less when they must be of an appropriate size. The markings must show:

- a) the United Nations packaging symbol 

This symbol must not be used for any purpose other than certifying that a packaging complies with the relevant requirements in Chapters 1.3 and performance tests in Chapter through 4.6. For embossed metal packagings the capital letters "UN" may be applied as the symbol;

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Chapter 4

PACKAGING PERFORMANCE TESTS

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4.1 PERFORMANCE AND FREQUENCY OF TESTS

4.1.1 The design type of each packaging must be tested as provided for in this Chapter in accordance with procedures established by the appropriate national authority.

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

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4.3.4 Target

The target must be a rigid, non-resilient, flat and horizontal surface and must be:

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

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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

5.1 GENERAL REQUIREMENTS

Note 1.— For aerosol dispensers ~~and~~ 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.

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5.1.1.9 Additional requirements for the construction of pressure receptacles for acetylene

Editorial Note.— The text below is moved from 4;4.1.1.2:

Cylinders for UN 1001 Acetylene, dissolved and UN 3374 Acetylene, solvent free must be filled with a porous mass, uniformly distributed, of a type that conforms to the requirements and testing specified by the appropriate national authority and which:

- a) is compatible with the cylinder and does not form harmful or dangerous compounds either with the acetylene or with the solvent in the case of UN 1001; and
- b) is capable of preventing the spread of decomposition of the acetylene in the porous mass.

In the case of UN 1001, the solvent must be compatible with the cylinders.

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5.1.3 Service equipment

5.1.3.1 Valves, piping and other fittings subjected to pressure. ~~Except for excluding~~ pressure relief devices, ~~valves, piping, fittings and other equipment subjected to pressure~~ must be designed and constructed to withstand at so that the burst pressure is at least 1.5 times the test pressure of the cylinders and closed cryogenic receptacles.

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Editorial Note.— Paragraph 5.1.4 below is moved from current 5.1.6:

5.1.6~~4~~5.1.4 Approval of cylinders and closed cryogenic receptacles

5.1.6~~4~~1 The conformity of cylinders and closed cryogenic receptacles must be assessed at the time of manufacture as required by the appropriate national authority. Cylinders and closed cryogenic receptacles must be inspected, tested and approved by an inspection body. The technical documentation must include full specifications on design and construction, and full documentation on the manufacturing and testing.

5.1.6~~4~~2 Quality assurance systems must conform to the requirements of the appropriate national authority.

5.1.4~~5~~5 Initial inspection and testing

5.1.4~~5~~1 New cylinders must be subjected to inspection and testing during and after manufacture in accordance with the applicable design standards including the following:

On an adequate sample of cylinders:

- a) testing of the mechanical characteristics of the material of construction;
- b) verification of the minimum wall thickness;
- c) verification of the homogeneity of the material for each manufacturing batch;
- d) inspection of the external and internal conditions of the cylinders;
- e) inspection of the neck threads;
- f) verification of the conformance with the design standard;

For all cylinders:

- g) a hydraulic pressure test. Cylinders must withstand the test pressure without expansion greater than that allowed in the design specifications;

Note.— *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.*

- h) inspection and assessment of manufacturing defects and either repairing them or rendering the cylinders unserviceable. In the case of welded cylinders, particular attention must be paid to the quality of the welds;
- i) an inspection of the markings on the cylinders;
- j) in addition, cylinders intended for the transport of UN 1001 **Acetylene, dissolved**, and UN 3374 **Acetylene, solvent free**, must be inspected to ensure proper installation and condition of the porous mass and, if applicable, the quantity of solvent.

5.1.4~~5~~2 On an adequate sample of closed cryogenic receptacles, the inspections and tests specified in 5.1.4~~5~~1 a), b), d) and f) must be performed. In addition, welds must be inspected by radiographic, ultrasonic or another suitable non-destructive test method on a sample of closed cryogenic receptacles according to the applicable design and construction standard. This weld inspection does not apply to the jacket. Additionally, all closed cryogenic receptacles must undergo the inspections and tests specified in 5.1.4~~5~~1 g), h) and i), as well as a leakproofness test and a test of the satisfactory operation of the service equipment after assembly.

5.1.5~~6~~5.1.5 Periodic inspection and testing

5.1.5~~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.

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

5.1.5.6.2 ~~For~~ cylinders intended for the transport of UN 1001 **Acetylene, dissolved**, and UN 3374 **Acetylene, solvent free**, must be examined only as specified in 5.1.6.1 a), c) and e). ~~only the external condition (corrosion, deformation) and the~~ In addition, the condition of the porous ~~mass~~ material (e.g. cracks, top clearance, loosening, settlement) must be examined.

Editorial Note.— Paragraph 5.1.6 below is moved to 5.1.4:

~~5.1.6 Approval of cylinders and closed cryogenic receptacles~~

~~5.1.6.1 The conformity of cylinders and closed cryogenic receptacles must be assessed at the time of manufacture as required by the appropriate national authority. Cylinders and closed cryogenic receptacles must be inspected, tested and approved by an inspection body. The technical documentation must include full specifications on design and construction, and full documentation on the manufacturing and testing.~~

~~5.1.6.2 Quality assurance systems must conform to the requirements of the appropriate national authority.~~

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

+ *Note.— The maximum of 1 000 L volume as mentioned in the ISO standard ISO 21029-1:2004 Cryogenic vessels, does not apply for refrigerated liquefied gases in closed cryogenic receptacles installed in apparatus (e.g. MRI or cooling machines).*

For the cylinder shell:

ISO 9809-1:1999 Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa.

Note.— The note concerning the F factor in section 7.3 of this standard must not be applied for UN cylinders.

ISO 9809-3:2000 Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 3: Normalized steel cylinders.

> ~~ISO 11118:1999 Gas cylinders — Non-refillable metallic gas cylinders — Specification and test methods.~~

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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), the following standards apply to material compatibility:

ISO 11114-1:1997 Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials.

ISO 11114-2:2000 Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials.

Note.— The limitations imposed in ISO 11114-1 on high strength steel alloys at ultimate tensile strength levels up to 1 100 MPa do not apply to Silane (UN 2203).

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5.2.4 Periodic inspection and test

The following standards apply to the periodic inspection and testing of UN cylinders:

ISO 6406:1992~~2005~~ ~~Periodic inspection and testing of s~~ Seamless steel gas cylinders — Periodic inspection and testing.

ISO 10461:1993~~2005/A1:2006~~ Seamless aluminium—~~A~~ alloy gas cylinders — Periodic inspection and testing.

ISO 10462:1994~~2005~~ Transportable C cylinders for dissolved acetylene — Periodic inspection and maintenance.

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

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5.2.7 Marking of UN refillable cylinders and closed cryogenic receptacles

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5.2.7.1 The following certification marks must be applied:

a) The UN packaging symbol 

≠ This symbol must ~~only be marked on cylinders and closed cryogenic receptacles that conform to the requirements of these Instructions for UN cylinders and closed cryogenic receptacles~~ not be used for any purpose other than certifying that a packaging complies with the relevant requirements in Chapters 1 through 3;

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

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

5.4.1.1 Each receptacle or fuel cell cartridge must be subjected to a test performed in a hot water bath; the temperature of the bath and the duration of the test must be such that the internal pressure reaches that which would be reached at 55°C (50°C if the liquid phase does not exceed 95 per cent of the capacity of the receptacle or the fuel cell cartridge at 50°C). If the contents are sensitive to heat or if the receptacles or the fuel cell cartridges are made of plastics material which softens at this test temperature, the temperature of the bath must be set at between 20°C and 30°C but, in addition, one receptacle or fuel cell cartridge in 2 000 must be tested at the higher temperature.

5.4.1.2 No leakage or permanent deformation of a receptacle or fuel cell cartridge may occur, except that a plastic receptacle or fuel cell cartridge may be deformed through softening provided it does not leak.

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Chapter 6

INFECTIOUS SUBSTANCES OF CATEGORY A PACKAGINGS

6.1 GENERAL

6.1.1 The requirements of this chapter apply to packagings intended for the transport of infectious substances of Category A.

Editorial Note.— Paragraph 6.1.2 below is moved to 6.5.2.1:

6.2 REQUIREMENTS FOR PACKAGINGS

Editorial Note.— Paragraph 6.2.1 below is almost the same as 6;1.1.2:

6.2.1 The requirements for packagings in this section are based on packagings, as specified in Chapter 2, 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 this chapter provided that they are equally effective, acceptable to the competent authority and able successfully to withstand the tests described in 6.3.5. Methods of testing other than those described in these Regulations are acceptable provided they are equivalent.

Editorial Note.— Paragraph 6.2.2 below is almost the same as 4;1.1.2:

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

Editorial Note.— Paragraph 6.2.3 below almost the same as 6;1.1.3:

6.2.3 Manufacturers and subsequent distributors of packagings must provide information regarding procedures to be followed (including closure instructions for inner packagings and receptacles), a description of the types and dimensions of the closures (including required gaskets) and any other components needed to ensure that packages, as presented for transport, are capable of passing the applicable performance tests of this chapter.

6.3 CODE FOR DESIGNATING TYPES OF PACKAGINGS

6.3.1 The codes for designating types of packagings are set out in 6;1.2.

6.3.2 The letters “U” or “W” may follow the packaging code. The letter “U” signifies a special packaging conforming to the requirements of 6.5.1.6. The letter “W” signifies that the packaging, although, of the same type indicated by the code is manufactured to a specification different from that in Chapter 3 and is considered equivalent under the requirements of 6.2.1.

6.4 MARKING

Editorial Note.— Notes below are similar to 6;2, Introductory notes:

Note 1.— The marking indicates that the packaging which bears it corresponds to a successfully tested design type and that it complies with the provisions of this chapter which are related to the manufacture, but not to the use, of the packaging.

Note 2.— The marking is intended to be of assistance to packaging manufacturers, reconditioners, packaging users, operators and appropriate authorities.

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, test reports or register of successfully tested packagings.

Editorial Note.— Paragraph 6.4.1 below similar to 6;2.1.1:

6.4.1 Each packaging intended for use according to these Instructions must 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, must appear on the top or on a side of the packaging. Letters, numerals and symbols must be at least 12 mm high, except for packagings of 30 L or 30 kg capacity or less, when they must be at least 6 mm in height and for packagings of 5 L or 5 kg or less when they must be of an appropriate size.

6.4.2 A packaging that meets the requirements of this section and of 6.5 shall be marked with:

a) the United Nations 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 through 6.

- b) the code designating the type of packaging according to the requirements of 6.1.2;
- c) the text "CLASS 6.2";
- d) the last two digits of the year of manufacture of the packaging;
- e) the State authorizing the allocation of the mark, indicated by the distinguishing sign for motor vehicles in international traffic;
- f) the name of the manufacturer or other identification of the packaging specified by the competent authority; and
- g) for packagings meeting the requirements of 6.5.1.6, the letter "U", inserted immediately following the marking required in b) above.

Editorial Note.— Paragraph 6.4.3 below is similar to 6.2.1.7:

6.4.3 Marking must be applied in the sequence of the sub-paragraphs in 6.4.2; each element of the marking required in these sub-paragraphs must be clearly separated, e.g. by a slash or space, so as to be easily identified. For examples see 6.4.4. Any additional markings authorized by a competent authority must still enable the parts of the mark to be correctly identified with reference to 6.4.1.

Editorial Note.— Paragraph 6.4.4 below is similar to 6.2.2.3:

6.4.4 Example of marking

	<u>4G/CLASS 6.2/06</u>	<u>as in 6.4.2 a), b), c) and d)</u>
	<u>S/SP-9989-ERIKSSON</u>	<u>as in 6.4.2 e) and f)</u>

6.5 Test requirements for packagings

6.5.1 Performance and frequency of tests

6.5.1.1 The design type of each packaging must be tested as provided for in this Chapter in accordance with procedures established by the competent authority.

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

6.5.1.3 Tests must be repeated on production samples at intervals established by the competent authority.

6.5.1.4 Tests must also be repeated after each modification which alters the design, material or manner of construction of a packaging.

Editorial Note.— Paragraph 6.5.1.5 is moved from 6.6.1.3:

6.5.1.5 The appropriate national 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 or lower net mass of primary receptacles; and packagings such as drums, bags and boxes which are produced with small reductions in external dimension(s).

Editorial Note.— Paragraph 6.5.1.6 is moved from 6.4:

6.5.1.6 Inner primary receptacles of any type may be assembled within an intermediate (secondary) packaging and transported without testing in the rigid outer packaging under the following conditions:

- a) The intermediate/ rigid outer packaging combination must have been successfully tested in accordance with 6.5.2.2 with fragile (e.g. glass) inner primary receptacles;
- b) The total combined gross mass of inner primary receptacles must not exceed one-half the gross mass of inner primary receptacles used for the drop test in a) above;

- c) The thickness of cushioning between ~~inner~~ primary receptacles and between ~~inner~~ primary receptacles and the outside of the ~~intermediate~~ secondary packaging must not be reduced below the corresponding thicknesses in the originally tested packaging; and if a single ~~inner~~ primary receptacle was used in the original test, the thickness of cushioning between ~~inner~~ primary receptacles must not be less than the thickness of cushioning between the outside of the ~~intermediate~~ secondary packaging and the ~~inner~~ primary receptacle in the original test. When either fewer or smaller ~~inner~~ primary receptacles are used (as compared to the ~~inner~~ primary receptacles used in the drop test), sufficient additional cushioning material must be used to take up the void spaces;
- d) The rigid outer packaging must have successfully passed the stacking test in 4.6 while empty. The total mass of identical packages must be based on the combined mass of ~~inner receptacles~~ packagings used in the drop test in a) above;
- e) For ~~inner~~ primary receptacles containing liquids, an adequate quantity of absorbent material to absorb the entire liquid content of the ~~inner~~ primary receptacles must be present;
- f) If the rigid outer packaging is intended to contain ~~inner~~ primary receptacles for liquids and is not leakproof, or is intended to contain ~~inner~~ primary receptacles for solids and is not siftproof, a means of containing any liquid or solid contents in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally effective means of containment; and
- g) The marking required by 2.2.2 b) must be followed by the letter "U". In addition to the markings prescribed in 6.4.2 (a) to (f), packagings shall be marked in accordance with 6.4.2 (g).

6.5.1.7 The competent authority may at any time require proof, by tests in accordance with this Chapter, that serially produced packagings meet the requirements of the design type tests.

6.5.1.8 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.

~~6.1.1 Other than for packagings for live animals and organisms, samples of each packaging must be prepared for testing as described in 6.1.2 and then subjected to the tests in 6.2 and 6.3. If the nature of the packaging makes it necessary, equivalent preparation and tests are permitted, providing that these may be demonstrated to be at least as effective.~~

6.5.2 Preparation of packagings for testing

~~6.1.2~~ 6.5.2.1 Samples of each packaging must be prepared as for transport except that the liquid or solid infectious substance must be replaced by water or, where conditioning at -18°C is specified in 6.2.1, by a water/antifreeze mixture. Each primary receptacle must be filled to not less than 98 per cent of its capacity.

Note 2.— The term water includes water/antifreeze solution with a minimum specific gravity of 0.95 for testing at -18°C .

Editorial Note.— Paragraph 6.1.3 below is moved to 6.5.1.5:

~~6.1.3 The appropriate national 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).~~

~~6.1.4 Provided an equivalent level of performance is maintained, the following variations in the primary receptacles placed within a secondary packaging are allowed without further testing of the completed package:~~

~~a) primary receptacles of equivalent or smaller size as compared to the tested primary receptacles, provided:~~

- ~~1) the primary receptacles are of similar design to the tested primary receptacle (e.g. shape: round, rectangular, etc.);~~
- ~~2) the material of construction of the primary receptacle (glass, plastic, metal, etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested primary receptacle;~~
- ~~3) the primary receptacles have the same or smaller openings and the closure is of similar design (e.g. screw cap, friction lid, etc.);~~
- ~~4) sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the primary receptacles; and~~

- 5) the primary receptacles are oriented within the secondary packaging in the same manner as in the tested package;
- b) a lesser number of the tested primary receptacles, or of the alternate types of primary receptacles identified in a), providing sufficient cushioning is added to fill the void spaces and to prevent significant movement of the primary receptacles.

6.4.5.5.2.2 Tests and number of samples required

Table 6.4. Tests required for packaging types

Material of					Tests required				
outer packaging			inner packaging		refer to 6.2				refer to 6.3
Fibreboard	Plastic	Other	Plastic	Other	a	b	c	d	
x			x			x	x	when dry ice is used	x
x				x		x			x
	x		x				x		x
	x			x			x		x
		x	x				x		x
		x		x	x				x

<u>Type of packaging^a</u>		<u>Tests required</u>						
<u>Rigid outer packaging</u>	<u>Primary receptacle</u>		<u>Water spray</u> 6.5.3.6.1	<u>Cold conditioning</u> 6.5.3.6.2	<u>Drop</u> 6.5.3	<u>Additional drop</u> 6.5.3.6.3	<u>Puncture</u> 6.5.4	<u>Stack</u> 6.4.6
	<u>Plastics</u>	<u>Other</u>	<u>No. of samples</u>	<u>No. of samples</u>	<u>No. of samples</u>	<u>No. of samples</u>	<u>No. of samples</u>	<u>No. of samples</u>
<u>Fibreboard box</u>	X		5	5	10	Required on one sample when the packaging is intended to contain dry ice.	2	Required on three samples when testing a "U"-marked packaging as defined in 6.3.5.1.6 for specific provisions.
<u>Fibreboard drum</u>		X	5	0	5		2	
<u>Plastics box</u>	X		3	3	6		2	
<u>Plastics drum/jerrican</u>		X	3	0	3		2	
<u>Boxes of other material</u>	X		0	5	5		2	
<u>Drums/jerricans of other material</u>		X	0	0	5		2	
	X		0	3	3		2	
		X	0	0	3		2	

^a Type of packaging categorizes packagings for test purposes according to the kind of packaging and its material characteristics.

Note 1:— In instances where a primary receptacle is made of two or more materials, the material most liable to damage determines the appropriate test.

Note 2.— The material of the secondary packagings are not taken into consideration when selecting the test or conditioning for the test.

6.5.2.2.1 Explanation for use of the table

6.5.2.2.1.1 If the packaging to be tested consists of a fibreboard outer box with a plastics primary receptacle, five samples must undergo the water spray test (see 6.5.3.6.1) prior to dropping and another five must be conditioned to -18°C (see 6.5.3.6.2) prior to dropping. If the packaging is to contain dry ice then one further single sample must be dropped five times after conditioning in accordance with 6.5.3.6.3.

6.5.2.2.1.2 Packagings prepared as for transport must be subjected to the tests in 6.5.3 and 6.5.4. For outer packagings, the headings in the table relate to fibreboard or similar materials whose performance may be rapidly affected by moisture; plastics which may embrittle at low temperature; and other materials such as metal whose performance is not affected by moisture or temperature.

6.25.3 Drop test procedure

6.5.3.1 a)— Samples must be subjected to free-fall drops from a height of 9 metres onto a rigid, non-resilient, flat, horizontal, flat, massive and rigid surface ~~from a height of 9 metres~~ in conformity with 6.4.3.4.

6.5.3.2 Where the samples are in the shape of a box, five must be dropped ~~in sequence~~ one in each of the following orientations:

- 1a) flat onto the base;
- 2b) flat onto the top;
- 3c) flat onto the longest side;
- 4d) flat onto the shortest side;
- 5e) onto a corner.

6.5.3.3 Where the samples are in the shape of a drum, three must be dropped ~~in sequence~~ one in each of the following orientations:

- 6a) diagonally onto the top chime, with the centre of gravity directly above the point of impact;
- 7b) diagonally onto the base chime;
- 8c) flat onto the side.

Editorial Note.— Paragraph 6.5.3.4 below is moved from current Note under new 6.5.3.5 below:

6.5.3.4 While the sample must be released in the required orientation, it is accepted that for aerodynamic reasons the impact may not take place in that orientation.

6.5.3.5 Following the appropriate drop sequence, there must be no leakage from the primary receptacle(s), which must remain protected by cushioning/absorbent material in the secondary packaging.

~~— Note. — While the sample must be released in the required orientation, it is accepted that for aerodynamic reasons the impact may not take place in that orientation.~~

6.5.3.6 Special preparation of test sample for the drop test

6.5.3.6.1 Fibreboard — water spray test

— b) Fibreboard outer packagings: The sample must be subjected to a water spray that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour. It must then be subjected to the test described in a) 6.5.3.1 above.

6.5.3.6.2 Plastics material — cold conditioning

— c) Plastics primary receptacles or outer packagings: ~~The samples must be conditioned in an atmosphere of temperature of the test sample and its contents shall be reduced to~~ –18°C or less, lower for a period of at least 24 hours and within 15 minutes of removal from that atmosphere the test sample must be subjected to the test described in a) ~~above~~ 6.5.3.1. Where the sample contains dry ice, the conditioning period may be reduced to 4 hours.

6.5.3.6.3 Packagings intended to contain dry ice — additional drop test

— d) ~~Where the packaging is intended to contain dry ice, a test additional to that specified in a) or b) or c) 6.5.3.1 and, when appropriate, in 6.5.3.6.1 or 6.5.3.6.2 must be carried out. One sample must be stored so that all the dry ice dissipates and then that sample be subjected to the test described in a) must be dropped in one of the orientations described in 6.5.3.2 which must be that most likely to result in failure of the packaging.~~

~~6.36.5.4~~ 6.5.4 Puncture test

6.5.4.1 ~~Packagings with a gross mass of 7 kg or less must be subjected to the test described in a) below and packagings with a gross mass exceeding 7 kg must be subjected to the test described in b) below.~~

— a) ~~Samples must be placed on a level, hard surface. A cylindrical steel rod with a mass of at least 7 kg, a diameter not exceeding 38 mm and the impact end edges of a radius not exceeding 6 mm 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

—b) 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. 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).

6.4 SPECIAL PACKAGING

Editorial Note.— Moved to 6;5.1.6

~~Inner receptacles of any type may be assembled within an intermediate (secondary) packaging and transported without testing in the outer packaging under the following conditions:~~

- ~~—a) The intermediate/outer packaging combination must have been successfully tested in accordance with 6.2 with fragile (e.g. glass) inner receptacles;~~
- ~~—b) The total combined gross mass of inner receptacles must not exceed one half the gross mass of inner receptacles used for the drop test in a) above;~~
- ~~—c) The thickness of cushioning between inner receptacles and between inner receptacles and the outside of the intermediate packaging must not be reduced below the corresponding thicknesses in the originally tested packaging; and if a single inner receptacle was used in the original test, the thickness of cushioning between inner receptacles must not be less than the thickness of cushioning between the outside of the intermediate packaging and the inner receptacle in the original test. When either fewer or smaller inner receptacles are used (as compared to the inner receptacles used in the drop test), sufficient additional cushioning material must be used to take up the void;~~
- ~~—d) The outer packaging must have successfully passed the stacking test in 4.6 while empty. The total mass of identical packages must be based on the combined mass of inner receptacles used in the drop test in a) above;~~
- ~~—e) For inner receptacles containing liquids, an adequate quantity of absorbent material to absorb the entire liquid content of the inner receptacles must be present;~~
- ~~—f) If the outer packaging is intended to contain inner receptacles for liquids and is not leakproof, or is intended to contain inner receptacles for solids and is not siftproof, a means of containing any liquid or solid contents in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally effective means of containment; and~~
- ~~—g) The marking required by 2.2.2 b) must be followed by the letter "U".~~

6.5.5 Test report

6.5.5.1 A written test report containing at least the following particulars must be prepared and must be available to the users of the packaging:

- a) name and address of the test facility;
- b) name and address of the applicant (where appropriate);
- c) a unique test report identification;
- d) date of the test and of the report;
- e) manufacturer of the packaging;

- f) 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);
- g) maximum capacity;
- h) characteristics of the test contents, e.g. viscosity and relative density for liquids and particle size for solids;
- i) test descriptions and results;
- j) a signature and the name and status of the signatory.

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

Chapter 7

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

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7.4 REQUIREMENTS FOR INDUSTRIAL PACKAGES

...

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

7.4.4.1 Packages may be used as a Type IP-2 package, provided that:

- a) they satisfy the requirements of 7.4.1;
- b) they are designed to conform to the standards prescribed satisfy the requirements prescribed for packing group I or II in Part 6, Chapters 1 through 3, 4, or other requirements at least equivalent to those standards of these Instructions; and
- c) when subjected to the tests required for Packing Group I or II in Part 6, Chapter 4, 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 package.

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

...

7.10 REQUIREMENTS FOR PACKAGES CONTAINING FISSILE MATERIAL

...

7.10.2 Fissile material meeting one of the provisions in a) to d) below of 2;7.2.3.5 is excepted from the requirement to be transported in packages that comply with 7.10.3 to 7.10.12, as well as the other requirements of these Instructions that apply to fissile material. Only one type of exception is allowed per consignment:

Editorial Note.— The remaining paragraph 7.10.2 has been moved to 2;7.2.3.5:

~~— a) A mass limit per consignment such that:~~

$$\frac{\text{mass of uranium - 235(g)} + \text{mass of other fissile material (g)}}{X + Y} \leq 1$$

~~≠ where X and Y are the mass limits defined in Table 6-5, provided that the smallest external dimension of each package is not less than 10 cm and that either:~~

- ~~— i) each individual package contains not more than 15 g of fissile material;~~
- ~~— ii) the fissile material is a homogeneous hydrogenous solution or mixture where the ratio of fissile nuclides to hydrogen is less than 5 per cent by mass; or~~
- ~~≠ — iii) there are not more than 5 g of fissile material in any 10 L volume of material.~~

~~+ Neither beryllium nor deuterium in hydrogenous material enriched in deuterium must be present in quantities exceeding 1 per cent of the applicable consignment mass limits provided in Table 6-5, except for deuterium in natural concentration in hydrogen.~~

- ~~— b) Uranium enriched in uranium-235 to a maximum of 1 per cent by mass, and with a total plutonium and uranium-233 content not exceeding 1 per cent of the mass of uranium-235, provided that the fissile material is distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it must not form a lattice arrangement;~~
- ~~— c) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 per cent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 per cent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2;~~
- ~~— d) Packages containing, individually, a total plutonium mass not more than 1 kg, of which not more than 20 per cent by mass may consist of plutonium-239, plutonium-241 or any combination of those radionuclides.~~

Table 6-5. Consignment mass limits for exceptions from the requirements for packages containing fissile material

<i>Fissile material</i>	<i>Fissile material mass (g) mixed with substances having an average hydrogen density less than or equal to water</i>	<i>Fissile material mass (g) mixed with substances having an average hydrogen density greater than water</i>
Uranium-235 (X)	400	290
Other fissile material (Y)	250	180

...

7.10.12 A number “N” must be derived, such that two times “N” must be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

- a) hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 20 cm of water; and
- b) the tests specified in 7.14 followed by whichever of the following is the more limiting:
 - i) the tests specified in 7.16.2 b) and, either 7.16.2 c) for packages having a mass not greater than 500 kg and an overall density not greater than 1 000 kg/m³ based on the external dimensions, or 7.16.2 a) for all other packages; followed by the test specified in 7.16.3 and completed by the tests specified in 7.18.1 to 7.18.3; or
 - ii) the test specified in 7.16.4; and
- c) where any part of the fissile material escapes from the containment system following the tests specified in 7.10.12 b), it must be assumed that fissile material escapes from each package in the array and all of the fissile

material must be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.

7.10.13 The criticality safety index (CSI) for packages containing fissile material must be obtained by dividing the number 50 by the smaller of the two values of N derived in 7.10.11 and 7.11.12 (i.e. $CSI = 50/N$). The value of the criticality safety index may be zero, provided that an unlimited number of packages is subcritical (i.e. N is effectively equal to infinity in both cases).

...

7.21 APPROVALS OF PACKAGE DESIGNS AND MATERIALS

7.21.1 The approval of designs for packages containing 0.1 kg or more of uranium hexafluoride requires that:

- a) each design that meets the requirements of 7.5.4 requires multilateral approval;
- b) each design that meets the requirements of 7.5.1 to 7.5.3 must require unilateral approval by the competent authority of the State of Origin of the design, unless multilateral approval is otherwise required by these Instructions.

7.21.2 Each Type B(U) and Type C package design requires unilateral approval, except that:

- ≠ a) a package design for fissile material, which is also subject to 5;1.2.3.2.1 and 7.21.4 must require multilateral approval; and
- ≠ b) a Type B(U) package design for low dispersible radioactive material must require multilateral approval.

7.21.3 Each Type B(M) package design, including those for fissile material which are also subject to 5;1.2.3.2.1 and 7.21.4 and those for low dispersible radioactive material, must require multilateral approval.

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— END —