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**COMMITTEE OF EXPERTS ON THE TRANSPORT OF
DANGEROUS GOODS AND ON THE GLOBALLY
HARMONIZED SYSTEM OF CLASSIFICATION
AND LABELLING OF CHEMICALS**

**Sub-Committee of Experts on the
Transport of Dangerous Goods**
(Twentieth session, 3-12 December 2001,
agenda item 2)

ADDITIONAL PROVISIONS FOR THE TRANSPORT OF GASES

Proposed provisions for refrigerated liquefied gases

Transmitted by the European Industrial Gases Association (EIGA)

Introduction

The text proposed below provides essential requirements for receptacles used for the multimodal transport of refrigerated liquefied gases. The proposal excludes open receptacles because they are unsuitable for journeys of long duration, particularly sea voyages.

It is anticipated that standards currently being developed for cryogenic vessels by ISO TC 220 will be future candidates for reference in the Model Regulations. This text will provide a framework within which TC 220 can work.

The text has been adapted from the provisions currently in 6.7.4 of the Model Regulations covering portable tanks intended for the transport of refrigerated liquefied gases.

The opportunity has also been taken to make some minor improvements to the existing text relating to other pressure receptacles.

Proposal 1

4.1.6 Special packing provisions for dangerous goods of Class 2

Revise the text as follows; new text is shown underlined and deletions are shown by stikethrough.

4.1.6.1 General requirements

4.1.6.1.1 This section provides general requirements applicable to the use of pressure receptacles for the transport of Class 2 gases and other dangerous goods that are transported in pressure receptacles (e.g. UN 1051 hydrogen cyanide, stabilized,). Pressure receptacles shall be constructed and closed so as to prevent any loss of contents which might be caused under normal conditions of transport, including by vibration, or by changes in temperature, humidity or pressure (resulting from change in altitude, for example).

4.1.6.1.2 Parts of pressure receptacles which are in direct contact with dangerous goods shall not be affected or weakened by those dangerous goods and shall not cause a dangerous effect (e.g. catalysing a reaction or reacting with the dangerous goods). The provisions of ISO 11114-1:1997 and ISO 11114-2:2000 shall be met as applicable. Pressure receptacles for UN 1001 acetylene, dissolved, and UN 3374 acetylene, solvent free, shall be filled with a porous material, uniformly distributed, of a type that conforms to the requirements and testing specified by the competent authority and which:

- (a) is compatible with the pressure receptacle and does not form harmful or dangerous compounds either with the acetylene or with the solvent in the case of UN 1001; and
- (b) is capable of preventing the spread of decomposition of the acetylene in the mass. In the case of UN 1001, the solvent shall be compatible with the pressure receptacles

4.1.6.1.3 Pressure receptacles, including their closures, shall be selected to contain a gas or a mixture of gases according to the requirements of 6.2.1.2 ("Materials") and the requirements of the specific packing instructions of section 4.1.4.1. This section also applies to pressure receptacles which are elements of MEGCs.

4.1.6.1.4 Refillable pressure receptacles shall not be filled with a gas or gas mixture different from that previously contained unless the necessary operations for change of gas service have been performed. The change of service for compressed and liquefied gases shall be in accordance with ISO 11621:1997, as applicable. In addition, a pressure receptacle that previously contained a Class 8 corrosive substance or a substance of another class with a corrosive subsidiary risk shall not be authorized for the transport of a Class 2 substance unless the necessary inspection and testing as specified in 6.2.1.5 have been performed.

Prior to filling, the filler shall perform an inspection of the pressure receptacle and ensure that the pressure receptacle is authorized for the gas to be transported and that the provisions of these Model Regulations have been met. Shut-off valves shall be closed after filling and remain closed during transport. The shipper shall verify that the closures and equipment are not leaking.

4.1.6.1.5 Pressure receptacles shall be filled according to the working pressures, filling ratios and provisions specified in the appropriate packing instruction for the specific substance being filled. Reactive gases and gas mixtures shall be filled to a pressure such that if complete decomposition of the gas occurs, the working pressure of the pressure receptacle shall not be exceeded. Bundles of cylinders shall not be filled in excess of the lowest working pressure of any given cylinder in the bundle.

4.1.6.1.6 Pressure receptacles, including their closures, shall conform to the design, construction, inspection and testing requirements detailed in section 6.2. When outer packagings are prescribed, the pressure receptacles shall be firmly secured therein. Unless otherwise specified in the detailed packing instructions, one or more inner packagings may be enclosed in an outer packaging.

4.1.6.1.7 Valves shall be designed and constructed in such a way that they are inherently able to withstand damage without leakage of product or shall be protected from damage which could cause inadvertent release of the contents of the pressure receptacle, by one of the following methods:

- (a) Valves are placed inside the neck of the pressure receptacle and protected by a threaded plug or cap;
- (b) Valves are protected by caps. Caps shall possess vent-holes of sufficient cross-sectional area to evacuate the gas if leakage occurs at the valves;
- (c) Valves are protected by shrouds or guards;
- ~~(d) Valves are designed and constructed in such a way that they are inherently able to withstand damage without leakage of product;~~
- (d) Pressure receptacles are transported in frames, (e.g. bundles); or
- (e) Pressure receptacles are transported in an outer packaging. The packaging as prepared for transport shall be capable of meeting the drop tests specified in 6.1.5.3 at the PG I performance level.

For ~~pressure receptacles with~~ valves of gas cylinders as described in (b) and (c), the requirements of ISO 11117:1998 shall be met; for unprotected valves of gas cylinders as described in ~~(d)~~ the first sentence, the requirements of annex B of ISO 10297:1999 shall be met

4.1.6.1.8 Non-refillable pressure receptacles shall:

- (a) be transported in an outer packaging, such as a box or crate, or in a shrink wrapped or stretch wrapped trays;
- (b) be of a water capacity less than or equal to 1.25 litres when filled with flammable or toxic gas;
- (c) not be used for toxic gases with an LC_{50} less than or equal to 200 ml/m^3 ; and
- (d) not be repaired after being put into service.

4.1.6.1.9 Refillable pressure receptacles shall be periodically inspected according to the provisions of 6.2.1.5 and P200 or P203 as applicable. Pressure receptacles shall not be charged or filled after they become due for periodic inspection but may be transported after the expiry of the time limit.

4.1.6.1.10 Repairs shall be consistent with the fabrication and testing requirements of the applicable design and construction standards and are only permitted as indicated in the relevant periodic inspection standards specified in 6.2.2.4, consistent with the applicable design and construction standards. Pressure receptacles, other than cryogenic receptacles, shall not be subjected to repairs of any of the following;

- (a) weld cracks or other weld defects;
- (b) cracks in walls;
- (c) leaks or defects in the material of the wall, head or bottom.

4.1.6.1.11 Pressure receptacles shall not be offered for filling:

- (a) when damaged to such an extent that the integrity of the pressure receptacle or its service equipment may be affected;
- (b) unless the pressure receptacle and its service equipment has been examined and found to be in good working order; and
- (c) unless the required certification, retest, and filling markings are legible.

4.1.6.1.12 Charged pressure receptacles shall not be offered for transport;

- (a) when leaking;
- (b) when damaged to such an extent that the integrity of the pressure receptacle or its service equipment may be affected;
- (c) unless the pressure receptacle and its service equipment has been examined and found to be in good working order; and
- (d) unless the required certification, retest, and filling markings are legible.

Proposal 2**4.1.4.1** *Replace the existing P203 with the following packing instruction.*

P203	PACKING INSTRUCTION	P203
	<p>For cryogenic receptacles, the general requirements of 4.1.6.1 shall be met.</p> <p>Cryogenic receptacles constructed as specified in 6.2. are authorized for the transport of refrigerated liquefied gases and their mixtures.</p> <p>The receptacles shall be so insulated that they cannot become coated with hoar-frost.</p> <p>1. <u>Test Pressure</u></p> <p>For cryogenic receptacles with vacuum insulation the test pressure shall not be less than 1.3 times the sum of the MAWP (see definition in 6.7.4.1) and 100 kPa (1 bar). The test pressure for other cryogenic receptacles shall be 1.3 times the MAWP.</p> <p>2. <u>Degree of filling</u></p> <p>For non-flammable, non-toxic refrigerated liquefied gases the degree of filling, at the filling temperature and at a pressure of 0.1 MPa (1 bar) shall not exceed 98% of the capacity.</p> <p>For flammable refrigerated liquefied gases the degree of filling shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the opening pressure of the relief valve, the volume would reach 98% of the capacity at that temperature.</p> <p>For toxic refrigerated liquefied gases the degree of filling shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the opening pressure of the relief valve, the volume would reach 95% of the capacity at that temperature</p> <p>3 <u>Pressure Relief Devices</u></p> <p>Cryogenic receptacles shall be fitted with at least one pressure relief device.</p> <p>4 <u>Periodic Inspection</u></p> <p>Cryogenic receptacles shall be subjected to periodic inspections in accordance with the provisions of 6.2.1.5. Periodic inspections shall be carried out every 10 years.</p> <p>5 <u>Compatibility</u></p> <p>In the case of receptacles intended for the carriage of oxidizing gases, (i.e. with a subsidiary risk of 5.1) the substances used to ensure the leakproofness of the joints or for the maintenance of the closures shall be compatible with the contents.</p>	

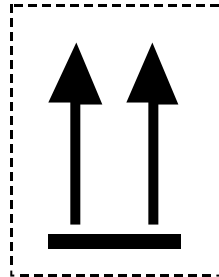
In 3.2.2, insert the Packing Instruction "P203" in Column 8 of the Dangerous Goods List for the following 20 substances.

UN No.	Name and description
1003	AIR, REFRIGERATED LIQUID
1038	ETHYLENE, REFRIGERATED LIQUID
1073	OXYGEN, REFRIGERATED LIQUID
1913	NEON, REFRIGERATED LIQUID
1951	ARGON, REFRIGERATED LIQUID
1961	ETHANE, REFRIGERATED LIQUID
1963	HELIUM, REFRIGERATED LIQUID
1966	HYDROGEN, REFRIGERATED LIQUID
1970	KRYPTON, REFRIGERATED LIQUID
1972	METHANE, REFRIGERATED LIQUID or NATURAL GAS, REFRIGERATED LIQUID, with high methane content
1977	NITROGEN, REFRIGERATED LIQUID
2186	HYDROGEN CHLORIDE, REFRIGERATED LIQUID
2187	CARBON DIOXIDE, REFRIGERATED LIQUID
2201	NITROUS OXIDE, REFRIGERATED LIQUID
2591	XENON, REFRIGERATED LIQUID
3136	TRIFLOUROMETHANE, REFRIGERATED LIQUID
3138	ETHYLENE, ACETYLENE AND PROPYLENE MIXTURE, REFRIGERATED LIQUID, containing at least 71.5% ethylene with not more than 22.5% acetylene and not more than 6% propylene
3158	GAS, REFRIGERATED LIQUID, N.O.S.
3311	GAS, REFRIGERATED LIQUID, OXIDIZING, N.O.S.
3312	GAS, REFRIGERATED LIQUID, FLAMMABLE, N.O.S.

Proposal 3

Add a new provision to Chapter 5.2 as follows

5.2.2.1.13 The following orientation label shall be displayed on two opposite sides of cryogenic receptacles intended for the transport of refrigerated liquefied gases. They shall be rectangular, of standard format A5 (148 x 210 mm). If the size of the package so requires, the dimensions of the labels may be reduced, provided that they remain clearly visible.



Two black arrows on white
or suitable contrasting background

Proposal 4

CHAPTER 6.2

REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF PRESSURE RECEPTACLES, ETC.

Revise the text as follows: (new text is shown underlined and deletions are shown by strikethrough)

6.2.1 General requirements

6.2.1.1 *Design and construction*

6.2.1.1.1 Pressure receptacles and their closures shall be designed, manufactured, tested and equipped in such a way as to withstand all conditions to which they will be subjected during normal conditions of transport.

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

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

6.2.1.1.4 For welded pressure receptacles, only metals of weldable quality shall be used.

6.2.1.1.5 The following additional requirements apply to the construction of ~~closed~~ cryogenic ~~pressure~~ receptacles for refrigerated liquefied gases.

6.2.1.1.5.1 The mechanical properties of the metal used shall be established for each pressure receptacle at the initial inspection, including the impact strength and the bending coefficient;

6.2.1.1.5.2 The pressure receptacles shall be thermally insulated. The thermal insulation shall be protected against impact by means of continuous sheathing. If the space between the pressure receptacle shell (see definition in 6.7.4.1) and the sheathing is evacuated of air (vacuum-insulation), the protective sheathing shall 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 is so closed as to be gas-tight (e.g. in the case of vacuum-insulation), a device shall be provided to prevent any dangerous pressure from developing in the insulating layer in the event of inadequate gas-tightness of the pressure receptacle or its fittings. The device shall prevent moisture from penetrating into the insulation.

6.2.1.1.5.3 Cryogenic receptacles intended for the transport of refrigerated liquefied gases having a boiling point below minus (-) 182 °C at atmospheric pressure shall not include materials which may react with oxygen or oxygen enriched atmospheres in a dangerous manner, when located in parts of the thermal insulation when there is a risk of contact with oxygen or with oxygen enriched fluid.

6.2.1.1.5.4 Cryogenic receptacles shall be designed and constructed with suitable lifting and tie-down attachments.

6.2.1.1.5.5 Cryogenic receptacles shall be designed to withstand, without loss of contents, at least the internal pressure due to the contents, and the static, dynamic and thermal loads during normal conditions of handling and transport. The design shall demonstrate that the effects of fatigue, caused by repeated application of these loads through the expected life of the cryogenic receptacles, have been taken into account.

6.2.1.1.5.6 Cryogenic receptacles and their fastenings under the maximum permissible load shall be capable of absorbing the following separately applied static forces:

- (a) In the direction of travel: twice the MPGM multiplied by the acceleration due to gravity (g)*:
- (b) Horizontally at right angles to the direction of travel: the MPGM (when the direction of travel is not clearly determined, the forces shall be equal to twice the MPGM) multiplied by the acceleration due to gravity (g)*:
- (c) Vertically upwards: the MPGM multiplied by the acceleration due to gravity (g) *; and
- (d) Vertically downwards: twice the MPGM (total loading including the effect of gravity) multiplied by the acceleration due to gravity (g) *.

6.2.1.1.5.7 Cryogenic receptacles intended for the transport of flammable refrigerated liquefied gases shall be capable of being electrically earthed.

6.2.1.1.6 The test pressure of cylinders, tubes, pressure drums and bundles of cylinders shall be in accordance with P200. The test pressure for ~~closed~~ cryogenic receptacles shall be in accordance with P203.

6.2.1.1.7 Pressure receptacles assembled in bundles shall be structurally supported and held together as a unit. Pressure receptacles shall be secured in a manner that prevents movement in relation to the structural assembly and movement that would result in the concentration of harmful local stresses. Manifolds shall be designed such that they are protected from impact. For Division 2.3 liquefied gases, means shall be provided to ensure that each pressure receptacle can be separately charged and that no interchange of pressure receptacle contents can occur during transport.

6.2.1.1.8 Contact between dissimilar metals which could result in damage by galvanic action shall be avoided.

* For calculation purposes $g = 9.81 \text{ m/s}^2$.

6.2.1.2 *Materials*

6.2.1.2.1 Construction materials of pressure receptacles and their closures which are in direct contact with dangerous goods shall not be affected or weakened by the dangerous goods intended and shall not cause a dangerous effect e.g. catalysing a reaction or reacting with the dangerous goods.

6.2.1.2.2 Pressure receptacles and their closures shall 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 pressure receptacle. The materials shall be resistant to brittle fracture and to stress corrosion cracking as indicated in the design and construction technical standards.

6.2.1.3 *Service equipment*

6.2.1.3.1 Except for pressure relief devices, valves, piping, fittings and other equipment subjected to pressure, shall be designed and constructed to withstand at least 1.5 times the test pressure of the pressure receptacles. The additional requirements of 6.2.1.3.5 shall be applied to cryogenic receptacles.

6.2.1.3.2 Service equipment shall be configured or designed to prevent damage that could result in the release of the pressure receptacle contents during normal conditions of handling and transport. Manifold piping leading to shut-off valves shall be sufficiently flexible to protect the valves and the piping from shearing or releasing the pressure receptacle contents. The filling and discharge valves and any protective caps shall be capable of being secured against unintended opening. Valves shall be protected as specified in section 4.1.6.1.8.

6.2.1.3.3 Pressure receptacles which are not capable of being handled manually or rolled, shall 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 pressure receptacle.

6.2.1.3.4 Individual pressure receptacles shall be equipped with approved pressure relief devices as required in P200(1) or P203(3) ~~as specified by the country of use~~. When fitted, pressure relief devices on manifolded horizontal pressure receptacles filled with flammable gas shall be arranged to discharge freely to the open air in such a manner as to prevent any impingement of escaping gas upon the pressure receptacles under normal conditions of transport.

6.2.1.3.5 *Additional requirements for cryogenic receptacles*

6.2.1.3.5.1 Each filling and discharge opening in a cryogenic receptacle used for the transport of flammable refrigerated liquefied gases shall be fitted with at least two mutually independent shut-off devices in series, the first being a stop-valve situated as close as reasonably practicable to the jacket, the second being a cap or equivalent device.

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

6.2.1.3.5.3 Vacuum insulated cryogenic receptacle need not have an opening for inspection.

6.2.1.3.5.4 Each connection on a cryogenic receptacle shall be clearly marked to indicate its function.

6.2.1.3.5.5 The materials of construction of valves and accessories shall have satisfactory properties at the lowest operating temperature of the cryogenic receptacle.

6.2.1.3.5.6 Pressure-relief devices

6.2.1.3.5.6.1 Every cryogenic receptacle shall be provided with at least one pressure relief device. This pressure relief device shall open automatically at a pressure not less than the MAWP and be fully open a pressure equal to 110% of the MAWP. It shall, after discharge, close at a pressure not lower than 10% below the pressure at which discharge starts and shall remain closed at all lower pressures. The pressure relief device shall be of the type that will resist dynamic forces including surge.

6.2.1.3.5.6.2 Cryogenic receptacles intended for non-flammable, non-toxic refrigerated liquefied gases and for UN 1966 hydrogen, refrigerated liquid may, in addition, have a frangible disc in parallel with the spring-loaded device in order to meet the requirements of 6.2.1.3.5.7.3.

6.2.1.3.5.6.3 Connections to pressure-relief devices shall be of sufficient size to enable the required discharge to pass unrestricted to the safety device.

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

6.2.1.3.5.7 Capacity and setting of pressure-relief devices

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

6.2.1.3.5.7.2 Frangible discs shall rupture at nominal pressure above the MAWP but not higher than the test pressure.

6.2.1.3.5.7.3 The required capacity of the relief devices shall be calculated in accordance with a well-established technical code recognized by the competent authority^{*}.

6.2.1.3.6 Pressure receptacles whose filling is measured by volume shall be provided with a level indicator.

6.2.1.4 Initial inspection and test

6.2.1.4.1 Excepting cryogenic receptacles, new pressure receptacles shall 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 pressure receptacles:

- (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~~ ;

* See for example CGA Pamphlet S-1.2-1995.

- (d) Inspection of the external and internal conditions of the pressure receptacles;
- (e) Inspection, of the neck threads;
- (f) Verification of the conformance with the design standard;

For all pressure receptacles:

- (g) A hydraulic pressure test. Pressure receptacles shall withstand the test pressure without expansion greater than that allowed in the design specification;

NOTE : With the agreement of the inspection body, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.

- (h) Inspection and assessment of manufacturing defects and either repairing them or rendering the pressure receptacles unserviceable.
- (i) An inspection of the markings on the pressure receptacles;
- (j) In addition, pressure receptacles intended for the transport of UN 1001 acetylene, dissolved, and UN 3374 acetylene, solvent free, shall be inspected to ensure proper installation and condition of the porous material and the quantity of solvent if applicable.

6.2.1.4.2 On an adequate sample of cryogenic receptacles, in addition to the tests in 6.2.1.4.1 (a), (b), (d), (f), welds subject to full stress level shall be inspected by radiographic, ultrasonic or another suitable non-destructive test method; this weld inspection does not apply to the jacket. Additionally, all cryogenic receptacles shall undergo the tests in 6.2.1.4.1 (g), (h), (i), a leakproofness test and a test of the satisfactory operation of the service equipment after assembly.

6.2.1.5 Periodic inspection and test

6.2.1.5.1 Refillable pressure receptacles, other than cryogenic receptacles, shall be subjected to periodic inspections and tests under the supervision of an inspection body, in accordance with the following:

- (a) Check of the external conditions of the pressure receptacle and verification of the equipment and the external markings;
- (b) Check of the internal conditions of the pressure receptacle (e.g. by weighing, internal inspection, checks of 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, 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 competent authority, the hydraulic pressure test of cylinders and tubes may be replaced by an equivalent method based on acoustic emission or ultrasound.*

6.2.1.5.2 For pressure receptacles 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) shall be required to be examined.

6.2.1.5.3 Cryogenic receptacles shall be subject to an external examination of the cryogenic receptacle and its fittings, the legibility and adequacy of markings, a leakproofness test and a test of the satisfactory operation of all service equipment. The thermal insulation need not be removed. The leakproofness test shall be carried out with the gas contained in the cryogenic receptacle or with an inert gas. Checking shall be performed by means of a pressure gauge or by a vacuum measurement.

6.2.2.6 Marking of UN certified refillable pressure receptacles

UN certified refillable pressure receptacles shall be marked clearly and legibly with certification and gas or pressure receptacle specific marks. These marks shall be permanently affixed (e.g. stamped, engraved, or etched) on the pressure receptacle. The marks shall be on the shoulder, top end or neck of the pressure receptacle or on a permanently affixed component of the pressure receptacle (e.g. welded collar or corrosion resistant plate welded on the outer jacket of a cryogenic receptacle.). Except for the ~~“UN” mark~~ UN packaging symbol, the minimum size of the marks shall be 5mm for pressure receptacles with a diameter greater than or equal to 140 mm and 2.5 mm for pressure receptacles with a diameter less than 140 mm. The minimum size of the ~~“UN” mark~~ UN packaging symbol shall be 10mm for pressure receptacles with a diameter greater than or equal to 140 mm and 5mm for pressure receptacles with a diameter less than 140 mm.

6.2.2.6.1 The following certification marks shall be applied:

- (a) The UN packaging symbol



This symbol shall only be marked on pressure receptacles which conform to the requirements of these model regulations for UN certified pressure receptacles;

- (b) The technical standard (e.g. ISO 9809-1) used for design, manufacture and testing;
- (c) The character(s) identifying the country of approval as indicated by the distinguishing signs of motor vehicles in international traffic;
- (d) The identity mark or stamp of the inspection body that is registered with the competent authority of the country authorizing;
- (e) The date of the initial inspection, the year (four digits) followed by the month (two digits) separated by a slash (i.e. “/”).

6.2.2.6.2 The following operational marks shall 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 pressure receptacle including all permanently attached integral parts (e.g. neck ring, foot ring, etc.) in kilograms, followed by the letters “KG”. This mass shall not include the mass of valve, valve cap or valve guard, any coating, or porous mass for acetylene. The empty mass shall be expressed to three significant figures rounded up to the last digit. For cylinders of less than 1 kg, the mass shall be expressed to two significant figures rounded up to the last digit;
- (h) The minimum guaranteed wall thickness of the pressure receptacle in millimetres followed by the letters “MM”. This mark is not required for pressure receptacles with a water capacity less than or equal to 1 litre or for composite cylinders or for cryogenic receptacles;
- (i) In the case of pressure receptacles 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 cryogenic receptacles, the maximum allowable working pressure preceded by the letters “MAWP”;
- (j) In the case of liquefied gases and refrigerated liquefied gases, the water capacity in litres expressed to three significant digits 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 UN 1001 acetylene, dissolved, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling, the porous material, 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 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 expressed to two significant figures rounded down to the last digit followed by the letters “KG”;

6.2.2.6.3 The following manufacturing marks shall be applied

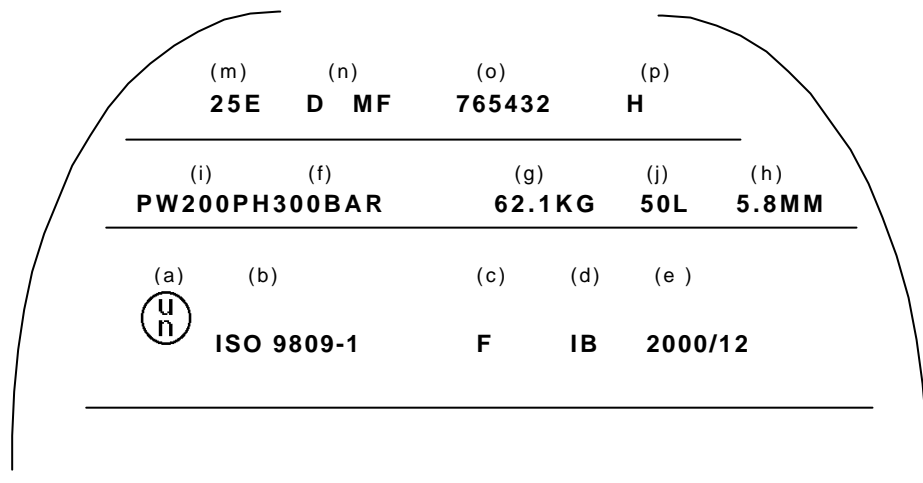
- (m) Identification of the cylinder thread (e.g. 25E). This mark is not required for cryogenic receptacles;
- (n) The manufacturer’s mark registered by the competent authority. When the country of manufacture is not the same as the country of approval, then the manufacturer’s mark shall be preceded 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 shall be separated by a space or slash;
- (o) The serial number assigned by the manufacturer;

- (p) In the case of steel pressure receptacles and composite pressure receptacles 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);
- (q) In the case refrigerated liquefied gases, the maximum permissible gross mass in kilograms preceded by the letters “MPGM”.

6.2.2.6.4 The above marks shall be placed in three groups ~~as shown in the example below.~~

- Manufacturing marks shall be the top grouping and shall appear consecutively in the sequence given in 6.2.2.6.3.
- The middle grouping shall include the test pressure (f) which shall be immediately preceded by the working pressure (i) when the latter is required.
- Certification marks shall be the bottom grouping and shall appear in the sequence given in 6.2.2.6.1.

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



6.2.2.6.5 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 cryogenic receptacles, such marks may be on a separate plate attached to the outer jacket. Such marks shall not conflict with required marks.

6.2.2.6.6 In addition to the preceding marks, each refillable pressure receptacle shall be marked indicating the date (year (two digits) followed by the ~~and~~ month) of the last periodic inspection and the registered mark of the inspection body authorized by the competent authority of the country of use.