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**COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS**

**Sub-Committee of Experts on the Transport of Dangerous Goods**
**(Eighteenth session, 3-14 July 2000, agenda item 2 (a))**

# DEVELOPMENT OF PROVISIONS FOR THE TRANSPORT OF GASES

## Gas cylinders and other gas receptacles

## Comments on proposed text in ST/SG/AC.10/C.3/34/Add.1

## Transmitted by the expert from Canada

The expert from Canada would like to submit the following comments for consideration with regard to the development of provisions for the transport of gases. Specific comments are given with reference to the proposed text contained in the "Annex to the Report of the Working Group on Gas Receptacles and Multiple-Element Gas Containers (MEGCs)" from the December 1999 meeting (ST/SG/AC.10/C.3/34/Add.1).

### General comment

1. The expert from Canada would like these provisions to be developed as soon as possible.

   The work on MEGCs (contained in proposals 6 and 7) was continued from the last biennium, and it is possible that it could be completed this biennium.

   However, the work on gas cylinders was started this biennium. There are several major issues remaining to be discussed regarding gas cylinders and transport of gases in proposals 3 and 4. Issues, such as the use of pressure relief devices, verification of the filling table and formulae, markings, and quality conformance and certification, still need to be considered and finalised.

In view of the number and the complexity of issues yet to be resolved, the expert from Canada believes that it is not unreasonable to foresee this work continuing into the next biennium. If this is the case, a work plan should be developed to complete this work during the next biennium.

**Comments on Proposal 1**

2. (p. 2) **1.2.1, "Cryogenic receptacles"**

Change "closed or not" to ", open or closed,". The term "open cryogenic vessel' is used throughout the text.

3. (p. 2) **1.2.1, "Settled pressure"**

Change "gas receptacle" to "pressure receptacle". The term "pressure receptacle" is defined and used throughout the text.

**Comments on Proposal 3**

4. (p. 4) **4.1.6.1.1**

The reference to "4.1.4.2" should be changed to "4.1.4.1".

5. (p. 4) **4.1.6.1.2**

"liquid substances with corrosive properties" should be changed to "Class 8 corrosive substances".

6. (p. 4) **4.1.6.1.2**

The reference to "6.2.1.5" should be changed to "6.2.1.10".

7. (p. 4) **4.1.6.1.4**

In the first sentence, it was agreed at the last WG meeting to delete the words "if the pressure receptacle falls during storage, transport or handling".

8. (p. 4) **4.1.6.1.4**

At the end of (d), "[ISO 10297, Annex A]" can be deleted, as it is addressed in the last sentence.

The last sentence should read "...annex A of ISO 10297:1999...".

9. (p. 5) **4.1.6.1.8**

This section does not seem to read correctly. The following reformatting is suggested:

"Pressure receptacles shall not be offered for filling or 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~~ have been examined and found to be in good working order; or
(d) unless the markings necessary for filling are legible ~~or;~~

~~(e)~~ unless for the purpose of repair in accordance with these regulations."

10. (p. 6) **P200**

This packing instruction will be inserted into 4.1.4.1, not 4.1.6.2. This reference was correct before and should not have been changed.

11. (p. 6) **P200**

Although the requirements for MEGCs are proposed to be inserted in sections for portable tanks (4.2.4 and 6.7.5), it seems to be proposed that packing instruction P200 will cover MEGCs (and not a portable tank instruction such as T50). If this is the case, then the following amendment to the preamble of P200 is suggested:

"This packing instruction applies to Class 2 compressed gases, liquefied gases, and gases in solution.

The following types of pressure receptacles are authorised: cylinders, tubes, pressure drums, and bundles of cylinders, as specified in 6.2. MEGCs, as specified in 6.7.5, are authorised.

For pressure receptacles, the general packing requirement of 4.1.6.1 shall be met. For MEGCs, the general provisions of 4.2.4 shall be met."

12. (p. 6) **P200, 200(a) and throughout**

"ppm" should be changed to "$mL/m^3$" throughout the entire proposed text. This is consistent with other toxicity specifications in the Model Regulations. It is unclear whether "ppm" is by mass or by volume.

13. (p. 6) **P200, 200(a)**

In the second sentence, delete the words "as specified in the table", since toxic gases with an LC50 less than or equal to 200 ppm ($mL/m^3$) do not seem to be "specified" in the table.

However, perhaps a new special requirement "p" could be added in 200(l) (and referred to in the appropriate rows of the table) as follows:

"p: Pressure receptacles shall not be fitted with any pressure-relief device."

and special requirement "z(3)" could be amended as follows:

"z: (3) Toxic gases ~~and gas mixtures~~ with $LC_{50}$ less than or equal to 200 ~~ppm~~ $mL/m^3$ shall not be transported in tubes and pressure drums, and any pressure receptacle containing such a gas shall not be fitted with a pressure-relief device."

(The words "and gas mixtures" should be deleted from 200(l)z(3) because the sentence could be read as applying to "toxic gases" (i.e. with an $LC_{50}$ less than or equal to 5000 $mL/m^3$) and "gas mixtures with an $LC_{50}$ less than or equal to 200 $mL/m^3$".)

14. (p. 6) **P200, 200(b)**

The second point should more correctly read:

"- identify the minimum test pressure, the maximum test period for periodic inspections, and the maximum filling ratio or pressure ~~and the maximum water capacity~~ for the various gases~~, as well as restrictions concerning toxic gases with LC50 < 200 ppm~~;"

15. (p. 6) **P200, 200(e)**

As agreed at the July 1999 meeting, the words "with insufficient thermo-dynamical and physical data" should be changed to "for which data is not provided in the table".

16. (p. 7) **P200, 200(f)**

Change "the vapour phase shall not disappear below 60°C" to "the liquid phase shall not fill the pressure receptacle at any temperature up to 60°C".

17. (p. 7) **P200, 200(g)**

For consistency with the previous comment, the words "with insufficient thermo-dynamical and physical data" should be changed to "for which data is not provided in the table".

18. (p. 7) **P200, 200(h)**

The first sentence should be amended as follows:

> "For acetylene, dissolved, UN 1001, ~~once equilibrium has been achieved at 15°C,~~ the ~~working~~ settled pressure at 15°C shall not exceed the value prescribed ~~by the competent authority~~ for the porous mass in the cylinder approval."

19. (p. 7) **P200, 200(j)**

Delete this paragraph, as it is not needed. Test periods are indicated for all n.o.s. entries in the table.

20. (p. 7) **P200, 200(k)**

As agreed at the July 1999 meeting, it would make more sense to switch the order of "MEGCS" (making it "(5)") and "Bundles of cylinders" (making it "(4)").

21. (p. 8) **P200, 200(l)g**

The meaning of "(re. 200(d))" is unclear.

22. (p. 8) **P200, 200(l)h**

Special provision PP23 under the current P200 (in the eleventh revised edition of the Model Regulations) already limits acetylene to cylinders "fitted with a homogeneous monolithic porous mass" (and containing "an adequate quantity of acetone or other equally suitable solvent").

23. (p. 8) **P200, 200(l)n**

The meaning of "calculation shows an equivalent resistance to mechanical impact" is not clear.

24. (p. 8) **P200, 200(l)z(3)**

Amend as follows: "Toxic gases ~~and gas mixtures~~ with $LC_{50}$ less than or equal to 200 ~~ppm~~ $mL/m^3$...".

As mentioned previously in comment 13, the words "and gas mixtures" should be deleted because the sentence could be read as applying to "toxic gases" (i.e. with an $LC_{50}$ less than or equal to 5000 $mL/m^3$) and "gas mixtures with an $LC_{50}$ less than or equal to 200 $mL/m^3$".

Also, the "less than sign" ("<") should be changed to a "less than or equal to" sign ("≤").

25. (p. 9) **P200, 200(l)z(4)**

Amend the first sentence as follows: "The valves of pressure receptacles for toxic gases ~~and gas mixtures~~ with an $LC_{50}$ less than or equal to 200 ~~ppm~~ $mL/m^3$...".

26. (pp. 9-17) **P200, table**

It would be helpful for verification purposes if this table could be sorted in order of UN number as soon as possible.

27. (pp. 9-17) **P200, table**

The headings for the columns of the table should be amended as follows:

Change "Identification No." to "UN No.".

Change "Name of the substance or article" to "Shipping name of the gas".

Change "Receptacles" to "Pressure receptacles".

Under "PERIOD (years)", delete the "*/" or add an explanation for it.

Under "MAX. FILL.", simplify to "ratio or MPa" (delete "kg/l" and " or Vol %").

For clarity, perhaps the "FILLING" column could be divided into two sub-columns, "Maximum filling ratio" and "Maximum settled pressure at 15°C (MPa)".

28. (p. 10) **P200, table, 2203, Silane, compressed**

In the "Name of the substance" column, delete the "**/" or add an explanation for it.

29. (p. 15) **P200, table, 1965, Hydrocarbon gas mixture, liquefied n.o.s.**

In the "FILLING" column, delete the "**/" or add an explanation for it.

30. (p. 16) **P200, table, 2192, Germane**

In the "Name of the substance" column, delete the "***/" or add an explanation for it.

31. (p. 16) **P200, table, 2199, Phosphine**

In the "Name of the substance" column, delete the "***/" or add an explanation for it.

32. (p.19) **P201**

As agreed to at the last meeting, and as noted in paragraph 25 of the report of the working group (ST/SG/AC.10/C.3/34/Annex 1), the proposed text for packing instruction P201 should be aligned with the current P201 in the eleventh revised edition of the Model Regulations.

The text from the current P201 in the eleventh revised edition of the Model Regulations should be used, except that P201(1) should be updated as follows: "Pressure receptacles conforming to the construction, testing, and filling requirements of 4.1.6.1 and 6.2, as applicable."

33. (p.19) **P202**

As agreed to at the last meeting, the proposed text for packing instruction P202 should be aligned with the current P202 in the eleventh revised edition of the Model Regulations.

The text from the current P202 in the eleventh revised edition of the Model Regulations should be used, except that additional requirement 2 under the current P202 should be updated as follows: "The pressure receptacle shall be in accordance with the requirements of 4.1.6.1 and 6.2."

(Note that ST/SG/AC.10/C.3/1998/19, referred to in the draft text, contains a proposal for P202 which preceded the eleventh revised edition of the Model Regulations; it is formatted differently. The formatting of the current P202 should be retained.)

34. (p. 19) **P203**

Packing instruction P203 is new, and it should be ensured that references to it are inserted for the appropriate refrigerated liquefied gases in the Dangerous Goods List in 3.2 of the Model Regulations.

35. (p. 19) **P203**

The following words should be added to the beginning of P203: "This packing instruction applies to Class 2 refrigerated liquefied gases."

36. (p. 19) **P203**

At the beginning of P203, the reference should be changed from "4.1.4.1" to "4.1.6.1".

37. (p. 19) **P203**

In the second heading, change "Particular instructions..." to "Requirements...".

38. (p. 19) **P203**

At the beginning of the section for closed cryogenic receptacles, the following words should be added: "Closed cryogenic receptacles, as specified in 6.2, are authorised."

39. (p. 19) **P203, 203(a)**

Change "the degree of filling" to "the liquid phase".

40. (p. 19) **P203, 203(b)**

Change "the volume would reach 95% of the capacity" to "the volume of the liquid phase would not exceed 95% of the water capacity".

41. (p. 19) **P203, 203(c)**

This should be applicable for all gases.

42. (p. 19) **P203, 203(c)**

(Change "carriage" to "transport".)

43. (p. 19) **P203, 203(d)**

The reference should be changed from "6.2.1.5" to "6.2.1.10".

44. (p. 19) **P203, 203(e)**

This paragraph should be changed to: "The test period for periodic inspections shall be as specified by the competent authority".

Since there is currently is no standard for periodic inspection of cryogenic receptacles, and for the time being, periodic inspections will be performed in accordance with national or regional requirements, the test period should not be specified.

45. (p. 19) **P203, 203(e)**

The paragraph, "By derogation...design and construction.", is unnecessary and should be deleted.

46. (p. 20) **P203**

In the third heading, change "Particular instructions..." to "Requirements...".

47. (p. 20) **P203**

At the beginning of the section for open cryogenic receptacles, the following words should be added: "Open cryogenic receptacles conforming to the requirements of the competent authority are authorised."

48. (p. 20) **P203, 203(h)**

As discussed at the last meeting, the "[...][?]" at the end of the sentence should be completed, or else, the last sentence should be deleted.

49. (p. 20) **P203, 203(j)**

As agreed to at the last two meetings, this paragraph should be moved to the beginning of the packing instruction, so that it applies to both open and closed cryogenic receptacles.

"the devices referred to above" should be changed to "any devices".

The word "glass" should be deleted, as this should apply to all types of cryogenic receptacles.

**Comments on Proposal 4**

50. (p. 21) **6.2**

It should be noted that in the current eleventh revised edition of the Model Regulations, 6.2.1 is reserved for requirements for gas cylinders. Section 6.2.2 contains requirements for aerosols.

It should be clarified that the text proposed for "6.2" in Proposal 4 is meant to be inserted into the currently reserved section 6.2.1 of the Model Regulations. The requirements for aerosols in the current 6.2.2 should be retained.

51. (p. 21) **6.2**

In the title, delete the words "including pressure receptacles which are elements of MEGCs".

52. (pp. 21-28) **6.2**

As agreed to at the last meeting, this section should be re-organised into *three parts*. The following subdivisions are suggested:

**6.2.1 General requirements**
6.2.1.1 Design and construction
6.2.1.2 Materials

6.2.1.3 Service equipment *(except not including the current 6.2.1.3.7)*
6.2.1.4 Initial inspection and test *(currently 6.2.1.9)*
6.2.1.5 Periodic inspection and test *(currently 6.2.1.10, except not including 6.2.1.10.4)*
6.2.1.6 Approval of pressure receptacles *(currently 6.2.1.8)*
6.2.1.7 Requirements for manufacturers *(currently 6.2.1.4)*
6.2.1.8 Requirements for testing and certifying bodies *(currently 6.2.1.5)*

**6.2.2 Requirements for UN certified pressure receptacles**
*(As agreed to at the last meeting)* "In addition to the general requirements of 6.2.1, UN certified pressure receptacles shall comply with the requirements of 6.2.2, including the standards specified in 6.2.2 as applicable."
*(As agreed to at the last two meetings, 6.2.2 should have similar subdivisions as 6.2.1, with references to appropriate ISO and other standards)*
6.2.2.1 Design, construction, and initial inspection and test *(currently 6.2.1.6)*
6.2.2.2 Materials *(extract from current 6.2.1.2.1)*
6.2.2.3 Service equipment *(currently 6.2.1.3.7)*
6.2.2.4 Periodic inspection and test *(currently 6.2.1.10.4)*
6.2.2.5 Approval of pressure receptacles
6.2.2.6 Requirements for manufacturers
6.2.2.7 Requirements for testing and certifying bodies
6.2.2.8 Marking *(currently 6.2.1.11)*

**6.2.3 Requirements for pressure receptacles not conforming to standards (non-UN certified pressure receptacles)** *(currently 6.2.1.7)*

(Note: In order to ease the visualisation of this re-organisation, as well as all of the following comments on Proposal 4, the expert from Canada would like to provide the attached Annex.)

53. (p. 21) **6.2.1.1.2**

Delete the last part of the sentence: "and provided that the competent authority determines that the alternative requirements...of this Chapter."

54. (p. 21) **6.2.1.1.4**

This section should be amended as follows:

"For welded pressure receptacles, only ~~materials~~ metals of ~~high~~ weldable quality ~~weldability whose adequate impact strength at an ambient temperature of -20°C can be guaranteed, particularly in the weld seams and the zones adjacent thereto,~~ shall be used. ~~Welds shall be skilfully made and shall afford the fullest safety.~~

Any additional thickness to allow for corrosion shall not be taken into consideration in calculating the thickness of the walls."

(It was agreed at the last meeting to delete the phrase, "whose adequate impact strength...adjacent thereto", and the sentence, "Welds shall be skilfully made and shall afford the fullest safety.".)

55. (p. 21) **6.2.1.1.6**

The first point should be amended as follows: "~~All t~~The mechanical ~~and technological characteristics~~ properties of the metal used shall be established for each pressure receptacle at the initial inspection~~; with regard to~~ , including the impact strength and the bending coefficient;".

56. (p. 22) **6.2.1.1.7**

"Maximum allowable working pressure (MAWP)" is not defined in Part 1 or for Chapter 6.2 of the Model Regulations.

57. (p. 22) **6.2.1.2.1**

Delete the words: "and all substances that might come into contact".

58. (p. 22) **6.2.1.2.1**

The references to the two ISO standards should be moved to the *second part* (i.e. the part containing "Requirements for UN certified pressure receptacles", e.g. 6.2.2.2), and compliance with these standards should be mandatory for UN certified pressure receptacles.

59. (p. 22) **6.2.1.3.2**

In the second sentence, delete the word "sufficiently".

60. (p. 22) **6.2.1.3.2**

The beginning of the third sentence should read: "The filling and discharge valves and any protective caps....".

61. (p. 22) **6.2.1.3.3**

At the end of the sentence, delete the words "the wall of".

62. (p. 22) **6.2.1.3.4**

In the last sentence, delete the word "sufficiently".

63. (p. 22-23) **6.2.1.3.5**

"MAWP" is not defined in Part 1 or for Chapter 6.2 of the Model Regulations.

64. (pp. 22-23) **6.2.1.3.5**

Amend the third and fourth sentences as follows: "The valves shall be ~~so~~ constructed as to ~~work perfectly even~~ function properly at their lowest working temperature. Their ~~reliability of~~ functioning at that temperature shall be ~~established and~~ checked by testing each valve or a sample of valves of the same type of construction."

65. (p. 23) **6.2.1.3.7**

The references to the five ISO standards should be moved to the *second part* (i.e. the part containing "Requirements for UN certified pressure receptacles", e.g. 6.2.2.3), and compliance with these standards should be mandatory for UN certified pressure receptacles.

66. (p. 23) **6.2.1.4.1**

Change "suitable means" to "resources".

67. (p. 23) **6.2.1.4.2**

At the end of the first sentence, change "country of origin" to "country of manufacture".

68. (p. 23) **6.2.1.4.2**

Delete the second sentence, "The particular certification process...taken into consideration.", as it is unnecessary.

69. (p. 23) **6.2.1.5**

Amend as follows: "Testing and certifying bodies shall be independent from manufacturing enterprises and ~~technologically~~ competent to ~~the degree required~~ perform the tests, inspections, and approvals required.

70. (p. 23) **6.2.1.6.1**

Perhaps this is better placed in *third part* (i.e. the part containing "Requirements for pressure receptacles not conforming to standards (non-UN certified pressure receptacles)", e.g. 6.2.3.2).

71. (p. 24) **6.2.1.6.2**

As agreed to at the last two meetings, a reference to the ISO standard on welded cylinders should be added in square brackets, i.e. [ISO 4706:1989 Refillable welded steel gas cylinders].

72. (p. 24) **6.2.1.6.2 and 6.2.1.6.3**

The table should have an additional column for exceptions or restrictions (i.e. for the "Notes").

73. (p. 24) **6.2.1.7.2 and 6.2.1.7.3**

Although it is not necessary to specify minimum burst ratios as in 6.2.1.7.2 and 6.2.1.7.3, if they are specified, in 6.2.1.7.2, the burst ratio should be lowered to 1.5 for welded refillable pressure receptacles.

(In Canada, welded cylinders are designed and manufactured such that the test pressure is two times the service pressure, and the burst pressure is three times the service pressure.)

74. (p. 25) **6.2.1.8.1 and 6.2.1.8.2**

Amend as follows:

> "6.2.1.8.1 The conformity of pressure receptacles shall be assessed ~~to the requirements of~~ as required by the competent authority. Pressure receptacles shall be ~~examined~~ inspected, tested, and approved by a testing and certifying body approved by the competent authority of the country of origin~~, on the basis of the technical documentation and declaration of the manufacturer on compliance with the relevant provisions of this Class~~.
>
> The technical documentation shall include full specifications on design and construction, and full documentation on the manufacturing and testing.
>
> 6.2.1.8.2 ~~The requirements of q~~Quality assurance systems shall ~~be deemed to be complied with, if they~~ conform to the requirements of the competent authority."

6.2.1.8.1 and 6.2.1.8.2 are general requirements, and these sections should be inserted into the *first part* (i.e. the part containing "General Requirements", e.g. 6.2.1.6).

Section 6.2.4.4 from the draft document generated after the July 1999 meeting (ST/SG/AC.10/C.3/32/Add.1) used to have a reference to the ISO document on quality conformance (ISO 14600). The reference to this document seems to have been erroneously deleted from the draft document generated after the December 1999 meeting (ST/SG/AC.10/C.3/34/Add.1). It should be re-instated into the *second part* (i.e. the part containing "Requirements for UN certified pressure receptacles", e.g. 6.2.2.5) as follows:

"UN certified pressure receptacles shall be manufactured under a quality system, inspected, tested, approved, and certified in accordance with the requirements in ISO/PDTR 14600, "Gas cylinders—International quality conformance system—Basic rules"."

Additional references to the ISO 14600 document should be inserted as follows:

(Requirements for manufacturers) "Manufacturers of UN certified pressure receptacles shall meet the applicable requirements of ISO/PDTR 14600, "Gas cylinders—International quality conformance system—Basic rules"."

(Requirements for testing and certifying bodies) "Testing and certifying bodies for UN certified pressure receptacles shall meet the requirements for inspection bodies and testing laboratories specified in ISO/PDTR 14600, "Gas cylinders—International quality conformance system—Basic rules", as applicable."

75. (p. 25) **6.2.1.9.1**

In the first sentence, amend as follows: "...testing and inspection during and after manufacture....".

76. (p. 25) **6.2.1.9.1(d)**

Amend as follows: "...without undergoing excessive permanent deformation or exhibiting any defects or cracks;".

77. (p. 25) **6.2.1.9.1(f)**

Delete the words "the nature of".

78. (p. 25) **6.2.1.9.2**

Delete this requirement. New pressure receptacles should not have to be inspected for intercrystalline corrosion.

79. (p. 26) **6.2.1.10.1**

It was agreed at the last meeting that this section would not apply to any cryogenic receptacles, and hence, the word "open" was deleted.

80. (p. 26) **6.2.1.10.1**

"under the supervision of" should be changed to "by".

81. (p. 26) **6.2.1.10.1(b)**

"checks of wall thickness" should be changed to "wall thickness measurement".

82. (p. 26) **new section between 6.2.1.10.1 and 6.2.1.10.2**

A new section should be added between 6.2.1.10.1 and 6.2.1.10.2:

> "6.2.1.10.x Non-refillable pressure receptacles and refillable pressure receptacles with a water capacity less than or equal to 1 L shall be exempt from periodic inspection and testing."

83. (p. 26) **6.2.1.10.3**

It was agreed at the last meeting that cryogenic receptacles do not need to be subjected to a leakproofness test, and this section was amended as follows:

> ~~"By derogation from paragraph 6.2.1.5.1(c) c~~Closed cryogenic pressure receptacles shall be subjected to ~~external inspection and to a leakproofness test~~ verification of external conditions, pressure relief devices, and markings. ~~The leakproofness test shall be carried out with the gas contained in the receptacle or with an inert gas. Checking shall be performed by means of a pressure gauge of by vacuum measurement.~~ The thermal insulation need not be removed."

84. (p. 26) **6.2.1.10.4**

The references to the six ISO standards should be moved to the *second part* (i.e. the part containing "Requirements for UN certified pressure receptacles", e.g. 6.2.2.4), and compliance with these standards should be mandatory for UN certified pressure receptacles.

85. (pp. 26-28) **6.2.1.11**

Marking requirements should only be specified for UN certified pressure receptacles. (This section should be moved to the *second part* (i.e. the part containing "Requirements for UN certified pressure receptacles", e.g. 6.2.2.8).) Otherwise, it would be implied that cylinders that continue to be manufactured according to current national or regional requirements would have to have their marks aligned with the new requirements specified here.

86. (pp. 26-27) **6.2.1.11.1**

As discussed at the July 1999 meeting, an order should be specified for these marks. The following is suggested:

"6.2.1.11.1 UN certified r~~R~~efillable pressure receptacles shall be marked clearly, legibly, and permanently, in the order as follows:

(a) The UN mark

(b) The country authorising the mark;

(c) The standard of the pressure receptacle;

(d) The working pressure in bar;

(e) The test pressure in bar;

(f) The date (month and year) of the initial inspection;

(g) The identification mark of the authorised body who carried out the tests and inspections;

(h) The name or the mark of the manufacturer;

(i) The serial number of the pressure receptacle provided by the manufacturer;

(j) The water capacity in litres;

(k) The mass of the pressure receptacle in kilograms;

(l) In the case of acetylene, dissolved, UN 1001, the tare of the pressure receptacle, including the fittings and accessories, the porous material, the solvent, and the saturation gas, in kilograms;

(m) The letter "H" indicating compatibility with gases with a risk of hydrogen embrittlement.

87. (pp. 26-27) **6.2.1.11.1**

The paragraph at the end of this section only gives examples for permanent markings on metallic cylinders. To address also composite cylinders, the following is suggested:

"These marks shall be permanently affixed ~~(e.g. stamped, engraved, or etched)~~ on the pressure receptacle. These markings shall be stamped, engraved, or etched into the metal of ~~on~~ the shoulder, top head, or neck of the pressure receptacle or on a permanently affixed component of the pressure receptacle (e.g. welded collar). For

composite pressure receptacles, these markings may be on a label embedded in the resin near the valve outlet end. ..."

88. (p. 27) **6.2.1.11.2**

The reference should be changed from "6.2.1.6.1" to "6.2.1.11.1".

89. (p. 27) **6.2.1.11.2**

The date should be marked "month and year", not "year and month", consistent with the required markings at manufacture in 6.2.1.11.1. It is important that this order be maintained to reduce confusion (e.g. "01 03" could be read January 2003 or March 2001).

90. (p. 27) **6.2.1.11.2**

The end of the sentence should be amended as follows: "...the ~~test~~ body authorised to perform the inspection by the competent authority of the country ~~of use~~ where the pressure receptacle is transported and used."

91. (p. 27) **6.2.1.11.3**

There are too many mandatory markings in ISO/DIS 13769, so compliance with this standard should not be mandatory for UN certified pressure receptacles. The following text is suggested:

"In addition to the required markings specified in (6.2.1.11.1) and (6.2.1.11.4), other markings as specified in ISO/DIS 13769 are permitted, but are not mandatory. Such markings shall not conflict with required markings. If stamped, engraved, or etched, these markings shall be made in low stress areas other than the side wall and shall not be of a size or depth that will create harmful stress concentrations."

(The last part of the text is taken from the end of 6.2.1.11.1 and 6.2.1.11.4.)

92. (pp. 27-28) **6.2.1.11.4**

As discussed at the July 1999 meeting, an order should be specified for these marks. The following is suggested:

"6.2.1.11.4 UN certified n~~N~~on-refillable pressure receptacles shall be marked clearly, legibly, and durably, in the order as follows:

(a) The UN mark

(b) The country authorising the mark;

(c) The standard of the pressure receptacle;

(d) The working pressure in bar;

(e) The test pressure in bar;

(f) The date (month and year) of manufacture;

(g) The identification mark of the authorised body who carried out the tests and inspections;

(h) The name or the mark of the manufacturer;

(i) The serial or batch number of the pressure receptacle provided by the manufacturer;

(j) The words “DO NOT REFILL”; this marking shall be a minimum of 6 mm in heights.

93. (p. 28) **6.2.1.11.5**

This section can be deleted, as the requirements for the UN mark should be incorporated into the sections for required markings (6.2.1.11.1 and 6.2.1.11.4).

**Comments on Proposal 6**

94. (p. 30) **4.2.4.3**

In the first sentence, delete the word “adequately”.

95. (p. 30) **4.2.4.4**

Amend as follows: “Toxic gases ~~and gas mixtures~~ with $LC_{50} \leq 200$ ~~ppm~~ mL/$m^3$...”.

The words “and gas mixtures” should be deleted because the sentence could be read as applying to “toxic gases” (i.e. with an $LC_{50}$ less than or equal to 5000 mL/$m^3$) and “gas mixtures with an $LC_{50}$ less than or equal to 200 mL/$m^3$”.

96. (p. 30) **4.2.4.5**

Amend as follows: “Empty MEGCs ~~not~~ that have not been cleaned and ~~not gas-free~~ purged shall comply with the same requirements as MEGCs filled with the previous gas.”

97. (pp. 30-31) **4.2.5 (including 4.2.5.1 to 4.2.5.6)**

Section "4.2.5" should be re-numbered "4.2.4.7". Hence, subsections 4.2.5.1 to 4.2.5.6 should be re-numbered 4.2.4.7.1 to 4.2.4.7.6.

98. (p. 31) **4.2.5.6**

This section does not seem to read correctly. The following amendments are suggested:

"MEGCs shall not be offered for ~~transport~~ filling or ~~filling~~ transport:

(a) when leaking;
(b) when damaged to such an extent that the integrity of the elements or the lifting or securing arrangements may be affected; ~~and~~
(c) unless the service equipment has been examined and found to be in good working order; or
(d) unless the markings necessary for filling are legible ~~or;~~

~~(e)~~ unless for the purpose of repair in accordance with these regulations."

**Comments on Proposal 7**

99. (p. 32) **6.7.5.2.3**

For clarity, amend the second sentence as follows: "All of the e~~E~~lements in a MEGC shall be of the same design type."

100. (p. 32) **6.7.5.2.4(a)**

Change "substantially immune to attack by" to "compatible with".

101. (p. 33) **6.7.5.2.9**

Perhaps the word "absorbing" should be changed to "withstanding".

102. (p. 33) **6.7.5.2.10**

Change "Under the stresses defined above" to "Under the forces defined above".

103. (p. 34) **6.7.5.3.1**

In the fourth sentence, delete the word "sufficiently".

104. (p. 34) **6.7.5.3.9**

The section number "6.7.5.3.9" is missing in front of "Ductile metals shall be used....".

105. (p. 35) **6.7.5.4.3**

In the first sentence, the reference should be changed from "4.2.5.2.8" to "4.2.4.2.6".

106. (p. 36) **6.7.5.7.1**

The reference to 6.6.5.6. is incorrect.

107. (p. 36) **6.7.5.8.1**

In the first sentence, "situated in the vapour space" should be changed to "in communication with the vapour space".

108. (p. 36) **6.7.5.10.1**

The reference to "6.7.5.2.8" should be changed to "6.7.5.2.9"

The reference to "6.7.5.2.9" should be changed to "6.7.5.2.11".

109. (p. 37) **6.7.5.11.1**

In the sixth sentence, the reference should be changed from "6.6.1.2" to "6.7.1.2".

110. (p. 38) **6.7.5.12.4**

In the second sentence, the reference should be changed from "6.2.1.5" to "6.2.1.10".

111. (p. 40) **6.7.5.13.1**

Is it necessary to mark the "Year (Date?) of manufacture: year and month", if the "Initial pressure test date" is marked?

112. (p. 40) **6.7.5.13.1**

Amend the eleventh row of marks as follows:

> "Initial pressure test date (month and year) and [~~witness~~] identification of the testing body"

113. (p. 40) **6.7.5.13.1**

In the thirteenth row, the order should be "Month" then "Year". This is consistent with the marking for portable tanks. It is important that this order be maintained to reduce confusion (e.g. "01 03" could be read January 2003 or March 2001).

114. (p. 40) **6.6.5.13.2**

This section number should be changed from “6.6.5.13.2” to “6.7.5.13.2”.

* * * * *

## Annex

## Comments on Proposal 4

*(It should be noted that in the current eleventh revised edition of the Model Regulations, 6.2.1 is reserved for requirements for gas cylinders. Section 6.2.2 contains requirements for aerosols.*

*It should be clarified that the text proposed for "6.2" in Proposal 4 is meant to be inserted into the currently reserved section 6.2.1 of the Model Regulations. The requirements for aerosols in the current 6.2.2 should be retained.)*

**6.2 Requirements for the construction and testing of pressure receptacles for gases ~~including pressure receptacles which are elements of MEGCs~~**

**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 their normal use and during normal transport conditions.

6.2.1.1.2 In recognition of scientific and technological advances, and recognising 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 authority~~y~~ies in the countries of transport and use ~~and provided that the competent authority determines that the alternative requirements provide at least the same level of safety as if the pressure receptacle were designed in accordance with the requirements of this Chapter~~.

6.2.1.1.3 Pressure receptacles and their closures shall be made of suitable materials which shall be resistant to brittle fracture and to stress corrosion cracking.

6.2.1.1.4 For welded pressure receptacles, only ~~materials~~ metals of ~~high~~ weldable quality ~~weldability whose adequate impact strength at an ambient temperature of -20 °C can be guaranteed, particularly in the weld seams and the zones adjacent thereto,~~ shall be used. ~~Welds shall be skilfully made and shall afford the fullest safety.~~ Any additional thickness to allow for corrosion shall not be taken into consideration in calculating the thickness of the walls.

6.2.1.1.5 Pressure receptacles for acetylene, dissolved, UN 1001, shall be filled entirely with a porous material, uniformly distributed, of a type approved by the competent authority, and which:

(a) does not attack the pressure receptacles or form harmful or dangerous compounds ~~either~~ with the acetylene or with the solvent; and

(b) is capable of preventing the spread of decomposition of the acetylene in the mass.

The solvent shall not attack the pressure receptacles.

6.2.1.1.6 The following requirements apply to the construction of closed cryogenic pressure receptacles for refrigerated liquefied gases:

(a) ~~All t~~The mechanical ~~and technological characteristics~~ properties of the metal used shall be established for each pressure receptacle at the initial inspection~~; with regard to~~ , including the impact strength and the bending coefficient;

(b) 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 and the sheathing is airless (vacuum-insulation), the protective sheathing shall be designed to withstand without deformation an external pressure of at least 100 kPa (1 bar). 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.

6.2.1.1.7 The test pressure of the pressure receptacles ~~is provided in~~ shall be in accordance with P200 for cylinders, tubes, pressure drums, and bundles of cylinders. [The test pressure for closed cryogenic receptacles~~, closed, is~~ shall be not less than 1.3 times the maximum allowable working pressure (MAWP) increased by 1 bar for vacuum insulated receptacles.]

*(MAWP is not defined in Part 1 or for Chapter 6.2 of the Model Regulations.)*

**6.2.1.2 Materials ~~of pressure receptacles~~**

6.2.1.2.1 The materials of which the pressure receptacles and their closures are made and ~~all substances that might come into contact~~ shall be compatible with the contents and shall not form harmful or dangerous compounds therewith.

~~Additionally, t~~The material shall resist brittle fracture at the lowest working temperature of the receptacle and its fittings.

**6.2.1.3 Service equipment** *(not including the previous 6.2.1.3.7)*

6.2.1.3.1 Valves, piping, fittings, and equipment subjected to pressure shall have at least the same test pressure as the pressure receptacles.

6.2.1.3.2 Service equipment shall be ~~so~~ arranged as to be protected ~~against the risk of~~ from being wrenched off or damaged during handling and transport. Manifold piping leading to shut-off valves shall be ~~sufficiently~~ flexible to protect the valves and the piping from shearing. 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.

6.2.1.3.3 Pressure receptacles which are not capable of being carried 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 wall of~~ the pressure receptacle.

6.2.1.3.4 [When fitted], ~~safety~~ pressure relief devices on manifolded horizontal pressure receptacles filled with flammable gas shall be arranged to discharge upward and unobstructed to the open air in such a

manner as to prevent any impingement of escaping gas upon the ~~containers~~ pressure receptacles. Individual pressure receptacles shall be equipped with approved pressure relief devices as required in P200. Manifold branch lines of individual shut-off valves shall be ~~sufficiently~~ flexible to prevent damage to the valves which otherwise might result from the use of rigid branch lines.

[6.2.1.3.5 Closed c~~C~~ryogenic receptacles~~, closed,~~ shall be fitted with one or more pressure-relief devices to protect the ~~vessel~~ pressure receptacle against excess pressure. Excess pressure means a pressure in excess of 110% of the MAWP due to normal heat leak or in excess of the test pressure due to the loss of vacuum for vacuum-insulated receptacles or due to the failure in the open position of a pressure build up system. The valves shall be ~~so~~ constructed as to ~~work perfectly even~~ function properly at their lowest working temperature. Their ~~reliability of~~ functioning at that temperature shall be ~~established and~~ checked by testing each valve or a sample of valves of the same type of construction. The vents and safety valves of pressure receptacles shall be so designed as to prevent the liquid from splashing out.]

*(MAWP is not defined in Part 1 or for Chapter 6.2 of the Model Regulations.)*

6.2.1.3.6 Pressure r~~R~~eceptacles whose filling is measured by volume shall be provided with a level indicator.

**6.2.1.4 Initial inspection and test** *(previously 6.2.1.9)*

6.2.1.4.1 New pressure receptacles shall be subjected to testing and inspection during and after manufacture in accordance with 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) Checking the homogeneity of the material for each manufacturing batch, and inspection of the external and internal conditions of the pressure receptacles;

For all pressure receptacles:

(d) A hydraulic pressure test. Pressure receptacles shall withstand the test pressure without undergoing excessive permanent deformation or exhibiting any defects or cracks;

***NOTE:*** *With the agreement of the testing and certifying body authorised by the competent authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.*

(e) An inspection of the markings on the pressure receptacles (see sub-section 6.2.1.11);

(f) In addition, pressure receptacles intended for the transport of acetylene, dissolved, UN 1001, shall have an inspection of ~~the nature of~~ the porous material and the quantity of solvent.

~~6.2.1.4.2 Aluminium alloys shall be checked for intercrystalline corrosion.~~

**6.2.1.5 Periodic inspection and test** *(previously 6.2.1.10, except not including 6.2.1.10.4)*

6.2.1.5.1 Refillable pressure receptacles, with the exception of ~~open~~ cryogenic receptacles, shall be subjected to periodic inspections ~~under the supervision of~~ by a body authorised 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 of~~ wall thickness measurement);

(c) ~~The~~ A hydraulic pressure test and, if necessary, verification of the characteristics of the material by suitable tests.

***NOTE 1**: With the agreement of the testing and certifying body authorised by the 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 testing and certifying body authorised by the competent authority, the hydraulic pressure test of cylinders and tubes may be replaced by an equivalent method based on acoustic emission or based on ultrasound.*

6.2.1.5.2 Non-refillable pressure receptacles and refillable pressure receptacles with a water capacity less than or equal to 1 L shall be exempt from periodic inspection and testing.

6.2.1.5.3 For pressure receptacles intended for the transport of acetylene, dissolved, UN 1001, only the external condition (corrosion, deformation) and the condition of the porous mass (loosening, settlement) shall be examined.

6.2.1.5.4 ~~By derogation from paragraph 6.2.1.5.1(c) c~~Closed cryogenic pressure receptacles shall be subjected to ~~external inspection and to a leakproofness test~~ verification of external conditions, pressure relief devices, and markings. ~~The leakproofness test shall be carried out with the gas contained in the receptacle or with an inert gas. Checking shall be performed by means of a pressure gauge or by vacuum measurement.~~ The thermal insulation need not be removed.

**6.2.1.6 Approval of pressure receptacles** *(previously 6.2.1.8)*

6.2.1.6.1 [The conformity of pressure receptacles shall be assessed ~~to the requirements of~~ as required by the competent authority. Pressure receptacles shall be ~~examined~~ inspected, tested, and approved by a testing and certifying body approved by the competent authority of the country of origin~~, on the basis of the technical documentation and declaration of the manufacturer on compliance with the relevant provisions of this Class~~.

The technical documentation shall include full specifications on design and construction, and full documentation on the manufacturing and testing.]

6.2.1.6.2 [~~The requirements of q~~Quality assurance systems shall ~~be deemed to be complied with, if they~~ conform to the requirements of the competent authority.]

**6.2.1.7 Requirements for manufacturers** *(previously 6.2.1.4)*

6.2.1.7.1 The manufacturer shall be technically able and shall possess all ~~suitable means~~ resources required for the satisfactory manufacture of pressure receptacles; this relates in particular to qualified personnel:

(a) to supervise the entire manufacturing process;

(b) to carry out joining of materials; and

(c) to carry out the relevant tests.

6.2.1.7.2 The proficiency test of a manufacturer shall in all instances be carried out by a testing and certifying body approved by the competent authority of the country of ~~origin~~ manufacture. ~~The particular certification process the manufacturer intends to apply shall be taken into consideration.~~

**6.2.1.8 Requirements for testing and certifying bodies** *(previously 6.2.1.5)*

6.2.1.8.1 Testing and certifying bodies shall be independent from manufacturing enterprises and ~~technologically~~ competent to ~~the degree required~~ perform the tests, inspections, and approvals required.

**6.2.2 Requirements for UN certified pressure receptacles**

In addition to the general requirements of section 6.2.1, UN certified pressure receptacles shall comply with the requirements of section 6.2.2, including the standards specified in section 6.2.2 as applicable.

**6.2.2.1 Design, ~~and~~ construction, and initial inspection and test ~~requirements for multi-modal transport~~** *(previously 6.2.1.6)*

[6.2.2.1.1 The following standards apply for the design, ~~and~~ construction, and initial inspection and test of UN ~~marked and~~ certified ~~gas~~ cylinders:]

| **Standard** | ***Title of standard*** | **Exceptions or restrictions** |
|---|---|---|
| ISO~~/DIS~~ 9809-1:1999 | Gas cylinders - ~~Transportable~~ Refillable seamless steel gas cylinders – Design, construction, and testing - Part 1: Quenched and tempered steel cylinders with tensile strength less than 1100 MPa | The design stress factor F shall not be variable. |
| ISO/FDIS 9809-2 | Gas cylinders - ~~Transportable~~ Refillable seamless steel gas cylinders – Design, construction and testing - Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1100 MPa | |
| ISO/DIS 9809-3 | Gas cylinders - ~~Transportable~~ Refillable seamless steel gas cylinders - Design, construction, and testing - Part 3: Normalised steel cylinders | |

| **Standard** | ***Title of standard*** | **Exceptions or restrictions** |
|---|---|---|
| ISO/~~DIS~~ 7866:1999 | Gas cylinders - Refillable ~~transportable~~ seamless aluminium alloy gas cylinders ~~for world-wide usage~~ – Design, ~~manufactured~~ ,construction, and ~~acceptance~~ testing | The design stress factor F shall not be variable. Aluminium alloy 6351A is not authorised. |
| ISO/~~CD~~ DIS 11119-1 | Gas cylinders of composite ~~material~~ construction – ~~s~~Specification~~s~~ and test methods - Part 1: Hoop wrapped~~,~~ ~~metallic~~ composite gas cylinders | |
| ISO/~~CD~~ DIS 11119-~~1~~ 2 | Gas cylinders of composite ~~material~~ construction – ~~s~~Specification~~s~~ and test methods - Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal~~lic~~ liners | |
| ISO/~~CD~~ DIS 11119-~~1~~ 3 | Gas cylinders of composite ~~material~~ construction – ~~s~~Specification~~s~~ and test methods - Part 3: Fully wrapped fibre reinforced composite gas cylinders with non-metallic and non-load-sharing metal liners | |
| ISO/~~CD~~ 3807-1:2000 | Cylinders for ~~Dissolved~~ acetylene ~~cylinders~~ – Basic requirements - Part 1: Cylinders without fusible plugs | |
| ISO/~~CD~~ 3807-2:2000 | Cylinders for ~~Dissolved~~ acetylene ~~cylinders~~ – Basic requirements - Part 2: Cylinders with fusible plugs | |
| ISO/~~DIS~~ 11118:1999 | Non-refillable metallic gas cylinders – Specification~~s~~ and test methods | |
| [ISO 4706:1989] | [Refillable welded steel gas cylinders] | |

[6.2.2.1.2 The following standards apply for the design, ~~and~~ construction, and initial inspection and test of UN ~~marked and~~ certified tubes:]

| **Standard** | **Title of standard** | **Exceptions or restrictions** |
|---|---|---|
| ~~prEN~~ ISO/~~DIS~~ 11120:1999 | Gas cylinders - Refillable seamless steel ~~gas cylinders,~~ tubes of water capacity between 150 L and 3000 L – Design, construction, and testing | The design stress factor F shall not be variable. |

**6.2.2.2 Materials** *(extracted from previous 6.2.1.2.1)*

~~This requirement is met by complying with t~~The following standards apply to material compatibility:

| **Standard** | **Title of standard** |
|---|---|
| **~~EN~~ ISO 11114-1:1997** | Compatibility of cylinder and valve materials with gas contents - Part 1: Metallic materials |
| ~~prEN~~ ISO/ FDIS 11114-2 | Compatibility of cylinder and valve materials with gas contents - Part 2: Non-metallic materials |

**6.2.2.3 Service equipment** *(previously 6.2.1.3.7)*

The following standards ~~pertain~~ apply to closures and their protection:

| Standard | Title of standard |
|---|---|
| ISO/AWI 14245 | Specifications and testing for liquefied petroleum gas ~~(LPG)~~ valves ~~self closing~~ |
| ISO/AWI 15995 | ~~Specifications and testing for m~~Manually operated liquefied petroleum gas valves – Specifications and testing |
| ISO~~/FDIS~~ 11117:1998 | Gas cylinders - Valve protection caps and valve guards for industrial and medical gas cylinders- ~~d~~Design, construction, and tests |
| ~~EN/~~ISO/DIS 13340 | Transportable g~~G~~as cylinders ~~valves~~ – Cylinder ~~V~~valves for non-refillable cylinders |
| ISO~~/DIS~~ 10297~~.2~~:1999 | Gas cylinders – Refillable g~~G~~as cylinder valves – Specification and type testing~~. All gases except LPG~~ |

**6.2.2.4 Periodic inspection and test** *(previously 6.2.1.10.4)*

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

| Standard | Title of standard |
|---|---|
| ISO 6406: 1992 | Periodic inspection and testing of seamless steel gas cylinders |
| ISO 10460:1993 | Welded carbon steel gas cylinders - Periodic inspection and testing |
| ISO 10461:1993 | Seamless aluminium - alloy gas cylinders - Periodic inspection and testing |
| ISO 10462:199~~3~~ 4 | Cylinders for dissolved acetylene - Periodic inspection and ~~testing~~ maintenance |
| ISO 10464:1993 | Liquefied petroleum gas cylinders - Periodic inspection and testing |
| ~~PrEN~~ ISO/DIS 11623 | Composite gas cylinders - Periodic inspection and testing |

**6.2.2.5 Approval of pressure receptacles**

UN certified pressure receptacles shall be manufactured under a quality system, inspected, tested, approved, and certified in accordance with the requirements in ISO/PDTR 14600, "Gas cylinders—International quality conformance system—Basic rules".

**6.2.2.6 Requirements for manufacturers**

Manufacturers of UN certified pressure receptacles shall meet the applicable requirements of ISO/PDTR 14600, "Gas cylinders—International quality conformance system—Basic rules".

**6.2.2.7 Requirements for testing and certifying bodies**

Testing and certifying bodies for UN certified pressure receptacles shall meet the requirements for inspection bodies and testing laboratories specified in ISO/PDTR 14600, "Gas cylinders—International quality conformance system—Basic rules", as applicable.

**6.2.2.8** **Marking ~~of receptacles~~** *(previously 6.2.1.11)*

6.2.2.8.1 UN certified r~~R~~efillable pressure receptacles shall be marked clearly, legibly, and permanently, in the order as follows:

(a) The UN mark

(b) The country authorising the mark;

(c) The ~~receptacles specification (the type specification or the~~ standard ~~used for the design)~~ of the pressure receptacle;

(d) The working pressure ~~in the case of compressed gases~~ in bar;

(e) The test pressure in bar;

(f) The date (month and year) of the initial inspection;

(g) The identification mark of the authorised body who carried out the tests and inspections;

(h) The name or the mark of the manufacturer;

(i) The serial number of the pressure receptacle provided by the manufacturer;

(j) The water capacity in litres;

(k) The mass of the pressure receptacle in kilograms;

(l) In the case of acetylene, dissolved, UN 1001, ~~the permitted filling pressure (see section 4.1.4.5) and the total of the mass of: the empty~~ the tare of the pressure receptacle, including the fittings and accessories, the porous material, ~~and~~ the solvent, and the saturation gas, in kilograms;

(m) The letter "H" ~~showing~~ indicating compatibility with gases with a risk of hydrogen embrittlement.

These marks shall be permanently affixed ~~(e.g. stamped, engraved, or etched)~~ on the pressure receptacle. The markings shall be stamped, engraved, or etched into the metal of ~~on~~ the shoulder, top head, or neck of the pressure receptacle or on a permanently affixed component of the pressure receptacle (e.g. welded collar). For composite pressure receptacles, these markings may be on a label embedded in the resin near the valve outlet end. ~~Other markings are allowed provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks shall not conflict with required markings.~~

6.2.2.8.2 In addition to the markings specified in section ~~6.2.1.6.1~~ 6.2.2.8.1, each refillable pressure receptacle shall be marked indicating the date (~~year and month~~ month and year) of the last periodic inspection and the registered mark of the ~~test~~ body authorised to perform the inspection by the competent authority of the country ~~of~~ where the pressure receptacle is transported and used.

6.2.2.8.3 UN certified n~~N~~on-refillable pressure receptacles shall be marked clearly, legibly, and durably, in the order as follows:

(a) The UN mark

(b) The country authorising the mark;

(c) The ~~pressure receptacles specification (the type specification or the~~ standard ~~used for the design)~~ of the pressure receptacle;

(d) The working pressure in bar;

(e) The test pressure in bar;

(f) The date (~~year and month~~ month and year) of manufactur~~inge~~ ;

(g) The identification ~~stamp~~ mark of the authorised body who carried out the tests and inspections;

(h) The name or the mark of the manufacturer;

(i) The serial or batch number of the pressure receptacle provided by the manufacturer;

(j) The words "DO NOT REFILL"; this marking shall be a minimum of 6 mm in height.

These marks shall be permanently stencilled, stamped, engraved, or etched on the pressure receptacle. Except when stencilled, the markings shall be on the shoulder, top head, or neck of the pressure receptacle or on a permanently affixed component of the pressure receptacle (e.g. welded collar). ~~Other markings are allowed provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks shall not conflict with required markings.~~

6.2.2.8.4 ~~The requirements of 6.2.1.11.1 and 6.2.1.11.2 are met when the marking has been applied according to ISO/CD 13769: Gas cylinders-Stampmarking.~~ In addition to the required markings specified in 6.2.2.8.1 and 6.2.2.8.3, other markings as specified in ISO/DIS 13769 are permitted, but are not mandatory. Such markings shall not conflict with required markings. If stamped, engraved, or etched, these markings shall be made in low stress areas other than the side wall and shall not be of a size or depth that will create harmful stress concentrations.

~~6.2.2.8.5 [Pressure receptacles designed, manufactured and tested according to the appropriate standards out of the reference list of 6.2.2 may in addition bear the UN mark. When affixed, the UN mark shall be followed by the country authorising the mark.]~~

**6.2.3 Requirements for pressure receptacles not ~~designed, constructed and tested according~~ conforming to standards (non-UN certified pressure receptacles)** *(previously 6.2.1.7)*

6.2.3.1 Pressure receptacles not designed, constructed, inspected, ~~and~~ tested, and approved according to ~~standards listed in the table of 6.2.1.6.2~~ the requirements of section 6.2.2 shall be designed, constructed, inspected, ~~and~~ tested, and approved in accordance with the provisions of a technical code recognised by the competent authority and the general requirements of ~~6.2.1.1 through 6.2.1.5 of this section~~ section 6.2.1.

[6.2.3.2 *(from previous 6.2.1.6.1)* For international transport, pressure receptacles approved under the provisions of ~~this paragraph~~ section 6.2.3 shall also be approved by the ~~applicable~~ competent authorities of the countries where the pressure receptacles will be used and transported.]

[6.2.3.3 *(from previous 6.2.1.6.1)* Pressure receptacles designed, constructed, inspected, tested, and approved ~~to requirements other than those specified in these Model Regulations~~ under the provisions of section 6.2.3 shall not be marked with the UN ~~certification~~ mark~~ing specified in this Chapter~~.]

6.2.3.4 [For metallic cylinders, tubes, pressure drums, and bundles of cylinders, the construction shall be such that ~~a.~~ the minimum burst ratio (burst pressure divided by test pressure) is

~~1.60~~ 1.5 for refillable pressure receptacles
2.00 for non-refillable pressure receptacles ]

6.2.3.5 [For ~~composite~~ cylinders, tubes, pressure drums, and bundles of cylinders ~~which make use of~~ manufactured with composite materials, i.e. comprising a liner hoop-wrapped or fully-wrapped with reinforcement material, the construction shall be such that ~~a.~~ the minimum burst ratio (burst pressure divided by test pressure) is

1.67 for hoop-wrapped pressure receptacles
2.00 for fully-wrapped pressure receptacles]

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