

**DANGEROUS GOODS PANEL (DGP)****NINETEENTH MEETING****Montreal, 27 October to 7 November 2003****Agenda Item 2 Development of recommendations for amendments to the Technical  
: Instructions for incorporation in the 2005/2006 edition****AMENDMENTS TO THE TECHNICAL INSTRUCTIONS TO ALIGN  
WITH THE UN RECOMMENDATIONS - PART 6**

(Presented by the Secretary)

**SUMMARY**

Below are the amendments to Part 6 Chapters 1, 2, 3, 4, 5 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 the first session (Geneva, 11 to 13 December 2002) and as modified by the meetings of the Working Group of the Whole (Frankfurt, 16 to 20 September 2002 and Montreal, 5 to 9 May 2003).

**Chapter 1****APPLICABILITY, NOMENCLATURE AND CODES**

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**1.2 CODES FOR DESIGNATING TYPES OF PACKAGINGS**

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1.2.5 The following numerals must be used for the kinds of packaging:

1. Drum
2. ~~Wooden barrel (not used in these Instructions)~~ **Reserved**
3. Jerrican
4. Box

5. Bag
6. Composite packaging

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### 1.3 INDEX OF PACKAGINGS

Table 6-2 contains an index of packagings, other than inner packagings, referred to in Chapters 1 to 4. It lists all the packagings, except inner packagings, specified in the United Nations Recommendations for the transport of dangerous goods, and notes those not used in these Instructions for air transport. The index lists the number of the paragraph containing the requirements of those packagings used in these Instructions. The performance tests are specified in Chapter 4. Table 6-3 contains an index of inner packagings and lists the paragraph number containing the requirements together with, where applicable, individual performance tests (e.g. for aerosols).

**Table 6-2. Index of packagings other than inner packagings**

<i>Kind</i>	<i>Code and, where applicable, category</i>		<i>Para- graph</i>	<i>Maximu m capacity (L)</i>	<i>Maximu m net mass (kg)</i>
Steel drums	1A1	non-removable head	3.1.1	450	400
	1A2	removable head	3.1.1	450	400
Aluminium drums	1B1	non-removable head	3.1.2	450	400
	1B2	removable head	3.1.2	450	400
Metal (other than steel or aluminium) drums	1N1	non-removable head	3.1.3	450	400
	1N2	removable head	3.1.3	450	400
Steel jerricans	3A1	non-removable head	3.1.4	60	120
	3A2	removable head	3.1.4	60	120
Aluminium jerricans	3B1	non-removable head	3.1.4	60	120
	3B2	removable head	3.1.4	60	120
Plywood drums	1D		3.1.5	250	400
<del>Wooden barrels</del> <b>Reserved</b>	<del>2C1</del>	<del>bung type</del>	<b>Not used in these Instructions</b>		
	<del>2C2</del>	<del>removable head</del>			
Fibre drums	1G		3.1.6	450	400
Plastic drums and jerricans	1H1	drums, non-removable head	3.1.7	450	400
	1H2	drums, removable head	3.1.7	450	400
	3H1	jerricans, non-removable head	3.1.7	60	120
	3H2	jerricans, removable head	3.1.7	60	120

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<i>Kind</i>	<i>Code and, where applicable, category</i>	<i>Para-graph</i>	<i>Maximu m capacity (L)</i>	<i>Maximu m net mass (kg)</i>
Boxes of natural wood	4C1 ordinary	3.1.8		400
	4C2 with sift-proof walls	3.1.8		400
Plywood boxes	4D	3.1.9		400
Reconstituted wood boxes	4F	3.1.10		400

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## Chapter 2

### MARKING OF PACKAGINGS OTHER THAN INNER PACKAGINGS

#### 2.1 MARKING REQUIREMENTS FOR PACKAGINGS OTHER THAN INNER PACKAGINGS

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2.1.2 In addition to the durable markings prescribed in 2.1.1, every new metal drum of a capacity greater than 100 L must bear the marks described in 2.1.1. 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 a 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 thicknesses of the top head, body and bottom head must be marked on the bottom in a permanent form (e.g. embossed), for example '1.0-1.2-1.0' or '0.9-1.0-1.0'. Nominal thicknesses of metal must be determined according to the appropriate ISO Standard, for example ISO 3574:~~1986~~ 1999 for steel. The marks indicated in 2.1.1 f) and g) must not be applied in a permanent form (e.g. embossed) except as provided for in 2.1.5.

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2.1.6 Packagings manufactured with recycled plastic material as defined in 1;3 must be marked "REC". This mark must be placed near the mark prescribed in 2.1.1.

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*Editorial Note.*— Renumber subsequent paragraphs

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## Chapter 3

### REQUIREMENTS FOR PACKAGINGS

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

##### 3.1.1 Steel drums

###### 1A1 non-removable head

###### 1A2 removable head

3.1.1.1 Body and heads must 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.

*Note.- In the case of carbon steel drums, "suitable" steels are identified in ISO 3573:1999 "Hot rolled carbon steel sheet of commercial and drawing qualities" and ISO 3574:1999 "Cold-reduced carbon steel of commercial and drawing qualities". For carbon steel drums below 100 litres, "suitable" steels in addition to the above standards are also identified in ISO 11949:1995 "Cold-reduced electrolytic tinplate", ISO 11950:1995 "Cold-reduced electrolytic chromium/chromium oxide-coated steel" and ISO 11951:1995 "Cold-reduced blackplate in coil form for the production of tinplate or electrolytic chromium/chromium-oxide coated steel".*

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##### 3.1.7 Plastic drums and jerricans

###### 1H1 drums, non-removable head

###### 1H2 drums, removable head

###### 3H1 jerricans, non-removable head

###### 3H2 jerricans, removable head

3.1.7.1 The packaging must be manufactured from suitable plastic material and be of adequate strength in relation to its capacity and intended use. Except for recycled plastic material as defined in 1.2, no used material other than production residues or regrind from the same manufacturing process may be used. The packaging must be adequately resistant to aging and to degradation caused either by the substance contained or by ultraviolet radiation. Any permeation of the substance contained must not constitute a danger under normal conditions of transport.

~~3.1.7.2 Unless otherwise approved by the appropriate national authority, the period of use permitted for the transport of dangerous substances must not exceed five years from the date of manufacture of the packaging except where a shorter period of use is prescribed because of the nature of the substance to be transported. Packagings manufactured with such recycled plastic material must be marked 'REC' near the marks prescribed in 2.1.~~

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*Editorial Note.—* renumber subsequent paragraphs

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## REQUIREMENTS FOR PACKAGINGS

### 3.1.18 Composite packagings (plastic material)

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

#### 3.1.18.1 *Inner receptacle*

3.1.18.1.1 The provisions of 3.1.7.1 and 3.1.7.43 to 3.1.7.76 apply to inner plastic receptacles.

3.1.18.1.2 The inner plastic receptacle must fit snugly inside the outer packaging, which must be free of any projection that might abrade the plastic material.

3.1.18.1.3 Maximum capacity of inner receptacles:

6HA1, 6HB1, 6HD1, 6HG1, 6HH1: 250 L;  
6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2: 60 L.

3.1.18.1.4 Maximum net mass:

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

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## Chapter 4

### PACKAGING PERFORMANCE TESTS

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#### 4.2 PREPARATION OF PACKAGINGS FOR TESTING

4.2.1 Tests must be carried out on packagings prepared as for transport including, with respect to combination packagings, the inner packagings used. Inner or single receptacles or packagings must be filled to not less than 98 per cent of their maximum capacity for liquids or 95 per cent for solids. **Bags must only be filled to the maximum mass at which they may be used.** For **other than bags** 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 transported in the packaging 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 must 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 invalidated.

4.2.2 In the drop tests for liquids, when another substance is used, it must be of similar relative density and viscosity to those of the substance being transported. Water may also be used for the liquid drop test under the conditions set forth in 4.3.45.

4.2.3 Paper or fibreboard packagings must 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 must be chosen. The preferred atmosphere is 23EC  $\pm$ 2EC and 50 per cent  $\pm$ 2 per cent r.h. The two other options are 20EC  $\pm$ 2EC and 65 per cent  $\pm$ 2 per cent r.h., or 27EC  $\pm$ 2EC and 65 per cent  $\pm$ 2 per cent r.h.

*Note.— Average values must fall within these limits. Short-term fluctuations and measurement limitations may cause individual measurements to vary by up to  $\pm$ 5 per cent relative humidity without significant impairment of test reproducibility.*

4.2.4 Additional steps must be taken to ascertain that the plastic material used in the manufacture of plastic drums, plastic jerricans and composite packagings (plastic material) intended to contain liquid complies with the provisions in 3.1.7.1, 3.1.7.43 and 4;1.1.3. This may be done, for example, by submitting sample receptacles or packagings to a preliminary test extending over a long period, for example six months, during which the samples would remain filled with the substances they are intended to contain, and after which the samples must be submitted to the applicable tests listed in 4.3, 4.4, 4.5 and 4.6. For substances which may cause stress-cracking or weakening in plastic drums or jerricans, the sample, filled with the substance or another substance that is known to have at least as severe a stress-cracking influence on the plastic materials in question, must be subjected to a superimposed load equivalent to the total mass of identical packages which might be stacked on it during transport. The minimum stacking height, including the test sample, must be 3 m.

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### 4.3 DROP TEST

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

For other than flat drops the centre of gravity must be vertically over the point of impact. Where more than one orientation is possible for a given drop, the orientation most likely to result in failure of the packaging must be used.

#### 4.3.2 Special preparation of test samples for the drop test

The temperature of the test sample and its contents must be reduced to ! 18EC or lower for the following packagings:

- a) plastic drums (see 3.1.7);
- b) plastic jerricans (see 3.1.7);
- c) plastic boxes other than expanded polystyrene boxes (see 3.1.12);
- d) composite packagings (plastic material) (see 3.1.18); and
- e) combination packagings with plastic inner packagings, other than plastic bags intended to contain solids or articles.

Where test samples are prepared in this way, the conditioning specified in 4.2.3 may be waived. Test liquids must be kept in the liquid state by the addition of antifreeze, if necessary.

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**4.3.3** Removable head packagings for liquids must not be dropped until at least 24 hours after filling and closing to allow for any possible gasket relaxation.

#### 4.3.34 Target

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*Editorial Note.*— renumber subsequent paragraphs

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

#### 4.3.45 Drop height

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



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

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

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

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

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

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

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

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#### 4.3.56 Criteria for passing the test

4.3.56.1 Each packaging containing liquid must be leakproof when equilibrium has been reached between the internal and external pressures, except for inner packagings of combination packagings when it is not necessary that the pressures be equalized.

4.3.56.2 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 plastic bag), even if the closure **while retaining its containment function** is no longer sift-proof.

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

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

4.3.56.5 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.

4.3.56.6 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.

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## Chapter 5

### REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF CYLINDERS, AEROSOL DISPENSERS AND SMALL RECEPTACLES CONTAINING GAS (GAS CARTRIDGES)

#### 5.1 GENERAL REQUIREMENTS

*Note 1* — For aerosol dispensers and small receptacles containing gas (gas cartridges) see 5.4.

*Note 2* — For packagings for refrigerated liquefied gases see 5.1.3.6 and 5.5.

##### 5.1.1 Design and construction

5.1.1.1 Cylinders and their closures must be designed, manufactured, tested and equipped in such a way as to withstand all conditions, including fatigue, to which they will be subjected during normal conditions of transport.

5.1.1.2 In recognition of scientific and technological advances, and recognizing that cylinders other than those that are marked with a UN certification marking may be used on a national or regional basis, cylinders conforming to requirements other than those specified in these Instructions may be used if approved by the appropriate national authorities in the countries of transport and use.

5.1.1.3 ~~Any additional thickness used for the purpose of providing a corrosion allowance must not be taken into consideration in calculating the thickness of the walls.~~ In no case must the minimum wall thickness be less than that specified in the design and construction technical standards.

5.1.1.4 For welded cylinders, only metals of weldable quality must be used.

5.1.1.6 5 The test pressure of cylinders must be in accordance with packing instruction P200. The test pressure for closed cryogenic receptacles must be in accordance with packing instruction P202.

5.1.1.6 Not used

5.1.1.7 Contact between dissimilar metals which could result in damage by galvanic action must be avoided.

5.1.1.58 The following additional requirements apply to the construction of closed cryogenic cylinders for refrigerated liquefied gases: .

(a) 5.1.1.8.1 The mechanical properties of the metal used must be established for each cylinder at the initial inspection, including the impact strength and the bending coefficient;

(b) 5.1.1.8.2 The cylinders must be thermally insulated. The thermal insulation must be protected against impact by means of continuous sheathing a jacket. If the space between the cylinder and the sheathing jacket is evacuated of air (vacuum-insulation),

the ~~protective sheathing~~ jacket must be designed to withstand without permanent deformation an external pressure of at least 100 kPa (1 bar) **calculated in accordance with a recognised technical code or a calculated critical collapsing pressure of not less than 200 kPa (2 bar) gauge pressure.** If the ~~sheathing~~ jacket is so closed as to be gas-tight (e.g. in the case of vacuum-insulation), a device must be provided to prevent any dangerous pressure from developing in the insulating layer in the event of inadequate gas-tightness of the cylinder or its fittings. The device must prevent moisture from penetrating into the insulation.

**5.1.1.8.3** Closed cryogenic receptacles intended for the transport of refrigerated liquefied gases having a boiling point below  $-182^{\circ}\text{C}$  at atmospheric pressure must not include materials which may react with oxygen or oxygen enriched atmospheres in a dangerous manner, when located in parts of the thermal insulation where there is a risk of contact with oxygen or oxygen enriched liquid.

**5.1.1.8.4** Closed cryogenic receptacles must be designed and constructed with suitable lifting and securing arrangements.

### **5.1.2 Materials**

**5.1.2.1** Construction materials of cylinders and their closures which are in direct contact with dangerous goods must not be affected or weakened by the dangerous goods intended and must not cause a dangerous effect e.g. catalysing a reaction or reacting with the dangerous goods.

**5.1.2.2** Cylinders and their closures must be made of the materials specified in the design and construction technical standards and the applicable packing instruction for the substances intended for transport in the cylinder. The materials must be resistant to brittle fracture and to stress corrosion cracking as indicated in the design and construction technical standards.

### **5.1.3 Service equipment**

**5.1.3.1** Except for pressure relief devices, valves, piping, fittings and other equipment subjected to pressure, must be designed and constructed to withstand at least 1.5 times the test pressure of the cylinders.

**5.1.3.2** Service equipment must be configured or designed to prevent damage that could result in the release of the cylinder contents during normal conditions of handling and transport. The filling and discharge valves and any protective caps must be capable of being secured against unintended opening. Valves must be protected as specified in 4; 4.1.1.78.

**5.1.3.3** Cylinders which are not capable of being handled manually or rolled, must be fitted with devices (skids, rings, straps) ensuring that they can be safely handled by mechanical means and so arranged as not to impair the strength of, nor cause undue stresses, in the cylinder.

**5.1.3.4** Individual cylinders must be equipped with ~~approved~~ pressure relief devices as ~~required~~ **specified** in packing instruction P200(1) or **5.1.3.6.4 and 5.1.3.6.5** ~~as specified by the country of use.~~ **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.**

~~5.1.3.5~~ ~~Not used~~

5.1.3.65 Cylinders whose filling is measured by volume must be provided with a level indicator.

5.1.3.56 —~~Not used.~~ **Additional requirements for closed cryogenic receptacles**

5.1.3.6.1 Each filling and discharge opening in a closed cryogenic receptacle used for the transport of flammable refrigerated liquefied gases must be fitted with at least two mutually independent shut-off devices in series, the first being a stop-valve, the second being a cap or equivalent device.

5.1.3.6.2 For sections of piping which can be closed at both ends and where liquid product can be trapped, a method of automatic pressure-relief must be provided to prevent excess pressure build-up within the piping.

5.1.3.6.3 Each connection to a closed cryogenic receptacle must be clearly marked to indicate its function (e.g. vapour or liquid phase).

5.1.3.6.4 Pressure-relief devices

5.1.3.6.4.1 Every closed cryogenic receptacle must be provided with at least one pressure-relief device. The pressure-relief device must be of the type that will resist dynamic forces including surge.

5.1.3.6.4.2 Closed cryogenic receptacles may, in addition, have a frangible disc in parallel with the spring loaded device(s) in order to meet the requirements of 5.1.3.6.5.

5.1.3.6.4.3 Connections to pressure-relief devices must be of sufficient size to enable the required discharge to pass unrestricted to the pressure-relief device.

5.1.3.6.4.4 All pressure-relief device inlets must under maximum filling conditions be situated in the vapour space of the closed cryogenic receptacle and the devices must be so arranged as to ensure that the escaping vapour is discharged unrestrictedly.

5.1.3.6.5 Capacity and setting of pressure-relief devices

*NOTE: In relation to pressure-relief devices, MAWP means the maximum effective gauge pressure permissible at the top of a loaded closed cryogenic receptacle in its operating position including the highest effective pressure during filling and discharge.*

5.1.3.6.5.1 The pressure-relief device must open automatically at a pressure not less than the MAWP and be fully open at a pressure equal to 110% of the MAWP. It must, after discharge, close at a pressure not lower than 10% below the pressure at which discharge starts and must remain closed at all lower pressures.

5.1.3.6.5.2 Frangible discs must be set to rupture at a nominal pressure which is the lower of either the test pressure or 150% of the MAWP.

5.1.3.6.5.3 In the case of the loss of vacuum in a vacuum-insulated closed cryogenic receptacle the combined capacity of all pressure-relief devices installed must be sufficient so that the pressure (including accumulation) inside the closed cryogenic receptacle does not exceed 120% of the MAWP.

5.1.3.6.5.4 The required capacity of the pressure-relief devices must be calculated in accordance with an established technical code recognized by the competent authority. (See for example CGA Publications S-1.2-1995 and S-1.1-2001)

#### 5.1.4 Initial inspection and test

5.1.4.1 New cylinders, **other than closed cryogenic receptacles**, must be subjected to testing and inspection 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, ~~and~~;
- (d)** Inspection of the external and internal conditions of the cylinders;
- ~~(d)~~**(e)** Inspection of the neck threads;
- ~~(e)~~**(f)** Verification of the conformance with the design standard;

For all cylinders:

- ~~(f)~~**(g)** A hydraulic pressure test. Cylinders must withstand the test pressure without expansion greater than that allowed in the design specification;

*Note* — *With the agreement of the ~~inspection body~~ **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.*

- ~~(g)~~**(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;**
- ~~(h)~~**(i)** An inspection of the markings on the cylinders;
- ~~(i)~~**(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 ~~material~~ **mass** and, **if applicable**, the quantity of solvent.

5.1.4.2 On an adequate sample of closed cryogenic receptacles, the inspections and tests specified in 5.1.4.1 (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 5.1.4.1 (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 Periodic inspection and test

5.1.5.1 Refillable cylinders must be subjected to periodic inspections and tests ~~under the supervision of an inspection~~ 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. ~~by weighing~~, internal inspection, ~~checks~~ **verification of minimum** wall thickness);
- (c) Checking of the ~~neck~~ threads **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 inspection body~~ **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 or ultrasound.

5.1.5.2 For cylinders intended for the transport of UN 1001 **Acetylene, dissolved**, and UN 3374 **Acetylene, solvent free**, only the external condition (corrosion, deformation) and the condition of the porous mass (loosening, settlement) must be required to be examined.

5.1.5.3 ——— Not used

### 5.1.6 Approval of cylinders

5.1.6.1 The conformity of cylinders must be assessed at time of manufacture as required by the appropriate national authority. Cylinders 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.

### 5.1.7 Requirements for manufacturers

5.1.7.1 The manufacturer must be technically able and must possess all resources required for the satisfactory manufacture of cylinders; this relates in particular to qualified personnel:

- (a) to supervise the entire manufacturing process;
- (b) to carry out joining of materials; and
- (c) to carry out the relevant tests.

5.1.7.2 The proficiency test of a manufacturer must in all instances be carried out by an inspection body approved by the appropriate national authority of the country of approval.

### 5.1.8 Requirements for inspection bodies

Inspection bodies must be independent from manufacturing enterprises and competent to perform the tests, inspections and approvals required.

## 5.2 REQUIREMENTS FOR UN ~~CERTIFIED~~ CYLINDERS

In addition to the general requirements of 5.1, UN ~~certified~~ cylinders 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 Test

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

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 1100 MPa

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

ISO 9809-2:2000 Gas cylinders – Refillable seamless steel gas cylinders - Design, construction and testing - Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1100 MPa

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



- 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 ~~certified~~ cylinders. Aluminium alloy 6351A – T6 or equivalent is must not be authorized.*
- ISO 11118:1999 Gas cylinders – Non-refillable metallic gas cylinders - Specification and test methods
- ISO 11119-1:2002 Gas cylinders of composite construction - Specification and test methods - Part 1: Hoop wrapped composite gas cylinders
- ISO 11119-2:2002 Gas cylinders of composite construction - Specification and test methods - Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal liners

*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.*

5.2.1.2 Not used.

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

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 1100 MPa  
*Note* — *The note concerning the F factor in section 7.3 of this standard must not be applied for UN ~~certified~~ cylinders*
- ISO 9809-3:2000 Gas cylinders – Refillable seamless steel gas cylinders - Design, construction and testing – Part 3: Normalized steel cylinders
- 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 ~~certified~~ cylinders. Aluminium alloy 6351A – T6 or equivalent is must not be authorized.*
- ISO 11118:1999 Gas cylinders – Non-refillable metallic gas cylinders - Specification and test

methods

For the porous mass in the cylinder:

ISO 3807-1:2000	Cylinders for acetylene – Basic requirements - Part 1: Cylinders without fusible plugs
ISO 3807-2:2000	Cylinders for acetylene – Basic requirements - Part 2: Cylinders with fusible plugs

### 5.2.2 Materials

In addition to the material requirements specified in the cylinder design and construction standards, and any restrictions specified in the applicable packing instruction for the gas(es) to be transported (e.g. packing instruction P200), 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

### 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	Gas cylinders –Refillable gas cylinder valves - Specification and type testing.

### 5.2.4 Periodic inspection and test

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

ISO 6406:1992	Periodic inspection and testing of seamless steel gas cylinders
ISO 10461:1993	Seamless aluminium - alloy gas cylinders - Periodic inspection and testing
ISO 10462:1994	Cylinders for dissolved acetylene – Periodic inspection and maintenance
ISO 11623:2002	Transportable gas cylinders - Periodic inspection and testing of composite gas cylinders

### 5.2.5 Conformity assessment system and approval for manufacture of cylinders

#### 5.2.5.1 Definitions

For the purposes of this section:

*Conformity assessment system:* means a system for appropriate national authority approval of a manufacturer, by cylinder design type approval, approval of manufacturer's quality system and approval of inspection bodies;

*Design type:* means a cylinder design as specified by a particular cylinder standard;

*Verify:* means confirm by examination or provision of objective evidence that specified requirements have been fulfilled.

#### 5.2.5.2 *General requirements*

##### *Appropriate National Authority*

5.2.5.2.1 The appropriate national authority that approves the cylinder must approve the conformity assessment system for the purpose of ensuring that cylinders conform to the requirements of these Instructions. In instances where the appropriate national authority that approves a cylinder is not the appropriate national authority in the country of manufacture, the marks of the approval country and the country of manufacture must be indicated in the cylinder marking (see 5.2.6 and 5.2.7).

The appropriate national authority of the country of approval must supply, upon request, evidence demonstrating compliance to this conformity assessment system to its counterpart in a country of use.

5.2.5.2.2 The appropriate national authority may delegate its functions in this conformity assessment system in whole or in part.

5.2.5.2.3 The appropriate national authority must ensure that a current list of approved inspection bodies and their identity marks and approved manufacturers and their identity marks is available.

##### *Inspection body*

5.2.5.2.4 The inspection body must be approved by the appropriate national authority **for the inspection** ~~as an inspector~~ of cylinders and must:

- (a) have a staff with an organisational structure, capable, trained, competent, and skilled, to satisfactorily perform its technical functions;
- (b) have access to suitable and adequate facilities and equipment;
- (c) operate in an impartial manner and be free from any influence which could prevent it from doing so;
- (d) ensure **commercial** confidentiality of the commercial and proprietary activities of the manufacturer and other bodies;
- (e) maintain clear demarcation between actual inspection body functions and unrelated functions;
- (f) operate a documented quality system;

- (g) ensure that the tests and inspections specified in the relevant cylinder standard and these ~~model regulations~~ **Instructions** are performed; and
- (h) maintain an effective and appropriate report and record system in accordance with 5.2.5.6.

5.2.5.2.5 The inspection body must perform design type approval, cylinder production testing and inspection, and certification to verify conformity with the relevant cylinder standard (see 5.2.5.4 and 5.2.5.1).

#### *Manufacturer*

5.2.5.2.6 The manufacturer must

- (a) operate a documented quality system in accordance with 5.2.5.3;
- (b) apply for design type approvals in accordance with 5.2.5.4;
- (c) select an inspection body from the list of approved inspection bodies maintained by the appropriate national authority in the country of approval; and
- (d) maintain records in accordance with 5.2.5.6.

#### *Testing laboratory*

5.2.5.2.7 The testing laboratory must have:

- (a) staff with an organisational structure, sufficient in number, competence, and skill; and
- (b) suitable and adequate facilities and equipment to perform the tests required by the manufacturing standard to the satisfaction of the inspection body.

#### 5.2.5.3 *Manufacturer's quality system*

5.2.5.3.1 The quality system must contain all the elements, requirements, and provisions adopted by the manufacturer. It must be documented in a systematic and orderly manner in the form of written policies, procedures and instructions.

The contents must in particular include adequate descriptions of:

- (a) the organisational structure, responsibilities, and power of the management with regard to design and product quality;
- (b) the design control and design verification techniques, processes, and systematic actions that will be used when designing the cylinders;
- (c) the relevant cylinder manufacturing, quality control, quality assurance, and process operation instructions that will be used;

- (d) quality records, such as inspection reports, test data, and calibration data;
- (e) management reviews to ensure the effective operation of the quality system arising from the audits in accordance with 5.2.5.3.2;
- (f) the process describing how customer requirements are met;
- (g) the process for control of documents and their revision;
- (h) the means for control of non-conforming cylinders, purchased components, in-process and final materials; and
- (i) training programmes **and qualification procedures** for relevant personnel.

#### 5.2.5.3.2 Audit of the quality system

The quality system must be initially assessed to determine whether it meets the requirements in 5.2.5.3.1 to the satisfaction of the appropriate national authority.

The manufacturer must be notified of the results of the audit. The notification must contain the conclusions of the audit and any corrective actions required.

Periodic audits must be carried out, to the satisfaction of the appropriate national authority, to ensure that the manufacturer maintains and applies the quality system. Reports of the periodic audits must be provided to the manufacturer.

#### 5.2.5.3.3 *Maintenance of the quality system*

The manufacturer must maintain the quality system as approved in order that it remains adequate and efficient.

The manufacturer must notify the appropriate national authority that approved the quality system, of any intended changes. The proposed changes must be evaluated in order to determine whether the amended quality system will still satisfy the requirements in 5.2.5.3.1.

#### 5.2.5.4 *Approval process*

##### *Initial design type approval*

5.2.5.4.1 The initial design type approval must consist of approval of the manufacturer's quality system and approval of the cylinder design to be produced. An application for an initial design type approval must **meet** ~~encompass~~ the requirements of 5.2.5.3, 5.2.5.4.2 to 5.2.5.4.6 and 5.2.5.4.9.

5.2.5.4.2 A manufacturer desiring to produce cylinders in accordance with a cylinder standard and these Instructions must apply for, obtain, and retain a Design Type Approval Certificate issued by the appropriate national authority in the country of approval for at least one cylinder design type in accordance with the procedure given in 5.2.5.4.9. This **certificate** ~~written approval~~ must, on request, be submitted to the appropriate national authority of the country of use.

5.2.5.4.3 An application must be made for each manufacturing facility and must include:

- (a) the name and registered address of the manufacturer and in addition, if the application is submitted by an authorised representative, its name and address;
- (b) the address of the manufacturing facility (if different from the above);
- (c) the name and title of the person(s) responsible for the quality system;
- (d) the designation of the cylinder and the relevant cylinder standard;
- (e) details of any refusal of approval of a similar application by any other appropriate national authority;
- (f) the identity of the inspection body for design type approval;
- (g) documentation on the manufacturing facility as specified under 5.2.5.3.1 and
- (h) the technical documentation required for design type approval, which must enable verification of the conformity of the cylinders with the requirements of the relevant cylinder design standard. The technical documentation must cover the design and method of manufacture and must contain, as far as is relevant for assessment, at least the following:
  - (i) cylinder design standard, design and manufacturing drawings, showing components and subassemblies, if any;
  - (ii) descriptions and explanations necessary for the understanding of the drawings and intended use of the cylinders;
  - (iii) a list of the standards necessary to fully define the manufacturing process;
  - (iv) design calculations and material specifications; and
  - (v) design type approval test reports, describing the results of examinations and tests carried out in accordance with 5.2.5.4.9.

5.2.5.4.4 An initial audit in accordance with 5.2.5.3.2 must be performed to the satisfaction of the appropriate national authority.

5.2.5.4.5 If the manufacturer is denied approval, the appropriate national authority must provide written detailed reasons for such denial.

5.2.5.4.6 Following approval, changes to the information submitted under 5.2.5.4.2 3 relating to the initial approval must be provided to the appropriate national authority.

*Subsequent design type approvals*

5.2.5.4.7 An application for a subsequent design type approval must encompass the requirements of 5.2.5.4.8 and 5.2.5.4.9, provided a manufacturer is in the possession of an initial design type approval. In such a case, the manufacturer's quality system according to 5.2.5.3 must have been approved during the initial design type approval and must be applicable for the new design.

5.2.5.4.8 The application must include:

- (a) the name and address of the manufacturer and in addition, if the application is submitted by an authorised representative, its name and address;
- (b) details of any refusal of approval of a similar application by any other appropriate national authority;
- (c) evidence that initial design type approval has been granted; and
- (d) the technical documentation, as described in 5.2.5.4.3 (h).

*Procedure for design type approval*

5.2.5.4.9 The inspection body must:

- (a) examine the technical documentation to verify that:
  - (i) the design is in accordance with the relevant provisions of the standard, and
  - (ii) the prototype lot has been manufactured in conformity with the technical documentation and is representative of the design;
- (b) verify that the production inspections have been carried out as required in accordance with 5.2.5.1;
- (c) select cylinders from a prototype production lot and supervise the tests of these cylinders as required for design type approval;
- (d) perform or have performed the examinations and tests specified in the cylinder standard to determine that:
  - (i) the standard has been applied and fulfilled, and
  - (ii) the procedures adopted by the manufacturer meet the requirements of the standard; and
- (e) ensure that the various type approval examinations and tests are correctly and competently carried out.

After prototype testing has been carried out with satisfactory results and all applicable requirements of 5.2.5.4 have been satisfied, a Design Type Approval Certificate must be issued which must include the name and address of the manufacturer, results and conclusions of the examination, and the necessary data for identification of the design type.

If the manufacturer is denied a design type **approval certification**, the appropriate national authority must provide written detailed reasons for such denial.

#### 5.2.5.4.10 *Modifications to approved design types*

The manufacturer must inform the issuing appropriate national authority of modifications to the approved design type as specified in the cylinder standard. A subsequent design type approval must be requested where such modifications constitute a new design according to the relevant cylinder standard. This additional approval must be given in the form of an amendment to the original Design Type Approval Certificate.

5.2.5.4.11 Upon request, the appropriate national authority must communicate to any other appropriate national authority, information concerning design type approval, modifications of approvals, and withdrawn approvals.

#### 5.2.5.5 *Production inspection and certification*

5.2.5.5.1 An inspection body, or its delegate, must carry out the inspection and certification of each cylinder. The inspection body selected by the manufacturer for inspection and testing during production may be different from the inspection body used for the design type approval testing.

5.2.5.5.2 Where it can be demonstrated to the satisfaction of the inspection body that the manufacturer has trained and competent inspectors, independent of the manufacturing operations, inspection may be performed by those inspectors. In such a case, the manufacturer must maintain training records of the inspectors.

5.2.5.5.3 The inspection body must verify that the inspections by the manufacturer and tests performed on those cylinders, fully conform to the standard and the requirements of these Instructions. Should non-conformance in conjunction with this inspection and testing be determined, the permission to have inspection performed by the manufacturer's inspectors may be withdrawn.

5.2.5.5.4 The manufacturer must, after approval by the inspection body, make a declaration of conformity with the certified design type. The application of the cylinder certification marking must be considered a declaration that the cylinder complies with the applicable cylinder standards and the requirements of this conformity assessment system and these Instructions. The inspection body must affix or delegate the manufacturer to affix the cylinder certification marking and the registered mark of the inspection body to each approved cylinder.

5.2.5.5.5 A certificate of compliance, signed by the inspection body and the manufacturer, must be issued before the cylinders are filled.

#### 5.2.5.6 *Records*

Design type approval and certificate of compliance records must be retained by the manufacturer and the inspection body for not less than 20 years.

## **5.2.6 Approval System for Periodic Inspection and Test of Cylinders**

### **5.2.6.1 Definitions**



For the purposes of this section:

**Approval system:** means a system for appropriate national authority approval of a body performing periodic inspection and test of cylinders (hereinafter referred to as “periodic inspection and test body”), including approval of that body’s quality system.

#### 5.2.6.2 *General requirements*

##### *Appropriate national authority*

5.2.6.2.1 The appropriate national authority must establish an approval system for the purpose of ensuring that the periodic inspection and test of cylinders conform to the requirements of these Instructions. In instances where the appropriate national authority that approves a body performing periodic inspection and test of a cylinder is not the appropriate national authority of the country approving the manufacture of the cylinder, the marks of the approval country of periodic inspection and test must be indicated in the cylinder marking (see 5.2.7).

The appropriate national authority of the country of approval for the periodic inspection and test must supply, upon request, evidence demonstrating compliance to this approval system including the records of the periodic inspection and test to its counterpart in a country of use.

The appropriate national authority of the country of approval may terminate the approval certificate referred to in 5.2.6.4.1, upon evidence demonstrating non-compliance with the approval system.

5.2.6.2.2 The appropriate national authority may delegate its functions in this approval system, in whole or in part.

5.2.6.2.3 The appropriate national authority must ensure that a current list of approved periodic inspection and test bodies and their identity marks is available.

##### *Periodic inspection and test body*

5.2.6.2.4 The periodic inspection and test body must be approved by the appropriate national authority and must:

- (a) have a staff with an organisational structure, capable, trained, competent, and skilled, to satisfactorily perform its technical functions;
- (b) have access to suitable and adequate facilities and equipment;
- (c) operate in an impartial manner and be free from any influence which could prevent it from doing so;
- (d) ensure commercial confidentiality;
- (e) maintain clear demarcation between actual periodic inspection and test body functions and unrelated functions;
- (f) operate a documented quality system accordance with 5.2.6.3;

- (g) apply for approval in accordance with 5.2.6.4;
- (h) ensure that the periodic inspections and tests are performed in accordance with 5.2.6.5; and
- (i) maintain an effective and appropriate report and record system in accordance with 5.2.6.6.

### *5.2.6.3 Quality system and audit of the periodic inspection and test body*

#### *5.2.6.3.1 Quality system*

The quality system must contain all the elements, requirements, and provisions adopted by the periodic inspection and test body. It must be documented in a systematic and orderly manner in the form of written policies, procedures, and instructions.

The quality system must include:

- (a) a description of the organisational structure and responsibilities;
- (b) the relevant inspection and test, quality control, quality assurance, and process operation instructions that will be used;
- (c) quality records, such as inspection reports, test data, calibration data and certificates;
- (d) management reviews to ensure the effective operation of the quality system arising from the audits performed in accordance with 5.2.6.3.2;
- (e) a process for control of documents and their revision;
- (f) a means for control of non-conforming cylinders; and training programmes and qualification procedures for relevant personnel.

#### *5.2.6.3.2 Audit*

The periodic inspection and test body and its quality system must be audited in order to determine whether it meets the requirements of these Inst to the satisfaction of the appropriate national authority.

An audit must be conducted as part of the initial approval process (see 5.2.6.4.3). An audit may be required as part of the process to modify an approval (see 5.2.6.4.6).

Periodic audits must be conducted, to the satisfaction of the appropriate national authority, to ensure that the periodic inspection and test body continues to meet the requirements of these Instructions.

The periodic inspection and test body must be notified of the results of any audit. The notification must contain the conclusions of the audit and any corrective actions required.

#### 5.2.6.3.3 *Maintenance of the quality system*

The periodic inspection and test body must maintain the quality system as approved in order that it remains adequate and efficient.

The periodic inspection and test body must notify the appropriate national authority that approved the quality system, of any intended changes, in accordance with the process for modification of an approval in 5.2.6.4.6.

#### 5.2.6.4 *Approval process for periodic inspection and test bodies*

##### *Initial approval*

5.2.6.4.1 A body desiring to perform periodic inspection and test of cylinders in accordance with a cylinder standard and these Instructions must apply for, obtain, and retain an Approval Certificate issued by the appropriate national authority.

This written approval must, on request, be submitted to the appropriate national authority of a country of use.

5.2.6.4.2 An application must be made for each periodic inspection and test body and must include:

- (a) the name and address of the periodic inspection and test body and, if the application is submitted by an authorised representative, its name and address;
- (b) the address of each facility performing periodic inspection and test;
- (c) the name and title of the person(s) responsible for the quality system;
- (d) the designation of the cylinders, the periodic inspection and test methods, and the relevant cylinder standards encompassed by the quality system;
- (e) documentation on each facility, the equipment, and the quality system as specified under 5.2.6.3.1;
- (f) the qualifications and training records of the periodic inspection and test personnel; and
- (g) details of any refusal of approval of a similar application by any other appropriate national authority.

5.2.6.4.3 The appropriate national authority must:

- (a) examine the documentation to verify that the procedures are in accordance with the requirements of the relevant cylinder standards and these Instructions; and
- (b) conduct an audit in accordance with 5.2.6.3.2 to verify that the inspections and tests are carried out as required by the relevant cylinder standards and these Instructions, to the satisfaction of the appropriate national authority.

5.2.6.4.4 After the audit has been carried out with satisfactory results and all applicable requirements of 5.2.6.4 have been satisfied, an Approval Certificate must be issued. It must include the name of the periodic inspection and test body, the registered mark, the address of each facility, and the necessary data for identification of its approved activities (e.g. designation of cylinders, periodic inspection and test method and cylinder standards).

5.2.6.4.5 If the periodic inspection and test body is denied approval, the appropriate national authority must provide written detailed reasons for such denial.

#### *Modifications to periodic inspection and test body approvals*

5.2.6.4.6 Following approval, the periodic inspection and test body must notify the issuing appropriate national authority of any modifications to the information submitted under 5.2.6.4.2 relating to the initial approval.

The modifications must be evaluated in order to determine whether the requirements of the relevant cylinder standards and these Instructions will be satisfied.

An audit in accordance with 5.2.6.3.2 may be required.

The appropriate national authority must accept or reject these modifications in writing, and an amended Approval Certificate must be issued as necessary.

5.1.1.5.3.7 Upon request, the appropriate national authority must communicate to any other appropriate national authority, information concerning initial approvals, modifications of approvals, and withdrawn approvals.

#### *5.2.6.5 Periodic inspection and test and certification*

The application of the periodic inspection and test marking to a cylinder must be considered a declaration that the cylinder complies with the applicable cylinder standards and the requirements of these Instructions. The periodic inspection and test body must affix the periodic inspection and test marking, including its registered mark, to each approved cylinder (see 5.2.7.7).

A record certifying that a cylinder has passed the periodic inspection and test must be issued by the periodic inspection and test body, before the cylinder is filled.

#### *5.2.6.6 Records*

The periodic inspection and test body must retain records of cylinder periodic inspection and tests (both passed and failed) including the location of the test facility, for not less than 15 years.

The owner of the cylinder must retain an identical record until the next periodic inspection and test unless the cylinder is permanently removed from service.

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*Editorial Note.*— renumber subsequent paragraphs

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~~UN certified~~ ~~r~~Refillable UN cylinders must be marked clearly and legibly with certification, **operational and manufacturing marks**, and ~~gas or cylinder specific marks~~. These marks must be permanently affixed (e.g. stamped, engraved, or etched) on the cylinder. The marks must be on the shoulder, top end or neck of the cylinder or on a permanently affixed component of the cylinder (e.g. welded collar **or corrosion resistant plate welded to the outer jacket of a closed cryogenic receptacle**). Except for the ~~"UN" mark~~ **UN packaging symbol**, the minimum size of the marks must be 5mm for cylinders with a diameter greater than or equal to 140 mm and 2.5 mm for cylinders with a diameter less than 140 mm. The minimum size of the ~~"UN" mark~~ **UN packaging symbol**, must be 10 mm for cylinders with a diameter greater than or equal to 140 mm and 5 mm for cylinders with a diameter less than 140 mm.

5.2.6.7.1 The following certification marks must be applied:

- (a) The UN packaging symbol 

This symbol must only be marked on cylinders which conform to the requirements of these Instructions for UN certified cylinders.

- (b) The technical standard (e.g. ISO 9809-1) used for design, construction 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. "/" ).

5.2.6.7.2 The following operational marks must be applied:

- (f) The test pressure in bar, preceded by the letters "PH" and followed by the letters "BAR";
- (g) The ~~empty~~ mass of the **empty** cylinder including all permanently attached integral parts (e.g. neck ring, foot ring, etc.) in kilograms, followed by the letters "KG". This mass must not include the mass of valve, valve cap or valve guard, any coating, or porous mass for acetylene. The ~~empty~~ mass must be expressed to three significant figures rounded up to the last digit. For cylinders of less than 1 kg, the mass must be expressed to two significant figures rounded up to the last digit;
- (h) The minimum guaranteed wall thickness of the cylinder in millimetres followed by the letters "MM". This mark is not required for cylinders with a water capacity less than or equal to 1 litre or for composite cylinders **or for closed cryogenic receptacles**;
- (i) In the case of cylinders ~~intended for the transport of~~ compressed gases, UN 1001 **Acetylene, dissolved**, and UN 3374 **Acetylene, solvent free**, the working pressure in bar, preceded by the letters "PW". **In the case of closed cryogenic receptacles, the maximum allowable working pressure preceded by the letters "MAWP"**;

- (j) In the case of **cylinders for liquefied gases and refrigerated liquefied gases**, the water capacity in litres expressed to three significant ~~digits~~ **figures** rounded down to the last digit, followed by the letter "L". If the value of the minimum or nominal water capacity is an integer, the digits after the decimal point may be neglected;
- (k) In the case of **cylinders for UN 1001 Acetylene, dissolved**, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling, the porous **material mass**, the solvent and the saturation gas expressed to two significant figures rounded down to the last digit followed by the letters "KG";
- (l) In the case of **cylinders for UN 3374 Acetylene, solvent free**, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling and the porous **material mass** expressed to two significant figures rounded down to the last digit followed by the letters "KG".

5.2.6.7.3 The following manufacturing marks must be applied

- (m) Identification of the cylinder thread (e.g. 25E). **This mark is not required for closed cryogenic receptacles;**
- (n) 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;
- (o) The serial number assigned by the manufacturer;
- (p) In the case of steel cylinders and composite cylinders with steel liner intended for the transport of gases with a risk of hydrogen embrittlement, the letter "H" showing compatibility of the steel (see ISO 11114-1:1997).


5.2.6.7.4 The above marks must be placed in three groups ~~as shown in the example below.~~

- Manufacturing marks must be the top grouping and must appear consecutively in the sequence given in 5.2.6.7.3.

- The **operational marks in 5.1.2.7.2 must be the** middle grouping ~~must include~~ **and** the test pressure (f) which must be immediately preceded by the working pressure (i) when the latter is required.

- Certification marks must be the bottom grouping and must appear in the sequence given in 5.2.6.7.1.

**The following is an example of the markings applied to a cylinder.**

(m) <b>25E</b>	(n) <b>D MF</b>	(o) <b>765432</b>	(p) <b>H</b>	
(i) <b>PW200PH</b>	(f) <b>300BAR</b>	(g) <b>62.1KG</b>	(j) <b>50L</b>	(h) <b>5.8MM</b>
(a) 	(b) <b>ISO 9809-1</b>	(c) <b>F</b>	(d) <b>IB</b>	(e ) <b>2000/12</b>

5.2.6 7.5 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. **In the case of closed cryogenic receptacles, such marks may be on a separate plate attached to the outer jacket.** Such marks must not conflict with required marks.

**5.2.7.6 Cylinders of composite construction with limited life must be marked with the letters “FINAL” followed by the expiry date year (four digits) and month (two digits).**

5.2.6 7.7 In addition to the preceding marks, each refillable cylinder **that meets the periodic inspection and test requirements of 5.2.4** must be marked indicating: ~~the date (year and month) of the last periodic inspection and the registered mark of the inspection body authorized by the appropriate national authority of the country of use.~~

- (a) **the character(s) identifying the country authorizing the body performing the periodic inspection and test. 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.**

**5.2. 7.8 Marking of ~~UN-certified non-refillable~~ UN cylinders**

5.2. 7.8.1 ~~UN certified n~~ **Non-refillable UN** cylinders must be marked clearly and legibly with certification and gas or cylinder specific marks. These marks must be permanently affixed (e.g. stencilled, stamped, engraved, or etched) on the cylinder. Except when stencilled, the marks must be on the shoulder, top end or neck of the cylinder or on a permanently affixed component of the cylinder (e.g. welded collar). Except for the "UN" mark and the "DO NOT REFILL" mark, the minimum size of the marks must be 5mm for cylinders with a diameter greater than or equal to 140 mm and 2.5 mm for cylinders with a diameter less than 140 mm. The minimum size of the "UN" mark must be 10mm for cylinders with a diameter greater than or equal to 140 mm and 5mm for cylinders with a diameter less than 140 mm. The minimum size of the "DO NOT REFILL" mark must be 5 mm.

5.2. 7.8.2 The marks listed in 5.2.6.1 to 5.2.6.3 must be applied with the exception of (g), (h), and (m). The serial number (o) may be replaced by the batch number. In addition, the words "DO NOT REFILL" in letters of at least 5 mm in height are required.

5.2. 7.8.3 The requirements of 5.2.6.4 must apply.

*Note --- Non-refillable cylinders may, on account of their size, substitute this marking by a label (see 5.2.2.2.1.2).*

5.2. 7.8.4 Other marks are allowed provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks must not conflict with required marks.

### 5.3 REQUIREMENTS FOR NON-UN ~~CERTIFIED~~ CYLINDERS

5.3.1 Cylinders not designed, constructed, inspected, tested and approved according to the requirements of 5.2 must be designed, constructed, inspected, tested and approved in accordance with the provisions of a technical code recognised by the appropriate national authority and the general requirements of 5.1.

5.3.2 Cylinders designed, constructed, inspected, tested and approved under the provisions of this section must not be marked with the UN packaging symbol.

5.3.3 For **metallic cylinders, tubes, pressure drums and bundles of cylinders**, the construction must be such that the minimum burst ratio (burst pressure divided by test pressure) is:

- 1.50 for refillable cylinders,
- 2.00 for non-refillable cylinders.

5.3.4 Marking must be in accordance with the requirements of the appropriate national authority of the country of use.

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## Chapter 7

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

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#### 7.2 ADDITIONAL REQUIREMENTS FOR PACKAGES TRANSPORTED BY AIR

7.2.1 The temperature of the accessible surfaces must not exceed 50EC at an ambient temperature of 38EC with no account taken for insolation.

7.2.2 Packages must be designed so that, if they were exposed to ambient temperatures ranging from ! 40EC to +55EC, the integrity of the containment would not be impaired.

7.2.3 Packages containing radioactive material must be capable of withstanding, without leakage, an internal pressure that produces a pressure differential of not less than **maximum normal operating pressure plus** 95 kPa.

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#### 7.4 REQUIREMENTS FOR INDUSTRIAL PACKAGES

7.4.1 Industrial packages Types 1, 2 and 3 (Types IP-1, IP-2 and IP-3) must meet the requirements specified in 7.1, 7.2 and 7.6.2.

7.4.2 ~~An Industrial~~ **A Type IP-2** package ~~Type 2 (Type IP-2)~~ must, if it were subjected to the tests specified in 7.14.4 and 7.14.5, prevent:

- a) loss or dispersal of the radioactive contents; and
- b) loss of shielding integrity which would result in more than a 20 per cent increase in the radiation level at any external surface of the package.

7.4.3 An ~~Industrial~~ **A Type IP-3** package Type 3 (Type IP-3) must meet all the requirements specified in 7.6.2 to 7.6.15.

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#### 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 ~~Industrial~~ **Type IP-2** package ~~Type 2 (Type IP-2)~~, provided that:

- a) they satisfy the requirements of 7.4.1;

- b) they are designed to conform to the standards prescribed in Part 6, Chapter 3 or other requirements at least equivalent to those standards; 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) loss of shielding integrity which would result in more than a 20 per cent increase in the radiation level at any external surface of the package.

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## 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: “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, the structural test as specified in 7.1.1;
- 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 meet requirements other than those given in ISO 7195:1993 and 7.5.2 and 7.5.3 but, notwithstanding, the requirements of 7.5.2 and 7.5.3 are met as far as practicable 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 7.1.1.

- (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.

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### 7.6.16 Type A packages to contain liquids

A Type A package designed to contain liquids 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

**Table 6-4. Insolation data**

<i>Case</i>	<i>Form and location of surface</i>	<i>Insolation for 12 hours per day (W/m<sup>2</sup>)</i>
1	Flat surfaces transported horizontally: - downward facing	<del>none</del> 0
2	<del>base</del> Flat surfaces transported horizontally upward facing = <del>other surfaces</del>	800
3	Flat Surfaces <del>not transported horizontally:</del> vertically = <del>each surface</del>	200*
4	Other downward facing (not horizontal) surfaces	200*
5	<del>Curved</del> All other surfaces	400*

\*Alternatively, a sine function may be used, with an absorption coefficient adopted and the effects of possible reflection from neighbouring objects neglected.

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## 7.10 REQUIREMENTS FOR PACKAGES CONTAINING FISSILE MATERIAL

7.10.1 Fissile material must be transported so as to:

- a) maintain subcriticality during normal and accident conditions of transport; in particular, the following contingencies must be considered:
  - i) water leaking into or out of packages;
  - ii) the loss of efficiency of built-in neutron absorbers or moderators;
  - iii) rearrangement of the contents either within the package or as a result of loss from the package;
  - iv) reduction of spaces within or between packages;
  - v) packages becoming immersed in water or buried in snow; and
  - vi) temperature changes; and
- b) meet the requirements:
  - i) of 7.6.2 for ~~fissile material contained in packages~~ **containing fissile material**;
  - ii) prescribed elsewhere in these Instructions and which pertain to the radioactive properties of the material; and
  - iii) specified in 7.10.3 to 7.10.12, unless excepted by 7.10.2.

7.10.2 Fissile material meeting one of the provisions in a) to d) below 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:

- a) A mass limit per consignment such that:

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

where X and Y are the mass limits defined in Table 6-5, provided 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% by mass; or
- iii) there is not more than 5 g of fissile material in any 10 L volume of material.

Neither beryllium nor deuterium **in hydrogenous material enriched in deuterium** must be present in quantities exceeding ~~0.1% of the fissile material mass~~ **1% of the applicable consignment mass limits provided in Table 6-5.**

- b) Uranium enriched in uranium-235 to a maximum of 1% by mass, and with a total plutonium and uranium-233 content not exceeding 1% of the mass of uranium-235, provided that the fissile material is distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it must not form a lattice arrangement;

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7.10.5 The ~~packaging~~ **package**, after being subjected to the tests specified in 7.14, must prevent the entry of a 10 cm cube.

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- 7.10.10 (a) The package must be subcritical under conditions consistent with the **Type C package** tests ~~prescribed~~ **specified** in 7.19.1 assuming reflection by at least 20 cm of water but no water in leakage.
- (b) ~~In the assessment of 7.10.9, a~~ Allowance must not be made for special features of 7.10.7 unless, following the **Type C package** tests specified in 7.19.1 and, subsequently, ~~the water inleakage test of~~ 7.18.3, leakage of water into or out of the void spaces is prevented.

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### 7.13 TARGET FOR DROP TESTS

The target for the drop tests specified in 2;7.4.5 a), 7.14.4, 7.15 a), 7.16.2, ~~and 7.19.2 and 7.19.4~~ must be a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

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### 7.16 TESTS FOR DEMONSTRATING THE ABILITY TO WITHSTAND ACCIDENT CONDITIONS IN TRANSPORT

7.16.1 The specimen must be subjected to the cumulative effects of the tests specified in 7.16.2 and 7.16.3, in that order. Following these tests, either this specimen or a separate specimen must be subjected to the effect(s) of the water immersion test(s) as specified in 7.16.4 and, if applicable, 7.17.

7.16.2 Mechanical test: the mechanical test consists of three different drop tests. Each specimen must be subjected to the applicable drops as specified in 7.7.7 or 7.10.12. The order in which the specimen is subjected to the drops must be such that, on completion of the mechanical test, the specimen must have suffered such damage as will lead to the maximum damage in the thermal test which follows:

- a) For drop I, the specimen must drop onto the target so as to suffer the maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target must be 9 m. The target must be as defined in 7.13;

- b) For drop II, the specimen must drop so as to suffer the maximum damage onto a bar rigidly mounted perpendicularly on the target. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar must be 1 m. The bar must be of solid mild steel of circular section,  $(15.0 \pm 0.5 \text{ cm})$  in diameter and 20 cm long unless a longer bar would cause greater damage, in which case a bar of sufficient length to cause maximum damage must be used. The upper end of the bar shall be flat and horizontal with its ~~edges~~ **edge** rounded off to a radius of not more than 6 mm. The target on which the bar is mounted shall be as described in 7.13;

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### **7.17 ENHANCED WATER IMMERSION TEST FOR TYPE B(U) AND TYPE B(M) PACKAGES CONTAINING MORE THAN $10^5$ A<sub>2</sub>, AND TYPE C PACKAGES**

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### **7.19 TESTS FOR TYPE C PACKAGES**

7.19.1 Specimens must be subjected to the effects of each of the following test sequences in the orders specified:

- a) the tests specified in 7.16.2 a), 7.16.2 c), 7.19.2 and 7.19.3; and
- b) the test specified in 7.19.4.

Separate specimens are allowed to be used for each of the sequences in a) and b).

7.19.2 Puncture/tearing test: the specimen must be subjected to the damaging effects of a solid probe made of mild steel. The orientation of the probe to the surface of the specimen must be positioned so as to cause maximum damage at the conclusion of the test sequence specified in 7.19.1 a).

- a) The specimen, representing a package having a mass less than 250 kg, must be placed on a target and subjected to a probe having a mass of 250 kg and falling from a height of 3 m above the intended impact point. For this test, the probe must be a 20 cm diameter cylindrical bar with the striking end forming a frustum of a right circular cone with the following dimensions: 30 cm height and 2.5 cm in diameter at the top **with its edge rounded off to a radius of not more than 6 mm**. The target on which the specimen is placed must be as specified in 7.13;
- b) For packages having a mass of 250 kg or more, the base of the probe must be placed on a target and the specimen dropped onto the probe. The height of the drop, measured from the point of impact with the specimen to the upper surface of the

probe must be 3 m. For this test, the probe must have the same properties and dimensions as specified in a) above, except that the length and mass of the probe must be such as to incur maximum damage to the specimen. The target on which the base of the probe is placed must be as specified in 7.13.

7.19.3 Enhanced thermal test: the conditions for this test must be as specified in 7.16.3, except that the exposure to the thermal environment must be for a period of 60 minutes.

7.19.4 Impact test: the specimen must be subject to an impact on a target at a velocity of not less than 90 m/s, at such an orientation as to suffer maximum damage. The target must be as defined in 7.13, **except that the target surface may be at any orientation as long as the surface is normal to the specimen path.**

— END —