



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

Auckland, New Zealand, 4 to 8 May 2009

Agenda Item 5: Resolution, where possible, of the non-recurrent work items identified by the Air Navigation Commission or the panel
5.4: Reformatting of the packing instructions

CLASS 1 AND CLASS 2 PACKING INSTRUCTIONS

(Presented by R. Richard)

SUMMARY

The purpose of this paper is to provide further notification and discussion on the reformatted and updating for Packing Instructions for Classes 1 and 2.

1. INTRODUCTION

1.1 Discussion on some of the actions that will need to be taken in order to format the Supplement is needed. This paper lays out some of these formatting questions so that the appropriate action can be taken.

1.2 Below are the updated tables for Class 1 and 2 that will be placed in the Supplement. These charts will be followed by packing instructions for that specific class (e.g. Class 1 chart, Class 1 Packing Instructions, Class 2 chart, Class 2 packing Instructions...).

ICAO SUPPLEMENT TABLE FOR CLASS 1

Packing Instructions for Class 1

Packing Instructions 110(a)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Bags: Plastic Textile, plastic coated or lined Rubber Textile, rubberized Textile	Bags: Plastic Textile, plastic coated or lined Rubber Textile, rubberized Receptacles : Plastic Metal

ADDITIONAL PACKING REQUIREMENTS

The intermediate packaging shall be filled with water saturated material such as an anti-freeze solution or wetted cushioning.

OUTER PACKAGINGS*Drums*

Plastics, removable head (1H2)
 Steel (1A2)

ADDITIONAL PACKING REQUIREMENTS

Outer packaging shall be fitted with water saturated material such as an anti-freeze solution or wetted cushioning. Outer packaging shall be constructed and sealed to prevent evaporation of the wetting solutions except for UN0224 when carried dry.

Packing Instructions 110(b)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
<p>Bags: Rubber, conductive Plastics, conductive</p>	<p>Dividing partitions: Metal Wood Plastic Fibreboard</p>
<p>Receptacles: Metal Wood Rubber, conductive Plastics, conductive</p>	

ADDITIONAL PACKING REQUIREMENTS

For UN0074, UN0113, UN0114, UN0129, UN0130, UN0135, UN0224 the following conditions must be met:

Inner packagings shall not contain more than 50g of explosive substance (quantity corresponding to dry substance)

Compartments between dividing partitions shall not contain more than one inner packaging, firmly fitted;

OUTER PACKAGINGS

Boxes

- natural wood, sift-proof wall (4C2)
- plywood (4D)
- reconstituted wood (4F)

ADDITIONAL PACKING REQUIREMENTS

For UN0074, UN0113, UN0114, UN0129, UN0130, UN0135, UN0224 the following conditions must be met:

The outer packaging may be partitioned up to 25 compartments

Packing Instructions 111

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Bags: Paper, waterproofed Plastics Textile, rubberized	Not necessary
Sheets: Plastic Textile, rubberized	

ADDITIONAL PACKING REQUIREMENTS

For UN0159, inner packagings are not required when metal (1A2 or 1B2) or plastic (1H2) drums are used as outer packaging.

OUTER PACKAGINGS

Boxes

Steel (4A)
 Aluminium (4B)
 Natural wood, ordinary (4C1)
 Natural wood, sift-proof (4C2)
 Plywood (4D)
 Reconstituted wood (4F)
 Fibreboard (4G)
 Plastic, expanded (4H1)
 Plastic, solid (4H2)

Drums

Steel, removable head (1A2)
 Aluminium, removable head (1B2)
 Plywood (1D)
 Fibreboard (1G)
 Plastic, removable head (1H2)

Packing Instructions 112(a)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Compatibility requirements

— This packing instruction applies to solid wetted, 1.1D substances

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
<p>Bags: Paper, multiwall, water resistant Plastics Textile Textile, rubberized Woven plastics</p>	<p>Bags: Plastics Textile, plastic coated or lined</p>
<p>Receptacles: Metal Plastics</p>	<p>Receptacles: Metal Plastics</p>

ADDITIONAL PACKING REQUIREMENTS

Intermediate packagings are not required if leak proof removable head drums are used as the outer packaging

For UN0004, UN0076, UN0078, UN0154, 0219, and 0394, packagings shall be lead free

For UN0072 and UN0226 intermediate packagings are not required

OUTER PACKAGINGS

Boxes

- Steel (4A)
- Aluminium (4B)
- Natural wood, ordinary (4C1)
- Natural wood, sift-proof (4C2)
- Plywood (4D)
- Reconstituted wood (4F)
- Fibreboard (4G)
- Plastic, expanded (4H1)
- Plastic, solid (4H2)

Drums

- Steel, removable head (1A2)
- Aluminium, removable head (1B2)
- Plywood (1D)
- Fibre (1G)
- Plastic, removable head (1H2)

Packing Instructions 112(b)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Compatibility requirements

— This packing instruction applies to solid dry, other than powder 1.1D

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Bags: Paper, kraft Paper, multiwall, water resistant Plastics Textile Textile, rubberised Woven plastics	Bags (UN0150 only): Plastics Textile, plastic coated or lined

ADDITIONAL PACKING REQUIREMENTS

For UN0004, UN0076, UN0078, UN0154, UN0216, UN0219 and UN0386 packings shall be lead free

For UN0209, bags, sift-proof (5H2) are recommended for flake or prilled TNT in the dry state and a maximum net mass of 30 kg.

For UN0222 inner packagings are not required when the outer packaging is a bag

OUTER PACKAGINGS

<i>Boxes</i>	<i>Drums</i>	<i>Bags</i>
Steel (4A)	Steel, removable head (1A2)	Woven plastics, sift-proof (5H2)
Aluminium (4B)	Aluminium, removable head (1B2)	Woven plastics, water – resistant (5H3)
Natural wood, ordinary (4C1)	Plywood (1D)	Plastics, film (5H4)
Natural wood, sift-proof (4C2)	Fibre (1G)	Textile, sift-proof (5L2)
Plywood (4D)	Plastic, removable head (1H2)	Textile, water resistant (5L3)
Reconstituted wood (4F)		Paper, multiwall, water resistant (5M2)
Fibreboard (4G)		
Plastic, expanded (4H1)		
Plastic, solid (4H2)		

Packing Instructions 112(c)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Compatibility requirements

— This packing instruction applies to solid wetted, 1.1D substances

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Bags: Paper, multiwall, water resistant Plastics Woven plastics	Bags: Paper, multiwall, water resistant with inner lining plastics
Receptacles: Metal Plastics Wood fibreboard	Receptacles: Metal Plastics

ADDITIONAL PACKING REQUIREMENTS

Inner packagings are not required if drums are used as the outer packaging

The packaging shall be sift-proof

For UN0004, UN0076, UN0078, UN0154, UN0216, UN0219 and UN0386 packings shall be lead free

For UN0209, bags, sift-proof (5H2) are recommended for flake or prilled TNT in the dry state and a maximum net mass of 30 kg

For UN0504, metal packagings shall not be used

OUTER PACKAGINGS*Boxes*

Steel (4A)
 Aluminium (4B)
 Natural wood, ordinary (4C1)
 Natural wood, sift-proof (4C2)
 Plywood (4D)
 Reconstituted wood (4F)
 Fibreboard (4G)
 Plastic, expanded (4H1)
 Plastic, solid (4H2)

Drums

Steel, removable head (1A2)
 Aluminium, removable head (1B2)
 Plywood (1D)
 Fibre (1G)
 Plastic, removable head (1H2)

Packing Instructions 113**General requirements**

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Bags: Paper, Plastics Textile, rubberised	Not necessary
Receptacles: Fibreboard Metal Plastics Wood	

ADDITIONAL PACKING REQUIREMENTS

Packaging shall be sift-proof

For UN0094 and UN0305, no more than 50g of substance shall be packed in an inner packaging

For UN0027, inner packagings are not necessary when drums are used as the outer packaging

For UN0028, paper kraft or waxed paper sheets may be used as inner packagings

OUTER PACKAGINGS

Boxes

- Steel (4A)
- Aluminium (4B)
- Natural wood, ordinary (4C1)
- Natural wood, sift-proof (4C2)
- Plywood (4D)
- Reconstituted wood (4F)
- Fibreboard (4G)
- Plastic, solid (4H2)

Drums

- Steel, removable head (1A2)
- Aluminium, removable head (1B2)
- Plywood (1D)
- Fibre (1G)
- Plastic, removable head (1H2)

Packing Instructions 115

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Receptacles: Plastics	Bags: Plastics in metal receptacles
	Drums: Metal

ADDITIONAL PACKING REQUIREMENTS

For UN 0144, intermediate packagings are not required, metal receptacles may be used as inner packagings, absorbent cushioning material shall be inserted, fibreboard boxes (4G) may be used as outer packaging and aluminium drums, removable head (1B2) shall not be used.

For UN0075, UN0143, UN0495 and UN0497, when boxes are used as the outer packagings, inner packagings shall have taped screw cap closures and be not more than 5 litres capacity each. Inner packagings shall be surrounded with non-combustible absorbent cushioning material. The amount of absorbent cushioning material shall be sufficient to absorb the liquid contents. Metal receptacles shall be cushioning from each other. Net mass of propellant is a limited to 30 kg for each package when outer packagings are boxes.

For UN0075, UN0143, UN0495 and UN0497, when drums are used as the outer packaging and when intermediate packagings are drums, shall be surrounded with non-combustible cushioning material in a quantity sufficient to absorb the liquid contents. A composite packaging consisting of a plastic receptacle in a metal drum may be used instead of the inner and intermediate packagings.

The net volume or propellant in each package shall not exceed 120 litres. Drums can only be used as intermediate packagings when drums are used as outer packagings.

For UN0075, UN0143, UN0495 and UN0497 bags shall be used as intermediate packaging when boxes used as outer packagings.

OUTER PACKAGINGS

<i>Boxes</i>	<i>Drums</i>
Natural wood, ordinary (4C1)	Steel, removable head (1A2)
Natural wood, sift-proof (4C2)	Aluminium, removable head (1B2)
Plywood (4D)	Plywood (1D)
Reconstituted wood (4F)	Fibre (1G)
	Plastic, removable head (1H2)

Packing Instructions 116

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Bags: Paper, water and oil resistant Plastics Textile, plastic coated or lined Woven plastics, sift –proof	Not necessary
Receptacles: Fibreboard, water resistant Metal Plastics Wood, sift-proof	
Sheets: Paper, water resistant Paper, waxed Plastics	

ADDITIONAL PACKING REQUIREMENTS

For UN0082, UN0241, UN0331 and 0332, inner packagings are not required if leakproof removable head drums are used as the outer packaging or when the explosive contained in a material impervious to liquid.

UN0081, inner packagings are not required when contained in rigid plastics which is impervious to nitric esters

For UN0331, inner packaging are not required when bags (5H2), (5H3), or (5H4) are used as outer packagings

OUTER PACKAGINGS

<i>Boxes</i>	<i>Drums</i>	<i>Bags</i>	<i>Jerricans</i>
Steel (4A)	Steel, removable head (1A2)	Woven plastics (5H1)	Steel, removable hear (3A2)
Aluminium (4B)	Aluminium, removable head (1B2)	Paper, multitwall, water resistant (5M2)	Plastics, removable head (3H2)
Natural wood, ordinary (4C1)	Plywood (1D)	Plastics, film (5H4)	
Natural wood, sift-proof (4C2)	Fibre (1G)	Textile, sift-proof (5L2)	
Plywood (4D)	Plastic, removable head (1H2)	Textile, water resistant (5L3)	
Reconstituted wood (4F)			
Fibreboard (4G)			
Plastic, solid (4H2)			

ADDITIONAL PACKING REQUIREMENTS

For UN0082, UN0241, UN0331 and UN0332 bags (5H2 or 5H3) may be used as outer packagings

For UN0081, bags shall not be used as outer packagings

Packing Instructions 132(a)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Compatibility requirements

- This packing instruction applies to articles consisting of closed metal, plastics, or fibreboard casings that contain a detonating explosive, or consisting of plastics – bonded detonating explosive

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Not necessary	Not necessary

OUTER PACKAGINGS*Boxes*

Steel (4A)

Aluminium (4B)

Natural wood,
ordinary (4C1)Natural wood, sift-
proof (4C2)

Plywood (4D)

Reconstituted wood
(4F)

Fibreboard (4G)

Plastic, solid (4H2)

Packing Instructions 132(b)

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Compatibility requirements

— This packing instruction applies to articles without closed casings

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Receptacles: Fibreboard Metal Plastics Wood	Not necessary
Sheets: Plastic Paper	

OUTER PACKAGINGS

Boxes

- Steel (4A)
- Aluminium (4B)
- Natural wood,
ordinary (4C1)
- Natural wood, sift-
proof (4C2)
- Plywood (4D)
- Reconstituted wood
(4F)
- Fibreboard (4G)
- Plastic, solid (4H2)

Packing Instructions 144

General requirements

Part 4, Chapter 1.1,1.3,1.5 requirements must be met, including:

Packaging	
<i>Inner Packaging</i>	<i>Intermediate packaging</i>
Receptacles: Fibreboard Metal Plastics	Not necessary

ADDITIONAL PACKING REQUIREMENTS

For UN0248 and UN0249 packaging shall be protected against the ingress or water. When water activated contrivances are transported unpackaged, they shall be provided with at least two independent protective features which prevent ingress of water.

OUTER PACKAGINGS

Boxes

Steel (4A)
 Aluminium (4B)
 Natural wood, ordinary (4C1) with metal liner
 Plywood (4D) with metal liner
 Reconstituted wood (4F) with metal liner
 Plastics, expanded (4H1)
 Plastic, solid (4H2)

Drums

Steel, removable head (1A2)
 Aluminium, removable head (1B2)
 Plastic, removable head (1H2)

ICAO SUPPLEMENT TABLE FOR CLASS 2

PACKING INSTRUCTIONS FOR CLASS 2

Packing Instructions 207													
<p>General requirements</p> <p>Part 4, Chapter 1 requirements must be met, including:</p> <p>1) Compatibility requirements</p> <p>— methyl bromide or methyl bromide with not more than 2 per cent by volume choropicrin may be offered for transport when packaged as follows:</p>													
Packaging													
<i>Inner packaging material</i>	<i>Inner quantity</i>												
Metal cans (IP.3), tin plated or lined with suitable material and with concave pressure ends	0.5Kg												
<p>ADDITIONAL PACKING REQUIREMENTS</p> <p>Cylinders for compressed gas as authorised for methyl bromide with valves and fittings protected by a cap or other suitable device. Filling density must provide a minimum ullage (outage) of 12 per cent at 21C. if cylinders are not protected by a cap or other suitable device (e.g fire extinguishers) they must be securely packed in strong packaging.</p>													
<p>OUTER PACKAGINGS</p> <p>Packaging Group II</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; padding: 5px;"><i>Boxes</i></td> <td style="width: 50%; vertical-align: top; padding: 5px;"><i>Drums</i></td> </tr> <tr> <td style="padding: 5px;">Fibreboard (4G)</td> <td style="padding: 5px;">Aluminium (1B2)</td> </tr> <tr> <td style="padding: 5px;">Natural wood (4C1, 4C2)</td> <td style="padding: 5px;">Fibre (1G)</td> </tr> <tr> <td style="padding: 5px;">Plastics (4H2, 4H1)</td> <td style="padding: 5px;">Plywood (1D)</td> </tr> <tr> <td style="padding: 5px;">Plywood (4D)</td> <td style="padding: 5px;">Steel (1A2)</td> </tr> <tr> <td style="padding: 5px;">Reconstituted wood (4F)</td> <td style="padding: 5px;">Jerricans (3A2)</td> </tr> </table>		<i>Boxes</i>	<i>Drums</i>	Fibreboard (4G)	Aluminium (1B2)	Natural wood (4C1, 4C2)	Fibre (1G)	Plastics (4H2, 4H1)	Plywood (1D)	Plywood (4D)	Steel (1A2)	Reconstituted wood (4F)	Jerricans (3A2)
<i>Boxes</i>	<i>Drums</i>												
Fibreboard (4G)	Aluminium (1B2)												
Natural wood (4C1, 4C2)	Fibre (1G)												
Plastics (4H2, 4H1)	Plywood (1D)												
Plywood (4D)	Steel (1A2)												
Reconstituted wood (4F)	Jerricans (3A2)												

ADDITIONAL PACKING REQUIREMENTS

Filling density must provide a minimum ullage (outage) of 12 per cent at 21C.

The cans must be capable of withstanding an interior gauge pressure of 900 kPa.

NOTE THAT THIS IS THE SAME NUMBER AS IS CURRENTLY IN THE TECHNICAL INSTRUCTIONS AND THAT IT NEEDS TO BE CHANGED

Packing Instructions 213

General requirements

Part 4, Chapter 1 requirements must be met, including:

1) Compatibility requirements

- Small quantities of gases in Division 2.3, including mixtures of gases, may be carried in an aircraft under the following conditions:

Packaging	
<i>Inner packaging material</i>	<i>Inner quantity</i>
Glass cylinder meeting the packing instructions of PI200 or IP8 glass ampoule, provided it is compatible with the gas	100g

ADDITIONAL PACKING REQUIREMENTS

Maximum quantity of gas permitted per package must be determined using the following formula:

Permitted mass $\leq 10^{-3}$ (RMM) (LC50)

Where

RMM = relative molecular mass

LC50 expressed in mL/m³ as defined in Part 2, Chapter 6 of the Technical Instructions

Permitted Mass expressed in grams

For mixture of toxic gases, where the LC50 for the mixture or its mass per unit volume at NTP are unknown, the following formula shall be used to determine the permitted mass of the mixture:

$$\frac{\text{Mass of component 1}}{10^{-3} (\text{RMM})_1 (\text{LC})_1} + \frac{\text{Mass of component 2}}{10^{-3} (\text{RMM})_2 (\text{LC})_2} + \frac{\text{mass of component n}}{10^{-3} (\text{RMM})_n (\text{LC}_{50})_n}$$

where

NTP is normal temperature and pressure

(RMM)= relative molecular mass of component 1...n

This latter formula makes no allowance for any synergistic effect of the mixture and it should not be used where the toxic effects are other than additive

OUTER PACKAGINGS

The glass ampoule or gas cylinder must be tightly packed as to prevent movement in an outer metal pressure vessel containing inert absorbent and cushioning material. The outer metal pressure vessels must be designed to contain the total quantity of gas in case of leakage of the ampoule or cylinder. The outer metal pressure vessel must meet the requirements of Packing Instruction 200. Special care must be taken to prevent corrosion of the inner wall of the outer metal pressure vessels.

The outer metal pressure vessel must be tightly packed, so as to prevent movement, in a strong outside packaging.

1.3 Below is copy of the P200 as written in the Model Recommendations on the Transport of Dangerous Goods for the United Nations. The sections highlighted in yellow are not included within the current version of PI200 within the Technical Instructions. The reason for this is that most of the substances that the highlighted parts would cover are already forbidden by air transport within the Technical Instructions. However, does the working group feel that the use of P200 or parts of P200 in the ICAO Supplement would have merit or be a useful tool when states are determining exemptions and approvals for those substances which are normally forbidden?

P200	PACKING INSTRUCTION	P200
<p>For pressure receptacles, the general packing requirements of 4.1.6.1 shall be met. In addition, for MEGCs, the general requirements of 4.2.4 shall be met.</p> <p>Cylinders, tubes, pressure drums, bundles of cylinders constructed as specified in Chapter 6.2 and MEGCs constructed as specified in 6.7.5 are authorised for the transport of a specific substance when specified in the following tables. For some substances the special packing provisions may prohibit a particular type of cylinder, tube, pressure drum or bundle of cylinders.</p> <p>(1) Pressure receptacles containing toxic substances with an LC₅₀ less than or equal to 200 ml/m³ (ppm) as specified in the table shall not be equipped with any pressure relief device. Pressure relief devices shall be fitted on pressure receptacles used for the transport of UN 1013 carbon dioxide and UN 1070 nitrous oxide. Other pressure receptacles shall be fitted with a pressure relief device if specified by the competent authority of the country of use. The type of pressure relief device, the set to discharge pressure and relief capacity of pressure relief devices, if required, shall be specified by the competent authority of the country of use.</p> <p>(2) The following three tables cover compressed gases (Table 1), liquefied and dissolved gases (Table 2) and substances not in Class 2 (Table 3). They provide:</p> <ul style="list-style-type: none"> (a) the UN number, name and description, and classification of the substance; (b) the LC₅₀ for toxic substances; (c) the types of pressure receptacles authorised for the substance, shown by the letter “X”; 		

- (d) the maximum test period for periodic inspection of the pressure receptacles;
NOTE: For pressure receptacles which make use of composite materials, the periodic inspection frequencies shall be as determined by the competent authority which approved the receptacles.
- (e) the minimum test pressure of the pressure receptacles;
- (f) the maximum working pressure of the pressure receptacles for compressed gases (where no value is given, the working pressure shall not exceed two thirds of the test pressure) or the maximum filling ratio(s) dependent on the test pressure(s) for liquefied and dissolved gases;
- (g) special packing provisions that are specific to a substance.

(3) In no case shall pressure receptacles be filled in excess of the limit permitted in the following requirements.

- (a) For compressed gases, the working pressure shall be not more than two thirds of the test pressure of the pressure receptacles. Restrictions to this upper limit on working pressure are imposed by (4), special packing provision “o”. In no case shall the internal pressure at 65 °C exceed the test pressure;
- (b) For high pressure liquefied gases, the filling ratio shall be such that the settled pressure at 65 °C does not exceed the test pressure of the pressure receptacles.

The use of test pressures and filling ratios other than those in the table is permitted, except where (4), special packing provision “o” applies, provided that:

- (i) the criterion of (4), special packing provision “r” is met when applicable; or
 (ii) the above criterion is met in all other cases.

For high pressure liquefied gases and gas mixtures for which relevant data are not available, the maximum filling ratio (FR) shall be determined as follows:

$$FR = 8.5 \times 10^{-4} \times d_g \times P_h$$

where

FR	=	maximum filling ratio
d_g	=	gas density (at 15 °C, 1 bar)(in g/l)
P_h	=	minimum test pressure (in bar)

If the density of the gas is unknown, the maximum filling ratio shall be determined as follows:

$$FR = \frac{P_h \times MM \times 10^{-3}}{R \times 338}$$

where

FR	=	maximum filling ratio
P_h	=	minimum test pressure (in bar)
MM	=	molecular mass (in g/mol)
R	=	8.31451×10^{-2} bar.l/mol.K (gas constant)

For gas mixtures, the average molecular mass is to be taken, taking into account the volumetric concentrations of the various components;

- (c) For low pressure liquefied gases, the maximum mass of contents per litre of water capacity (filling factor) shall equal 0.95 times the density of the liquid phase at 50 °C; in addition, the liquid phase shall not fill the pressure receptacle at any temperature up to 60 °C. The test pressure of the pressure receptacle shall be at least equal to the vapour pressure (absolute) of the liquid at 65 °C, minus 100 kPa (1 bar).

For low pressure liquefied gases and gas mixtures for which relevant data are not available, the maximum filling ratio shall be determined as follows:

$$FR = (0.0032 \times BP - 0.24) \times d_1$$

where FR = maximum filling ratio
 BP = boiling point (in Kelvin)
 d_1 = density of the liquid at boiling point (in kg/l);

- (d) For UN 1001, acetylene, dissolved, and UN 3374 acetylene, solvent free, see (4), special packing provision “p”.
- (4) Keys for the column “Special packing provisions”:
Material compatibility (for gases see ISO 11114-1:1997 and ISO 11114-2:2000)
- a: Aluminium alloy pressure receptacles are not authorized.
 - b: Copper valves shall not be used.
 - c: Metal parts in contact with the contents shall not contain more than 65% copper.
 - d: When steel pressure receptacles are used, only those bearing the “H” mark shall be authorized.

Requirements for toxic substances with an LC_{50} less than or equal to 200 ml/m^3 (ppm)

k: Valve outlets shall be fitted with gas tight plugs or caps.

Each cylinder within a bundle shall be fitted with an individual valve that shall be closed during transport. After filling, the manifold shall be evacuated, purged and plugged.

Bundles containing UN 1045 Fluorine, compressed, may be constructed with isolation valves on groups of cylinders not exceeding 150 litres total water capacity instead of isolation valves on every cylinder.

Cylinders and individual cylinders in a bundle shall have a test pressure greater than or equal to 200 bar and a minimum wall thickness of 3.5 mm for aluminium alloy or 2 mm for steel. Individual cylinders not complying with this requirement shall be transported in a rigid outer packaging that will adequately protect the cylinder and its fittings and meeting the packing group I performance level. Pressure drums shall have a minimum wall thickness as specified by the competent authority.

Pressure receptacles shall not be fitted with a pressure relief device.

Cylinders and individual cylinders in a bundle shall be limited to a maximum water capacity of 85 litres.

Each valve shall have a taper threaded connection directly to the pressure receptacle and be capable of withstanding the test pressure of the pressure receptacle.

Each valve shall either be of the packless type with non-perforated diaphragm, or be of a type which prevents leakage through or past the packing.

Each pressure receptacle shall be tested for leakage after filling.

Gas specific provisions

- l: UN 1040 ethylene oxide may also be packed in hermetically sealed glass or metal inner packagings suitably cushioned in fibreboard, wooden or metal boxes meeting the packing group I performance level. The maximum quantity permitted in any glass inner packaging is 30 g, and the maximum quantity permitted in any metal inner packaging is 200 g. After filling, each inner packaging shall be determined to be leak-tight by placing the inner packaging in a hot water bath at a temperature, and for a period of time, sufficient to ensure that an internal pressure equal to the vapour pressure of ethylene oxide at 55 °C is achieved. The maximum net mass in any outer packaging shall not exceed 2.5 kg.
- m: Pressure receptacles shall be filled to a working pressure not exceeding 5 bar.
- n: Cylinders and individual cylinders in a bundle shall contain not more than 5 kg of the gas. When bundles containing UN 1045 Fluorine, compressed are divided into groups of cylinders in accordance with special packing provision “k” each group shall contain not more than 5 kg of the gas.
- o: In no case shall the working pressure or filling ratio shown in the table be exceeded.
- p: For UN 1001 acetylene, dissolved and UN 3374 acetylene, solvent free: cylinders shall be filled with a homogeneous monolithic porous material; the working pressure and the quantity of acetylene shall not exceed the values prescribed in the approval or in ISO 3807-1:2000 or ISO 3807-2:2000, as applicable.
For UN 1001 acetylene, dissolved: cylinders shall contain a quantity of acetone or suitable solvent as specified in the approval (see ISO 3807-1:2000 or ISO 3807-2:2000, as applicable); cylinders fitted with pressure relief devices or manifolded together shall be transported vertically.
The test pressure of 52 bar applies only to cylinders conforming to ISO 3807-2:2000.
- q: The valves of pressure receptacles for pyrophoric gases or flammable mixtures of gases containing more than 1% of pyrophoric compounds shall be fitted with gas-tight plugs or caps. When these pressure receptacles are manifolded in a bundle, each of the pressure receptacles shall be fitted with an individual valve that shall be closed during transport, and the manifold outlet valve shall be fitted with a gas-tight plug or cap.
- r: The filling ratio of this gas shall be limited such that, if complete decomposition occurs, the pressure does not exceed two thirds of the test pressure of the pressure receptacle.
- s: Aluminium alloy pressure receptacles shall be:
- Equipped only with brass or stainless steel valves; and
- Cleaned in accordance with ISO 11621:1997 and not contaminated with oil.
- t: (i) The wall thickness of pressure receptacles shall be not less than 3 mm.
(ii) Prior to transport it shall be ensured that the pressure has not risen due to potential hydrogen generation.

Periodic inspection

- u: The interval between periodic tests may be extended to 10 years for aluminium alloy pressure receptacles when the alloy of the pressure receptacle has been subjected to stress corrosion testing as specified in ISO 7866:1999.
- v: The interval between periodic inspections for steel cylinders may be extended to 15 years if approved by the competent authority of the country of use.

Requirements for N.O.S. descriptions and for mixtures

- z: The construction materials of the pressure receptacles and their accessories shall be compatible with the contents and shall not react to form harmful or dangerous compounds therewith.

The test pressure and filling ratio shall be calculated in accordance with the relevant requirements of (3).

Toxic substances with an LC_{50} less than or equal to 200 ml/m^3 shall not be transported in tubes, pressure drums or MEGCs and shall meet the requirements of special packing provision "k". However, UN 1975 Nitric oxide and dinitrogen tetroxide mixture may be transported in pressure drums.

For pressure receptacles containing pyrophoric gases or flammable mixtures of gases containing more than 1% pyrophoric compounds, the requirements of special packing provision "q" shall be met.

The necessary steps shall be taken to prevent dangerous reactions (i.e. polymerisation or decomposition) during transport. If necessary, stabilisation or addition of an inhibitor shall be required.

Mixtures containing UN 1911 diborane, shall be filled to a pressure such that, if complete decomposition of the diborane occurs, two thirds of the test pressure of the pressure receptacle shall not be exceeded.

Mixtures containing UN 2192 germane, other than mixtures of up to 35% germane in hydrogen or nitrogen or up to 28% germane in helium or argon, shall be filled to a pressure such that, if complete decomposition of the germane occurs, two thirds of the test pressure of the pressure receptacle shall not be exceeded.