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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

REPORT OF THE SUB-COMMITTEE OF EXPERTS ON ITS TWENTIETH SESSION

(Geneva, 3-11 December 2001)

Addendum 1

Annex 1

Report of the Working Group on Additional Provisions for the Transport of Gases

General

1. The Working Group on Additional Provisions for the Transport of Gases met from 3 December to 5 December 2001 under the chairmanship of Mr. H. Puype (EIGA). Representatives of Austria, Brazil, Canada, Czech Republic, France, Germany, Iran, Sweden, Spain, South Africa, Switzerland, the United Kingdom, the United States of America, ISO, AEGPL, CGA, and EIGA participated.

2. The objective of the Working Group was to review the following documents: 2001/31 (United States of America), 2001/48 (EIGA) and informal documents INF.12 (AEGPL), INF.13 (Canada), INF.31 (Germany), INF.33 (UK), INF 34 (Canada), and papers (no numbers) from Sweden and three from the United States of America.

3. The annex to this report gives the text agreed by the Working Group. It is based on the EIGA document 2001/48 and changes from the text in the twelfth revised edition of the Recommendations on the Transport of Dangerous Goods, Model Regulations, are shown by underlining of new text.

Discussion on Proposed Provisions for Refrigerated Liquefied Gases

EIGA Proposal 1

4. It was agreed to re-instate the word "closed" before "cryogenic receptacles" to clarify that open receptacles, whilst in the scope of the UN Model Regulations, are not covered by requirements within the existing and proposed text where it relates to pressure receptacles. It was recognised that further work will be needed to provide requirements for open cryogenic receptacles, but since they are not pressure receptacles, the provisions for their use and construction would be separate sections.

5. The proposal from EIGA to restrict the application of ISO standard 11117:1998 to the protection of valves for cylinders only was rejected. The Working Group recognised that other standards detailing performance requirements for valve protection would be required in the future to cover pressure receptacles other than cylinders when their construction standards were referenced in Section 6.2.2.

6. The derogation to allow specific repairs to cryogenic receptacles was restricted to the jackets of closed cryogenic receptacles.

7. With the above changes and several editorial changes, Proposal 1 by EIGA was agreed by the Working Group.

8. UN 3353 Air bag inflators, compressed gas or Air bag modules, compressed gas or Seat-belt pretensioners, compressed gas was deleted from the 12th Revision of the Model Regulations. Consequently, P202 should also be deleted.

9. ISO was asked to provide a written proposal detailing which cryogenic receptacle standards currently under development would be offered for inclusion where they should be referenced.

Proposal 2

10. Various editorial changes to clarify the text of the P 203 were adopted and the wording on test pressure was changed to that proposed by Canada in order to make it suitable for and relevant to a Packing Instruction.

11. The instructions for periodic inspection were put in square brackets for further discussion. The United States of America and Canada do not currently require periodic inspection for cryogenic receptacles in their national regulations. It was agreed that at the next meeting the inspections and tests which constitute the periodic inspection would be reviewed and a decision made whether such inspection is essential to safety.

12. The section on compatibility was reworded to generalise the requirement to all gases as well as covering the issue of oxidising gases.

13. The word carriage was replaced by transport and the Working Group recommended that a check be made throughout the Model Regulations to effect this same change.

14. The recommendation to change the packing instruction in the Dangerous Goods List to P203 for the refrigerated liquefied gases listed in EIGA proposal 2 was accepted, except for UN 2186 Hydrogen chloride, refrigerated liquid. This entry should be re-allocated to Packing Instruction P099 (Only packagings which are approved by the competent authority may be used). No expert in the Working Group had knowledge of the transport of UN 2186 in cryogenic receptacles. In consequence, the filling instruction for toxic gases was deleted from P203.

Proposal 3

15. Proposal 3 to introduce an orientation label on cryogenic receptacles was accepted subject to the following changes. The standard size was aligned with that specified by ICAO, but smaller or larger labels would be allowed if the size of the package so requires. Options were introduced allowing either red or black arrows and allowing a border. The two formats, with and without a border are to be shown.

16. The label for cryogenic liquids which is used in the IATA Dangerous Goods Regulations was discussed. The Working Group considered it would be inappropriate to include this label in the Model Regulations for the following reasons:

- the label relates specifically to open receptacles which were not addressed in the current provisions;
- the use of the green background would be misleading for flammable gases;
- understanding the label's message depends upon the reader's knowledge of English;
- the hazard and safety action are not adequately communicated to the untrained person.

Proposal 4

17. The Working Group developed clearer wording concerning the relationship between corrosion allowance and the calculation of wall thickness.

18. It was agreed to standardise on the word "jacket" to describe the outer envelope of the cryogenic receptacle, in line with the provisions for portable tanks, and delete the alternative "sheathing".

19. The provision that closed cryogenic receptacles should be designed to resist the service loads and fatigue is applicable to all pressure receptacles. It was therefore deleted and the necessary requirements were covered by adding to the text in the general requirement that covers all pressure receptacles. Similarly, the requirement to provide a capability for electrically earthing when transporting flammable gases was extended to all pressure receptacles.

20. The provision defining the acceleration loads on the receptacles which was copied from the portable tanks provisions was deemed to be adequately covered by the general requirements and the design and construction standard for closed cryogenic receptacles and was therefore deleted.

21. Provisions detailing requirements for low temperature properties for accessories and the lack of need for inspection openings were agreed to be unnecessary and were deleted.

22. The experts noted an inconsistent use of hyphens in the phrase “pressure relief device” (or pressure-relief device) and agreed to delete the hyphen*.

23. The Secretariat was asked to replace all references to “safety valve” and “safety device”(where appropriate) with the phrase “pressure relief valve” and “pressure relief device”(no hyphen)* e.g. in 6.7.4.9.1, 6.7.3.10.1 and 6.7.2.14.1.

24. The hazards associated with the premature bursting of frangible discs was debated at length. The Working Group proposed to allow the set pressure of frangible discs to be either at 150% of MAWP or at the test pressure, whichever is the lower, in order to provide sufficient allowance for the tolerance in frangible disc construction and to prevent it from operating near the range of the primary automatic pressure-relief device.

25. Following a suggestion from Switzerland, the Working Group reviewed all provisions relating to pressure-relief devices from the portable tanks section on refrigerated liquefied gases. Some were incorporated, others were deemed adequately covered by other provisions. One provision was criticised as being inappropriate, both for portable tanks and closed cryogenic receptacles. A proposal should be made to alter 6.7.4.6.4 and equivalent provisions for other portable tanks to replace “approved by the competent authority” by “as specified by the competent authority”.

26. It was agreed that the provisions for pressure-relief devices were inadequately covered. Further work is needed to consider marking, the insulating jacket and the relevant ISO and ICAO provisions. The expert from the UNITED STATES OF AMERICA agreed to submit an official proposal for the next session.

27. It was noted that the capacity calculations of pressure-relief devices for closed cryogenic receptacles had to be covered by reference to two CGA publications. A CEN Standard covered the whole size range. These documents will be circulated for consideration by the Working Group. The CEN standard is being used as a base for the future ISO standard.

28. The text covering the initial inspection of closed cryogenic receptacles was amended to clarify the provisions for inspecting welds by referring to the applicable design and construction standard.

29. For periodic inspection the term “inspection body” was not deemed to correspond to actual practice. It was decided to replace it with “body authorised by the competent authority”.

30. The requirement to mark the Maximum Permissible Gross Mass was considered unnecessary for closed cryogenic receptacles and was deleted. The Working Group noted that the specific marks for closed cryogenic receptacles may need additional review when the ISO standard is completed.

31. The Canadian proposal (INF. 13) addressed the marking of the characters identifying the country where the periodic inspection and test was performed in order to provide traceability. Several proposals resulted from the discussion and the final one is given in

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* *<u>Note by the secretariat</u>: After consultation with the United Nations languages service and checking of the established practice in relevant regulatory texts such as ADR, RID, IMDG Code and IBC Code, it appears that the consistent use of the hyphen ("pressure-relief device") would be more appropriate. Therefore the terms "pressure-relief device" have been used consistently in the annex.*

square brackets in the annex to this report. Delegates will consider this and agree on a text at the next meeting of the Working Group.

32. The United States of America and Canada agreed to propose text detailing the characteristics and responsibilities of the body performing the periodic inspection and test. They would make a proposal taking into consideration the existing text in 6.2.2.5 and the European Transportable Pressure Equipment Directive, EIGA to provide a copy.

Discussion of other provisions

Proposal 2001/31(United States of America)

33. Paper 2001/31 was superseded by 3 tabled papers. One of the papers compared the ISO working draft on cryogenic receptacles with the CFR (DOT4L) and came to the conclusion that they could adopt the ISO standard.

34. A second paper concerning the standard ISO 4706 for welded steel cylinders concluded that it could also be adopted, subject to satisfactory revision.

35. There was a general discussion about the implementation of the ISO standards covering ultrasonic examination and acoustic emission examination in place of the hydraulic test during periodic inspection. The United States of America will prepare a further and more detailed proposal.

36. The United States of America favoured the adoption of the requirement for a first inspection of the porous mass after a short time in service to be specified by the relevant ISO standards.

INF.31 (Germany)

37. INF. 31 from Germany summarised the latest information on LC_{50} values and provided a comparative table. It was agreed that the most stringent value would be retained in the P200 and as a result two values were changed. All asterisks and the corresponding footnote could then be deleted.

38. Germany reported on the validation of the filling ratios and no changes were recommended pending the work on filling ratios in progress at CGA, in conjunction with NIST. On the subject of highly toxic gases the Working Group agreed with Germany that given the limitation of the capacity of the receptacles to 85 litres in conjunction with the special packing requirements (k), a further reduction of the quantity limits was not warranted.

INF.33 (United Kingdom)

39. The Working Group discussed INF. 33 from the United Kingdom which proposed new provisions for lightweight cylinders for LPG to be used in hot air ballooning. There was no support for including such provisions in the Model Regulations because it was, in effect, creating an exemption which would be inappropriate for international multi-modal regulations. Delegates recognised the problem and recommended possible alternative routes.

INF. 12 AEGPL

40. The proposals 1, 2, 4 and 5 concerning empty receptacles, cartridges and aerosols were referred back to the Plenary for guidance as to whether they fell within the remit of the Working Group.

41. The other proposals were discussed and editorial changes incorporated. No consensus could be reached on other changes, however, and the AEGPL was invited to submit an official proposal.

Annex to the report of the Working Group for the additional provisions for the transport of gases

The agreed text is as follows; items for further discussion are shown in square brackets.

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 21010:XXXX], 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~~ mass, 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. *(format change only)*

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.

4.1.6.1.5 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~~6 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~~7 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~~8 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 as described in (b) and (c), the requirements of ISO 11117:1998 shall be met; for ~~unprotected~~ valves with inherent protection ~~as described in (d)~~, the requirements of annex B of ISO 10297:1999 shall be met.

4.1.6.1.~~8~~9 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~~10 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~~11 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 the jacket of closed 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~~12 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~~ or

(c) unless the required certification, retest, and filling markings are legible.

4.1.6.1.~~12~~13 ~~Charged~~ Filled 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~~ or

(d) unless the required certification, retest, and filling markings are legible.

Proposal 2

4.1.4.1

In the P200:

(a) *Delete all asterisks on LC_{50} values and delete the associated footnote.*

(b) *Change the LC_{50} value for UN1050 Hydrogen cyanide stabilized from* 140 *to* 40

(c) *Change the LC_{50} value for UN1746 Bromine pentafluoride from* 180 *to* 50

Delete P202 entirely

Replace the existing P203 with the following new packing instruction.

P203	**PACKING INSTRUCTION**	**P203**

This instruction applies to Class 2 refrigerated liquefied gases.

For closed cryogenic receptacles, the general requirements of 4.1.6.1 shall be met.

Closed cryogenic receptacles constructed as specified in 6.2. are authorized for the transport of refrigerated liquefied gases.

The closed cryogenic receptacles shall be so insulated that they do not become coated with frost.

1. Test Pressure

Refrigerated liquids shall be filled in closed cryogenic receptacles with the following minimum test pressures:

(a) for closed cryogenic receptacles with vacuum insulation, the test pressure shall not be less than 1.3 times the sum of the maximum internal pressure of the filled receptacle, including during filling and discharge, plus 100 kPa (1 bar);

(b) for other closed cryogenic receptacles, the test pressure shall be not less than 1.3 times the maximum internal pressure of the filled receptacle, including during filling and discharge.

2. Degree of filling

For non-flammable, non-toxic refrigerated liquefied gases the liquid phase at the filling temperature and at a pressure of 0.1 MPa (1 bar) shall not exceed 98% of the water capacity.

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 of the liquid phase would reach 98% of the water capacity at that temperature.

3. Pressure-relief Devices

Closed cryogenic receptacles shall be fitted with at least one pressure-relief device.

4. [Periodic Inspection

Closed cryogenic receptacles shall be subjected to periodic inspections in accordance with the provisions of 6.2.1.5. The maximum interval between the initial and first periodic inspection or between two periodic inspections shall be 10 years.]

5. Compatibility

Substances used to ensure the leakproofness of the joints or for the maintenance of the closures shall be compatible with the contents. In the case of receptacles intended for the transport of oxidizing gases, (i.e. with a subsidiary risk of 5.1) these substances shall not react with these gases in a dangerous manner.

In 3.2.2, insert the Packing Instruction "P203" *in Column 8 of the Dangerous Goods List for the following 19 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
2187	CARBON DIOXIDE, REFRIGERATED LIQUID
2201	NITROUS OXIDE, REFRIGERATED LIQUID
2591	XENON, REFRIGERATED LIQUID
3136	TRIFLUOROMETHANE, 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.

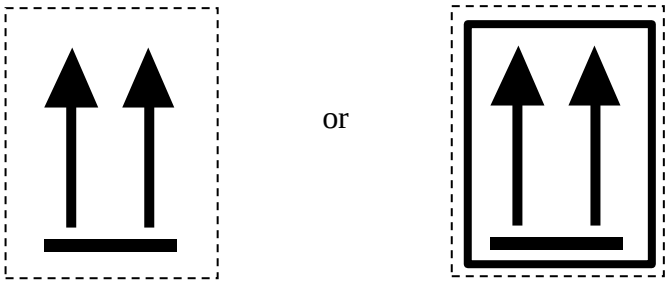
Insert the Packing Instruction "P099" *in Column 8 of the Dangerous Goods List for the following substance:*

UN 2186 HYDROGEN CHLORIDE, REFRIGERATED LIQUID

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 A7 (74 x 105 mm). If the size of the package so requires, the dimensions of the labels may be changed, provided that they remain clearly visible.



or

Two black or red 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, including fatigue, 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. Any additional thickness used for a corrosion allowance shall be added.

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~~ a jacket. If the space between the pressure receptacle and the ~~sheathing~~ jacket is evacuated of air (vacuum-insulation), the ~~protective sheathing~~ jacket 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~~ jacket 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 Closed cryogenic receptacles intended for the transport of refrigerated liquefied gases having a boiling point below -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 liquid.

6.2.1.1.5.4 Closed cryogenic receptacles shall be designed and constructed with suitable lifting and securing arrangements.

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 filled 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.

6.2.1.1.9 Pressure receptacles intended for the transport of flammable gases shall be capable of being electrically earthed

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.

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.*(Editorial note: this reference is correct for the renumbered paragraph)*

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 6.2.1.3.6.4 and 6.2.1.3.6.5 ~~as specified by the country of use~~. Pressure-relief devices shall be designed to prevent the entry of foreign matter, the leakage of gas and the development of any dangerous excess pressure. 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 Pressure receptacles whose filling is measured by volume shall be provided with a level indicator. *(Existing text formerly 6.2.1.3.6)*

6.2.1.3.6 ***Additional requirements for closed cryogenic receptacles***

6.2.1.3.6.1 Each filling and discharge opening in a closed 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, the second being a cap or equivalent device.

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

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

6.2.1.3.6.4 *Pressure-relief devices*

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

6.2.1.3.6.4.2 Closed cryogenic receptacles, in addition, have a frangible disc in parallel with the spring loaded device in order to meet the requirements of 6.2.1.3.6.5.

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

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

6.2.1.3.6.5 *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.*

6.2.1.3.6.5.1 The 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.

6.2.1.3.6.5.2 [Frangible discs shall be set to rupture at a nominal pressure which is the lower of 150% of the MAWP or the test pressure.]

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

6.2.1.3.6.5.4 The required capacity of the pressure-relief devices shall be calculated in accordance with an established technical code recognized by the competent authority *.

6.2.1.4 *Initial inspection and test*

6.2.1.4.1 New pressure receptacles, other than closed cryogenic 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:

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* [*See for example CGA Publications S-1.2-1995 and S-1.1-2001 and ENXXXX]*.

(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 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~~ competent authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.*

(h) Inspection and assessment of manufacturing defects and either repairing them or rendering the pressure receptacles unserviceable. In the case of welded pressure receptacles, particular attention shall be paid to the quality of the welds.

(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~~ mass and the quantity of solvent if applicable.

6.2.1.4.2 On an adequate sample of closed cryogenic receptacles, the inspections and tests specified in 6.2.1.4.1 (a), (b), (d), and (f) shall be performed. In addition, welds shall 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 shall undergo the inspections and tests specified in 6.2.1.4.1 (g), (h), and (i), as well as a leakproofness test and a test of the satisfactory operation of the service equipment after assembly.

6.2.1.5 ***Periodic inspection and test***

6.2.1.5.1 Refillable pressure receptacles, other than closed cryogenic receptacles, shall be subjected to periodic inspections and tests ~~under the supervision of an inspection~~ by a body authorized by the competent authority, 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~~ 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~~ competent 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 competent authority, the hydraulic pressure test of cylinders ~~and~~ or 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 Closed cryogenic receptacles shall be subject to an external examination of the closed cryogenic receptacle and its fittings, an inspection to verify the legibility and adequacy of the 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 closed 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 closed 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 10 mm 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 closed 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 closed 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~~ 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 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 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 closed 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 1SO 11114-1 :1997);

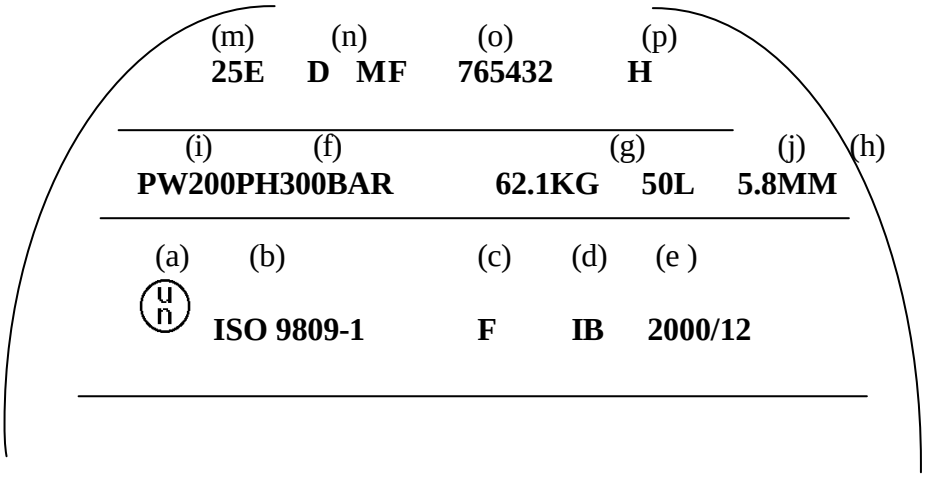
6.2.2.6.4 The above marks shall be placed in three groups ~~as shown in the example below~~:

- Manufacturing marks shall be the top grouping and shall appear consecutively in the sequence given in 6.2.2.6.3.

- The operational marks shall be the middle grouping ~~shall include~~ and 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 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 closed 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 that meets the periodic and test requirements of 6.2.2.4 shall be marked indicating;

(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 competent authority of the country approving manufacture;

(b) the registered mark of the body authorised by the competent 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 shall appear consecutively in the sequence given.]

~~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.~~