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NEW PROPOSALS OF AMENDMENTS TO RID/ADR/ADN

Chapter 6.2: Revision to align with the structure of the 13th Revision of the UN Model Regulations

Transmitted by the European Industrial Gases Association (EIGA)

SUMMARY

Executive summary: EIGA proposes that Chapter 6.2, which already is technically aligned with the UN Model Regulations, be revised to align with the structure of the UN text..

Action to be taken: Replace the current text of Chapter 6.2 (excluding 6.2.4) with the text proposed below.

Relevant documents: ST/SG/AC.10/1/Rev. 13
ADR/RID 2003
TRANS/WP.15/178.

Introduction

EIGA proposes that Chapter 6.2 be restructured to align with the 13th Revision of the UN Model Regulations. The ADR/RID is already technically aligned with the Model Regulations and by taking this further step in aligning the ADR/RID with the structure of the UN text, the future incorporation of the developments at the UN should be made easier.

* / Circulated by the Central Office for International Carriage by Rail (OCTI) under the symbol OCTI/RID/GT-III/2004/21.

The following text is the Model Regulations with additions underlined to bring in those things which already exist in ADR/RID 2005. The intention is to make minimal technical changes in ADR/RID. A small amount of text has not been used and this is shown in an Annex. Most of the ADR/RID requirements are present in the UN text, but in many cases the wording is not identical. Some of the ADR/RID is now of questionable value following the development of the UN text and the incorporation of a large number of standards. Such text has been put into square brackets as items which EIGA wishes to debate with a view to deleting or moving into section 6.2.3.

Changes from the UN are shown by deletion and any text added to the UN is shown underlined (except for the standards tables where EN standards are obviously imported). Comments on the text are given in italic text within brackets.

Proposal

Replace Chapter 6.2 with the following:

CHAPTER 6.2

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

6.2.1 General requirements

NOTE: For aerosol dispensers and small receptacles containing gas (gas cartridges) see 6.2.4.

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~~ carriage and use such as:

- internal pressure;
- ambient and operational temperatures, including during carriage;
- dynamic loads.

~~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 Regulations may be used if approved by the competent authorities in the countries of transport and use. (Comment: covered by 6.2.3)~~

6.2.1.1.2 Pressure receptacles for UN No.1001, acetylene, dissolved, shall be filled entirely with a porous mass, 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;

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

The solvent shall not attack the pressure receptacles.

The above requirements, excluding those for the solvent, apply equally to pressure receptacles for UN No. 3374 acetylene, solvent free.

6.2.1.1.3 In no case shall the minimum wall thickness be less than that specified in the design and construction technical standards.

Normally the wall thickness shall be determined by calculation, accompanied, if needed, by experimental stress analysis. The wall thickness may be determined by experimental means.

Appropriate design calculations for the pressure envelope and supporting components shall be used to ensure the safety of the pressure receptacles concerned.

The minimum wall thickness to withstand pressure shall be calculated in particular with regard to:

- the calculation pressures, which shall not be less than the test pressure;

- the calculation temperatures allowing for appropriate safety margins;

- the maximum stresses and peak stress concentrations where necessary;

- factors inherent to the properties of the material.

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.

6.2.1.1.4 For welded pressure receptacles, only metals of weldable quality whose adequate impact strength at an ambient temperature of - 20° C can be guaranteed shall be used.

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

- 6.2.1.1.6 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 toxic liquefied gases with a classification code of 2T, 2TF, 2TC, 2TO, 2TFC or 2TOC, means shall be provided to ensure that each pressure receptacle can be filled separately and that no interchange of pressure receptacle contents can occur during ~~transport~~carriage.
- 6.2.1.1.7 Contact between dissimilar metals which could result in damage by galvanic action shall be avoided.
- 6.2.1.1.8 *Additional requirements for the construction of closed cryogenic receptacles for refrigerated liquefied gases*
- 6.2.1.1.8.1 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; with regard to the impact strength see 6.8.5.3.
- 6.2.1.1.8.2 The pressure receptacles shall be thermally insulated. The thermal insulation shall be protected against impact by means of a jacket. If the space between the pressure receptacle and the jacket is evacuated of air (vacuum-insulation), the 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 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.
- 6.2.1.1.8.3 Closed cryogenic receptacles intended for the ~~transport~~carriage 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 where there is a risk of contact with oxygen or with oxygen enriched liquid.
- 6.2.1.1.8.4 Closed cryogenic receptacles shall be designed and constructed with suitable lifting and securing arrangements.

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~~-carriage 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.

[The following materials may be used:

- (a) carbon steel for compressed, liquefied, refrigerated liquefied gases and dissolved gases as well as for substances not in Class 2 listed in Table 3 of packing instruction P200 in 4.1.4.1;
- (b) alloy steel (special steels), nickel, nickel alloy (such as monel) for compressed, liquefied, refrigerated liquefied gases and dissolved gases as well as for substances not in Class 2 listed in Table 3 of packing instruction P200 in 4.1.4.1;
- (c) copper for:
 - (i) gases of classification codes 1A, 1O, 1F and 1TF, whose filling pressure referred to a temperature of 15 °C does not exceed 2 MPa (20 bar);
 - (ii) gases of classification code 2A and also UN No. 1033 dimethyl ether; UN No.1037 ethyl chloride; UN No.1063 methyl chloride; UN No.1079 sulphur dioxide; UN No.1085 vinyl bromide; UN No. 1086 vinyl chloride; and UN No.3300 ethylene oxide and carbon dioxide mixture with more than 87% ethylene oxide;
 - (iii) gases of classification codes 3A, 3O and 3F;
- (d) aluminium alloy: see special requirement "a" of packing instruction P200 (12) in 4.1.4.1;
- (e) composite material for compressed, liquefied, refrigerated liquefied gases and dissolved gases;
- (f) synthetic materials for refrigerated liquefied gases; and
- (g) glass for the refrigerated liquefied gases of classification code 3A other than UN No.2187 carbon dioxide, refrigerated, liquid or mixtures thereof, and gases of classification code 3O.]

(Comment: In the opinion of EIGA, these requirements are no longer needed now that a substantial body of standards is available. If retained, however, they should be in 6.2.3.)

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~~ have at least the same test pressure of as the pressure receptacles. Such equipment shall be designed and constructed to withstand 1.5 times the test pressure when used with pressure receptacles bearing the UN mark.

(Comment: The current requirement in ADR/RID is “6.2.1.3.2 (d) The manifold shall have at least the same test pressure as the cylinders”.)

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~~carriage. 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 4.1.6.8.

6.2.1.3.3 Pressure receptacles which are not capable of being handled manually or rolled, shall be fitted with devices (skids, rings, straps) ensuring that they can be safely handled by mechanical means and so arranged as not to impair the strength of, nor cause undue stresses, in the pressure receptacle. Pressure drums which are capable of being rolled shall be equipped with rolling hoops or be otherwise protected against damage due to rolling (e.g. by corrosion-resistant metal sprayed on to the pressure receptacle surface).

6.2.1.3.4 Individual pressure receptacles shall be equipped with pressure relief devices as specified in P200(1) or 6.2.1.3.6.4 and 6.2.1.3.6.5. 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 receptacle itself under normal conditions of ~~transport~~carriage.

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

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~~carriage 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 may, in addition, have a frangible disc in parallel with the spring loaded device(s) 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 of closed cryogenic receptacles, 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 either the test pressure or 150% of the MAWP.
- 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~~¹.

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:

- (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;
- (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 undergoing permanent deformation or exhibiting cracks or expansion greater than that allowed in the design specification;

NOTE: With the agreement of 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.

- (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 carriage~~ of UN 1001 acetylene, dissolved, and UN 3374 acetylene, solvent free, shall be inspected to ensure proper installation and condition of the porous mass and, if applicable, the quantity of solvent.

¹ See for example CGA Publications S-1.2-1995 and S-1.1-2001.

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 initial 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.

6.2.1.4.3 Specific provisions applying to aluminium alloy pressure receptacles

- (a) In addition to the initial inspection required by 6.2.1.5.1, it is necessary to test for possible intercrystalline corrosion of the inside wall of the pressure receptacles where use is made of an aluminium alloy containing copper, or where use is made of an aluminium alloy containing magnesium and manganese and the manganese content is greater than 3.5% or the manganese content lower than 0.5%.
- (b) In the case of an aluminium/copper alloy the test shall be carried out by the manufacturer at the time of approval of a new alloy by the competent authority; it shall thereafter be repeated in the course of production, for each pour of the alloy.
- (c) In the case of an aluminium/magnesium alloy the test shall be carried out by the manufacturer at the time of approval of a new alloy and of the manufacturing process by the competent authority. The test shall be repeated whenever a change is made in the composition of the alloy or in the manufacturing process.]

(Comment: In the view of EIGA, this text should be transferred to 6.2.3 because it relates to aluminium receptacles made not according to standards.)

6.2.1.5 Periodic inspection and test

6.2.1.5.1 ~~Refillable pressure receptacles, other than cryogenic receptacles, shall be subjected to periodic inspections and tests by a body authorized by the competent authority, in accordance with the following:~~
Refillable pressure receptacles shall be subjected to periodic inspections under the supervision of a [testing and certifying / inspection] body approved by the competent authority of the country of approval¹, in accordance with the periodicities defined in the relevant packing instruction P200 or P203 in 4.1.4.1

¹ *If the country of approval is not a contracting party to ADR, the competent authority of a contracting party to ADR.*

and, except for cryogenic receptacles, in accordance with the following specifications:

(Comment: ADR uses the term testing and certifying body and UN inspection body – both are the same sort of body and ADR should convert to inspection body.)

- (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. internal inspection, verification of minimum wall thickness);
- (c) Checking of the 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 [testing and certifying / inspection] body approved by the competent authority of the country of approval ¹, the hydraulic pressure test may be replaced by a test using a gas, where such operation does not entail any danger, or by an equivalent method based on ultrasound.

NOTE 2: With the agreement of the [testing and certifying / inspection] body approved by the competent authority of the country of approval ¹, the hydraulic pressure test of cylinders and tubes may be replaced by an equivalent method based on acoustic emission.

NOTE 3: With the agreement of the [testing and certifying / inspection] body approved by the competent authority of the country of approval ¹, the hydraulic pressure test of each welded steel cylinder intended for the carriage of gases of UN No.1965, hydrocarbon gas mixture liquefied, n.o.s., with a capacity below 6,5 l may be replaced by another test ensuring an equivalent level of safety.

~~*NOTE 1: With the agreement of 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 competent authority, the hydraulic pressure test of cylinders 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-carriage~~ 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 By derogation from 6.2.1.5.1 closed cryogenic receptacles shall be inspected to verify external conditions, condition and operation of pressure relief devices and subjected to a leakproofness test. The leakproofness test shall be carried out with the gas contained in the pressure 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

~~6.2.1.6.1 The conformity of pressure receptacles shall be assessed at time of manufacture as required by the competent authority. Pressure receptacles shall be inspected, tested and approved by an inspection body. The technical documentation shall include full specifications on design and construction, and full documentation on the manufacturing and testing.~~

~~6.2.1.6.2 Quality assurance systems shall conform to the requirements of the competent authority.~~

NOTE: For Pressure receptacles bearing the UN packaging symbol, the conformity assessment system and approval shall be in accordance with 6.2.2.5.

6.2.1.6.1 The conformity of pressure receptacles, having a test pressure capacity product of more than 150 MPa.litre (1 500 bar.litre) with the provisions of Class 2, shall be assessed by one of the following methods:

(a) Single pressure receptacles shall be examined, tested and approved by a testing and certifying body approved by the competent authority of the country of approval¹, on the basis of the technical documentation and declaration of the manufacturer on compliance with the relevant provisions of Class 2.

The technical documentation shall include full specifications on design and construction, and full documentation on the manufacturing and testing; or

(b) The construction of the pressure receptacles shall be tested and approved by a testing and certifying body approved by the competent authority of the country of approval¹ on the basis of the technical documentation with regard to their compliance with the relevant provisions of Class 2.

¹ *If the country of approval is not a contracting party to ADR, the competent authority of a contracting party to ADR.*

Pressure receptacles shall furthermore be designed, manufactured and tested according to a comprehensive quality assurance programme for design, manufacture, final inspection and testing. The quality assurance programme shall guarantee the conformity of the pressure receptacles with the relevant provisions of Class 2 and shall be approved and supervised by a testing and certifying body approved by the competent authority of the country of approval¹; or

- (c) The design type of the pressure receptacles shall be approved by a testing and certifying body approved by the competent authority of the country of approval¹. Any pressure receptacle of this design shall be manufactured and tested according to a quality assurance programme for production, final inspection and testing, which shall be approved and supervised by a testing and certifying body approved by the competent authority of the country of approval¹; or
- (d) The design type of the pressure receptacles shall be approved by a testing and certifying body approved by the competent authority of the country of approval¹. Any receptacle of this design shall be tested under the supervision of a testing and certifying body approved by the competent authority of the country of approval¹ on the basis of a declaration of the manufacturer on compliance with the approved design and the relevant provisions of Class 2.

6.2.1.6.2 The conformity of pressure receptacles having a test pressure capacity product of more than 30 MPa.litre (300 bar.litre) and not more than 150 MPa.litre (1 500 bar.litre) with the provisions of Class 2 shall be assessed by one of the methods described in 6.2.1.4.1 or by one of the following methods:

- (a) The pressure receptacles shall be designed, manufactured and tested according to a comprehensive quality assurance programme for their design, manufacture, final inspection and testing, approved and supervised by a testing and certifying body approved by the competent authority of the country of approval¹; or
- (b) The design type of the pressure receptacle shall be approved by a testing and certifying body approved by the competent authority of the country of approval¹. The compliance of any pressure receptacle with the approved design shall be declared in writing by the manufacturer on the basis of his quality assurance programme for final inspection and testing of pressure receptacles, approved and supervised by a testing and certifying body approved by the competent authority of the country of approval¹; or
- (c) The design type of the pressure receptacle shall be approved by a testing and certifying body approved by the competent authority of the country of

approval¹. The compliance of any pressure receptacle with the approved design shall be declared in writing by the manufacturer and all pressure receptacles of this type shall be tested under the supervision of a testing and certifying body approved by the competent authority of the country of approval¹.

6.2.1.6.3 The conformity of pressure receptacles, having a test pressure capacity product of not more than 30 MPa.litre (300 bar.litre) with the provisions for Class 2 shall be assessed by one of the methods described in 6.2.1.4.1 or 6.2.1.4.2 or by one of the following methods:

- (a) The compliance of any pressure receptacle with a design, fully specified in technical documentation, shall be declared in writing by the manufacturer and pressure receptacles of this design shall be tested under the supervision of a testing and certifying body approved by the competent authority of the country of approval¹; or
- (b) The design type of the pressure receptacles shall be approved by a testing and certifying body approved by the competent authority of the country of approval¹. The compliance of all pressure receptacles with the approved design shall be declared in writing by the manufacturer and all pressure receptacles of this type shall be tested individually.

6.2.1.6.4 The requirements of 6.2.1.4.1 to 6.2.1.4.3 shall be deemed to be complied with:

- (a) as regards the quality assurance systems mentioned in 6.2.1.4.1 and 6.2.1.4.2, if they conform to the relevant European Standard of the EN ISO 9000 series;
- (b) in their entirety, if the relevant conformity assessment procedures of Council Directive 99/36/EC² have been complied with as follows:
 - (i) for the pressure receptacles listed under 6.2.1.4.1, the modules G, or H1, or B in combination with D, or B in combination with F;
 - (ii) for the pressure receptacles listed under 6.2.1.4.2, the modules H, or B in combination with E, or B in combination C1, or B1 in combination with F, or B1 in combination with D;
 - (iii) for the pressure receptacles listed under 6.2.1.4.3, the modules A1, or D1, or E1.

¹ *If the country of approval is not a contracting party to ADR, the competent authority of a contracting party to ADR.*

² *Council Directive 99/36/EC concerning transportable pressure equipment (Official Journal of the European Communities, No. L 138 of 1.06.1999).*

6.2.1.7 Requirements for manufacturers

6.2.1.7.1 The manufacturer shall be technically able and shall possess all 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 an inspection body approved by the competent authority of the country of approval¹. The particular certification process the manufacturer intends to apply shall be taken into consideration.

6.2.1.8 Requirements for inspection bodies (Comment: ADR uses the term testing and certifying body)

6.2.1.8.1 Inspection bodies shall be independent from manufacturing enterprises and competent to perform the tests, inspections and approvals required. These requirements shall be deemed to be met if the bodies have been approved on the basis of an accreditation procedure in accordance with the relevant European standards of series EN 45000.

NOTE: The marking requirements for refillable pressure receptacles are given in 6.2.2.7.

6.2.2 Pressure receptacles designed, constructed and tested according to standards and requirements for UN pressure receptacles

In addition to the general requirements of section 6.2.1, UN pressure receptacles shall comply with the requirements of this section, including the ISO standards, as applicable. For other pressure receptacles, the requirements of section 6.2.1 are considered to have been complied with if the following standards, as relevant, are applied.

NOTE 1: With the agreement of the competent authority, more recently published versions of the standards, if available, may be used.

¹ If the country of approval is not a contracting party to ADR, the competent authority of a contracting party to ADR.

NOTE 2: Persons or bodies identified in the standards as having responsibilities in accordance with ADR/RID shall meet the requirements of ADR/RID.

6.2.2.1 Design, construction and initial inspection and test

6.2.2.1.1 The following standards apply for the design, construction, and initial inspection and test of ~~UN~~-cylinders. For cylinders bearing the UN mark the ISO standards listed below shall be applied, except that inspection requirements related to the conformity assessment system and approval shall be in accordance with 6.2.2.5:

Reference	Title of document	Applicable sub-sections and paragraphs
Annex I, Parts 1 to 3 to 84/525/EEC	Council directive on the approximation of the laws of the Member States relating to seamless steel gas cylinders.	6.2.1.1 and 6.2.1.5
Annex I, Parts 1 to 3 to 84/526/EEC	Council directive on the approximation of the laws of the Member States relating to seamless, unalloyed aluminium and aluminium alloy gas cylinders.	6.2.1.1 and 6.2.1.5
Annex I, Parts 1 to 3 to 84/527/EEC	Council directive on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders.	6.2.1.1 and 6.2.1.5
EN 1442:1998	Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) - Design and construction.	6.2.1.1 and 6.2.1.5
EN 1800:1998/AC:1999	Transportable gas cylinders - Acetylene cylinders - Basic requirements and definitions.	6.2.1.1.2
EN 1964-1:1999	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless steel gas cylinders of capacity from 0.5 litres up to 150 litres – Part 1: Cylinders made of seamless steel with a Rm value of less than 1 100 MPa.	6.2.1.1 and 6.2.1.5
EN 1964-2:2001	Transportable gas cylinders – Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0.5 litre up to and including 150 litre – Part 2: Cylinders made of seamless steel with an Rm \geq 1100 MPa	6.2.1.1 and 6.2.1.5
EN 1964-3: 2000	Transportable gas cylinders-Specifications for the design and construction of refillable transportable seamless steel gas cylinders of capacity from 0.5	6.2.1.1 and 6.2.1.5

Reference	Title of document	Applicable sub-sections and paragraphs
	litre up to 150 litres - Part 3: Cylinders made of stainless steel.	
EN 1975:1999 +A1:2003	Transportable gas cylinders - Specification for the design and construction of refillable transportable seamless aluminium and aluminium alloy gas cylinders of capacity from 0.5 litre up to 150 litre	6.2.1.1 and 6.2.1.5
EN 12862: 2000	Transportable gas cylinders- Specifications for the design and construction of refillable transportable welded aluminium alloy gas cylinders.	6.2.1.1 and 6.2.1.5
EN 12257:2002	Transportable gas cylinders – Seamless, hoop wrapped composite cylinders	6.2.1.1 and 6.2.1.5
EN 12807:2001 (except Annex A)	Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) – Design and construction	6.2.1.1 and 6.2.1.5
EN 13293:2002	Transportable gas cylinders –Specification for the design and construction of refillable transportable seamless normalised carbon manganese steel gas cylinders of water capacity up to 0.5 litre for compressed, liquefied and dissolved gases and up to 1 litre for carbon dioxide	6.2.1.1 and 6.2.1.5
EN 13322-1:2003	Transportable gas cylinders – Refillable welded steel gas cylinders – Design and construction – Part 1: Welded steel	6.2.1.1 and 6.2.1.5
EN 13322-2:2003	Transportable gas cylinders – Refillable welded stainless steel gas cylinders – Design and construction – Part 2: Welded stainless steel	6.2.1.1 and 6.2.1.5
EN 12245:2002	Transportable gas cylinders. Fully wrapped composite cylinders	6.2.1.1 and 6.2.1.5
EN 12205:2001	Transportable gas cylinders – Non refillable metallic gas cylinders	6.2.1.1, 6.2.1.5 and 6.2.2.7
EN 13110:2002	Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG). Design and construction	6.2.1.1, 6.2.1.5 and 6.2.2.7
EN 14427:2004	Transportable refillable fully wrapped composite cylinders for liquefied petroleum gases - Design and construction <i>NOTE: This standard applies only to cylinders equipped with pressure relief valves.</i>	6.2.1.1, 6.2.1.5 and 6.2.2.7
EN 14140:2003	Transportable refillable welded steel cylinders for Liquefied Petroleum Gas (LPG) - Alternative design and construction	6.2.1.1, 6.2.1.5 and 6.2.2.7

Reference	Title of document	Applicable sub-sections and paragraphs
ISO 9809-1:1999	Gas cylinders – Refillable seamless steel gas cylinders Design, construction and testing Part 1: Quenched and tempered steel cylinders with tensile strength less than 1100 Mpa <i>NOTE: The note concerning the F factor in section 7.3 of this standard shall not be applied for UN cylinders.</i>	6.2.1.1 and 6.2.1.5
ISO 9809-2:2000	Gas cylinders – Refillable seamless steel gas cylinders Design, construction and testing Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1100 Mpa	6.2.1.1 and 6.2.1.5
ISO 9809-3:2000	Gas cylinders – Refillable seamless steel gas cylinders Design, construction and testing Part 3: Normalized steel cylinders	6.2.1.1 and 6.2.1.5
ISO 7866:1999	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing <i>NOTE: The note concerning the F factor in section 7.2 of this standard shall not be applied for UN cylinders. Aluminium alloy 6351A – T6 or equivalent shall not be authorized.</i>	6.2.1.1 and 6.2.1.5
ISO 11118:1999	Gas cylinders – Non-refillable metallic gas cylinders - Specification and test methods	6.2.1.1 and 6.2.1.5
ISO 11119-1:2002	Gas cylinders of composite construction – Specification and test methods – Part 1: Hoop wrapped composite gas cylinders	6.2.1.1 and 6.2.1.5
ISO 11119-2:2002	Gas cylinders of composite construction – Specification and test methods – Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal liners	6.2.1.1 and 6.2.1.5

NOTE 1: In the above referenced standards composite cylinders bearing the UN mark shall be designed for unlimited service life.

NOTE 2: After the first 15 years of service, composite cylinders bearing the UN mark manufactured according to these standards, may be approved for extended service by the competent authority which was responsible for the original approval of the cylinders and which will base its decision on the test information supplied by the manufacturer or owner or user.

6.2.2.1.2 The following standards apply for the design, construction, and initial inspection and test of UN-tubes. For tubes bearing the UN mark the ISO standards listed below shall be applied, except that inspection requirements related to the conformity assessment system and approval shall be in accordance with 6.2.2.5:

Reference	Title of document	Applicable sub-sections and paragraphs
EN ISO 11120:1999	Gas cylinders – Refillable seamless steel tubes for compressed gas transport, of water capacity between 150 l and 3000 l – Design, construction and testing <i>NOTE: The note concerning the F factor in section 7.1 of this standard shall not be applied for UN tubes</i>	6.2.1.1 and 6.2.1.5

6.2.2.1.3 The following standards apply for the design, construction and initial inspection and test of ~~UN~~ acetylene cylinders. For acetylene cylinders bearing the UN mark the ISO standards listed below shall be applied, except that inspection requirements related to the conformity assessment system and approval shall be in accordance with 6.2.2.5:

For the cylinder shell:

Reference	Title of document	Applicable sub-sections and paragraphs
Annex I, Parts 1 to 3 to 84/525/EEC	Council directive on the approximation of the laws of the Member States relating to seamless steel gas cylinders.	6.2.1.1 and 6.2.1.5
Annex I, Parts 1 to 3 to 84/526/EEC	Council directive on the approximation of the laws of the Member States relating to seamless, unalloyed aluminium and aluminium alloy gas cylinders.	6.2.1.1 and 6.2.1.5
Annex I, Parts 1 to 3 to 84/527/EEC	Council directive on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders.	6.2.1.1 and 6.2.1.5
EN 1964-1:1999	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless steel gas cylinders of capacity from 0.5 litres up to 150 litres – Part 1: Cylinders made of seamless steel with a Rm value of less than 1 100 MPa.	6.2.1.1 and 6.2.1.5
EN 1964-3: 2000	Transportable gas cylinders-Specifications for the design and construction of refillable transportable seamless steel gas cylinders of capacity from 0.5 litre up to 150 litres - Part 3: Cylinders made of stainless steel.	6.2.1.1 and 6.2.1.5

Reference	Title of document	Applicable sub-sections and paragraphs
EN 1975:1999 (except Annex G)	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless aluminium and aluminium alloy gas cylinders of capacity from 0.5 litres up to 150 litres.	6.2.1.1 and 6.2.1.5
EN 12862: 2000	Transportable gas cylinders- Specifications for the design and construction of refillable transportable welded aluminium alloy gas cylinders.	6.2.1.1 and 6.2.1.5
ISO 9809-1:1999	Gas cylinders – Refillable seamless steel gas cylinders - Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1100 MPa <i>NOTE: The note concerning the F factor in section 7.3 of this standard shall not be applied for UN cylinders.</i>	6.2.1.1 and 6.2.1.5
ISO 9809-3:2000	Gas cylinders – Refillable seamless steel gas cylinders - Design, construction and testing – Part 3: Normalized steel cylinders	6.2.1.1 and 6.2.1.5
ISO 7866:1999	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing <i>NOTE: The note concerning the F factor in section 7.2 of this standard shall not be applied for UN cylinders. Aluminium alloy 6351A – T6 or equivalent shall not be authorized.</i>	6.2.1.1 and 6.2.1.5
ISO 11118:1999	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods	6.2.1.1 and 6.2.1.5

For the porous mass in the cylinder:

Reference	Title of document	Applicable sub-sections and paragraphs
EN 1800:1998/AC: 1999	Transportable gas cylinders - Acetylene cylinders - Basic requirements and definitions.	6.2.1.1.2
ISO 3807-1:2000	Cylinders for acetylene – Basic requirements - Part 1: Cylinders without fusible plugs	6.2.1.1.2
ISO 3807-2:2000	Cylinders for acetylene – Basic requirements - Part 2: Cylinders with fusible plugs	6.2.1.1.2

6.2.2.1.4 The following standards apply for the design, construction, and initial inspection and test of bundles.

Reference	Title of document	Applicable sub-sections and paragraphs
EN 13769:2003	Transportable gas cylinders - Cylinder bundles - Design, manufacture, identification and testing	6.2.1.1, 6.2.1.5 and 6.2.1.7

6.2.2.1.5 The following standards apply for the design, construction, and initial inspection and test of pressure drums.

Reference	Title of document	Applicable sub-sections and paragraphs
EN 14208:2004	Transportable gas cylinders - Specification for welded pressure drums up to 1000 litre capacity for the transport of gases - Design and construction	6.2.1.1, 6.2.1.5 and 6.2.2.7

6.2.2.1.6 The following standards apply for the design, construction, and initial inspection and test of cryogenic receptacles.

Reference	Title of document	Applicable sub-sections and paragraphs
EN 1251-2: 2000	Cryogenic vessels- Transportable, vacuum insulated, of not more than 1 000 litres volume- Part 2: Design, fabrication, inspection and testing	6.2.1.1 and 6.2.1.5

6.2.2.2 *Materials*

In addition to the material requirements specified in the pressure receptacle design and construction standards, and any restrictions specified in the applicable packing instruction for the gas(es) to be ~~transported~~-carried (e.g. packing instruction P200), the following standards apply to material compatibility:

Reference	Title of document	Applicable sub-sections and paragraphs
EN 1797:2001	Cryogenic vessels - Gas/material compatibility	6.2.1.2
EN ISO 11114-1:199	Transportable gas cylinders - Compatibility of cylinder and valve materials with gas contents-Part	6.2.1.2

Reference	Title of document	Applicable sub-sections and paragraphs
7	1: Metallic materials.	
EN ISO 11114-2:2000 0	Transportable gas cylinders - Compatibility of cylinder and valve materials with gas contents-Part 2: Non-metallic materials.	6.2.1.2

6.2.2.3 Service equipment

The following standards apply to closures and their protection:

Reference	Title of document	Applicable sub-sections and paragraphs
EN 849:1996/A2:2001	Transportable gas cylinders - Cylinder valves: Specification and type testing	6.2.1.1
EN 13152:2001	Specifications and testing of LPG – cylinder valves - Self closing	6.2.1.1
EN 13153:2001	Specifications and testing of LPG – cylinder valves - Manually operated	6.2.1.1
ISO 11117:1998	Gas cylinders – Valve protection caps and valve guards for industrial and medical gas cylinders- Design, construction and tests	6.2.1.1
ISO 10297:1999	Gas cylinders –Refillable gas cylinder valves - Specification and type testing	6.2.1.1

6.2.2.4 Periodic inspection and test

The following standards apply to the periodic inspection and testing of UN Cylinders pressure receptacles. For cylinders bearing the UN mark the ISO standards listed below shall be applied.

NOTE : See 6.2.2.6 for the approval system for periodic inspection and test of pressure receptacles bearing the UN mark

Reference	Title of document	Applicable sub-sections and paragraphs
EN 1968:2002 (except Annex B)	Transportable gas cylinders –Periodic inspection and testing of seamless steel gas cylinders	6.2.1.6

Reference	Title of document	Applicable sub-sections and paragraphs
EN 1802:2002 (except Annex B)	Transportable gas cylinders – Periodic inspection and testing of seamless aluminium alloy gas cylinders	6.2.1.6
EN 12863:2002	Transportable gas cylinders – Periodic inspection and maintenance of dissolved acetylene cylinders <i>NOTE: In this standard "initial inspection" is to be understood as the "first periodic inspection" after final approval of a new acetylene cylinder.</i>	6.2.1.6
EN 1803:2002 (except Annex B)	Transportable gas cylinders – Periodic inspection and testing of welded steel gas cylinders	6.2.1.6
EN ISO 11623:2002 (except clause 4)	Transportable gas cylinders – Periodic inspection and testing of composite gas cylinders	6.2.1.6
EN 14189:2003	Transportable gas cylinders - Inspection and maintenance of cylinder valves at time of periodic inspection of gas cylinders	6.2.1.6
EN 1251-3: 2000	Cryogenic vessels- Transportable, vacuum insulated, of not more than 1 000 litres volume- Part 3: Operational requirements	6.2.1.6
ISO 6406:1992	Periodic inspection and testing of seamless steel gas cylinders	6.2.1.6
ISO 10461:1993	Seamless aluminium - alloy gas cylinders - Periodic inspection and testing	6.2.1.6
ISO 10462:1994	Cylinders for dissolved acetylene – Periodic inspection and maintenance	6.2.1.6
ISO 11623:2002	Transportable gas cylinders – Periodic inspection and testing of composite gas cylinders	6.2.1.6

6.2.2.5 *Conformity assessment system and approval for manufacture of pressure receptacles bearing the UN mark*

6.2.2.5.1 *Definitions*

For the purposes of this section:

Conformity assessment system means a system for competent authority approval of a manufacturer, by pressure receptacle design type approval, approval of manufacturer's quality system and approval of inspection bodies;

Design type means a pressure receptacle design as specified by a particular pressure receptacle standard;

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

6.2.2.5.2 General requirements

Competent Authority

6.2.2.5.2.1 The competent authority that approves the pressure receptacle shall approve the conformity assessment system for the purpose of ensuring that pressure receptacles conform to the requirements of these Regulations. In instances where the competent authority that approves a pressure receptacle is not the competent authority in the country of manufacture, the marks of the approval country and the country of manufacture shall be indicated in the pressure receptacle marking (see 6.2.2.7 and 6.2.2.8).

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

6.2.2.5.2.2 The competent authority may delegate its functions in this conformity assessment system in whole or in part.

6.2.2.5.2.3 The competent authority shall ensure that a current list of approved inspection bodies and their identity marks and approved manufacturers and their identity marks is available.

Inspection body

6.2.2.5.2.4 The inspection body shall be approved by the competent authority for the inspection of pressure receptacles and shall:

- (a) have a staff with an organisational structure, capable, trained, competent, and skilled, to satisfactorily perform its technical functions;
- (b) have access to suitable and adequate facilities and equipment;
- (c) operate in an impartial manner and be free from any influence which could prevent it from doing so;
- (d) ensure commercial confidentiality of the commercial and proprietary activities of the manufacturer and other bodies;
- (e) maintain clear demarcation between actual inspection body functions and unrelated functions;
- (f) operate a documented quality system;
- (g) ensure that the tests and inspections specified in the relevant pressure receptacle standard and these Regulations are performed; and
- (h) maintain an effective and appropriate report and record system in accordance with 6.2.2.5.6.

6.2.2.5.2.5 The inspection body shall perform design type approval, pressure receptacle production testing and inspection, and certification to verify conformity with the relevant pressure receptacle standard (see 6.2.2.5.4 and 6.2.2.5.5).

Manufacturer

6.2.2.5.2.6 The manufacturer shall:

- (a) operate a documented quality system in accordance with 6.2.2.5.3;
- (b) apply for design type approvals in accordance with 6.2.2.5.4;
- (c) select an inspection body from the list of approved inspection bodies maintained by the competent authority in the country of approval; and
- (d) maintain records in accordance with 6.2.2.5.6.

Testing laboratory

6.2.2.5.2.7 The testing laboratory shall have:

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

6.2.2.5.3 *Manufacturer's quality system*

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

The contents shall in particular include adequate descriptions of:

- (a) the organisational structure, responsibilities, and power of the management with regard to design and product quality;
- (b) the design control and design verification techniques, processes, and systematic actions that will be used when designing the pressure receptacles;
- (c) the relevant pressure receptacle manufacturing, quality control, quality assurance, and process operation instructions that will be used;
- (d) quality records, such as inspection reports, test data, and calibration data;

- (e) management reviews to ensure the effective operation of the quality system arising from the audits in accordance with 6.2.2.5.3.2;
- (f) the process describing how customer requirements are met;
- (g) the process for control of documents and their revision;
- (h) the means for control of non-conforming pressure receptacles, purchased components, in - process and final materials; and
- (i) training programmes and qualification procedures for relevant personnel.

6.2.2.5.3.2 Audit of the quality system

The quality system shall be initially assessed to determine whether it meets the requirements in 6.2.2.5.3.1 to the satisfaction of the competent authority.

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

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

6.2.2.5.3.3 Maintenance of the quality system

The manufacturer shall maintain the quality system as approved in order that it remains adequate and efficient. The manufacturer shall notify the competent authority that approved the quality system, of any intended changes. The proposed changes shall be evaluated in order to determine whether the amended quality system will still satisfy the requirements in 6.2.2.5.3.1.

6.2.2.5.4 *Approval process*

Initial design type approval

6.2.2.5.4.1 The initial design type approval shall consist of approval of the manufacturer's quality system and approval of the pressure receptacle design to be produced. An application for an initial design type approval shall meet the requirements of 6.2.2.5.4.2 to 6.2.2.5.4.6 and 6.2.2.5.4.9.

6.2.2.5.4.2 A manufacturer desiring to produce pressure receptacles in accordance with a pressure receptacle standard and these Regulations shall apply for, obtain, and retain a design type approval certificate issued by the competent authority in the country of approval for at least one pressure receptacle design type in accordance with the procedure given in 6.2.2.5.4.9. This certificate shall, on request, be submitted to the competent authority of the country of use.

- 6.2.2.5.4.3 An application shall be made for each manufacturing facility and shall include:
- (a) the name and registered address of the manufacturer and in addition, if the application is submitted by an authorised representative, its name and address;
 - (b) the address of the manufacturing facility (if different from the above);
 - (c) the name and title of the person(s) responsible for the quality system;
 - (d) the designation of the pressure receptacle and the relevant pressure receptacle standard;
 - (e) details of any refusal of approval of a similar application by any other competent authority;
 - (f) the identity of the inspection body for design type approval;
 - (g) documentation on the manufacturing facility as specified under 6.2.2.5.3.1; and
 - (h) the technical documentation required for design type approval, which shall enable verification of the conformity of the pressure receptacles with the requirements of the relevant pressure receptacle design standard. The technical documentation shall cover the design and method of manufacture and shall contain, as far as is relevant for assessment, at least the following:
 - (i) pressure receptacle design standard, design and manufacturing drawings, showing components and subassemblies, if any;
 - (ii) descriptions and explanations necessary for the understanding of the drawings and intended use of the pressure receptacles;
 - (iii) a list of the standards necessary to fully define the manufacturing process;
 - (iv) design calculations and material specifications; and
 - (v) design type approval test reports, describing the results of examinations and tests carried out in accordance with 6.2.2.5.4.9.
- 6.2.2.5.4.4 An initial audit in accordance with 6.2.2.5.3.2 shall be performed to the satisfaction of the competent authority.
- 6.2.2.5.4.5 If the manufacturer is denied approval, the competent authority shall provide written detailed reasons for such denial.

6.2.2.5.4.6 Following approval, changes to the information submitted under 6.2.2.5.4.3 relating to the initial approval shall be provided to the competent authority.

Subsequent design type approvals

6.2.2.5.4.7 An application for a subsequent design type approval shall encompass the requirements of 6.2.2.5.4.8 and 6.2.2.5.4.9, provided a manufacturer is in the possession of an initial design type approval. In such a case, the manufacturer's quality system according to 6.2.2.5.3 shall have been approved during the initial design type approval and shall be applicable for the new design.

6.2.2.5.4.8 The application shall include:

- (a) the name and address of the manufacturer and in addition, if the application is submitted by an authorised representative, its name and address;
- (b) details of any refusal of approval of a similar application by any other competent authority;
- (c) evidence that initial design type approval has been granted; and
- (d) the technical documentation, as described in 6.2.2.5.4.3 (h).

Procedure for design type approval

6.2.2.5.4.9 The inspection body shall:

- (a) examine the technical documentation to verify that:
 - (i) the design is in accordance with the relevant provisions of the standard, and
 - (ii) the prototype lot has been manufactured in conformity with the technical documentation and is representative of the design;
- (b) verify that the production inspections have been carried out as required in accordance with 6.2.2.5.5;
- (c) select pressure receptacles from a prototype production lot and supervise the tests of these pressure receptacles as required for design type approval;
- (d) perform or have performed the examinations and tests specified in the pressure receptacle standard to determine that:
 - (i) the standard has been applied and fulfilled, and

- (ii) the procedures adopted by the manufacturer meet the requirements of the standard; and
- (e) ensure that the various type approval examinations and tests are correctly and competently carried out.

After prototype testing has been carried out with satisfactory results and all applicable requirements of 6.2.2.5.4 have been satisfied, a design type approval certificate shall be issued, which shall include the name and address of the manufacturer, results and conclusions of the examination, and the necessary data for identification of the design type.

If the manufacturer is denied a design type approval, the competent authority shall provide written detailed reasons for such denial.

6.2.2.5.4.10 Modifications to approved design types

The manufacturer shall inform the issuing competent authority of modifications to the approved design type as specified in the pressure receptacle standard. A subsequent design type approval shall be requested where such modifications constitute a new design according to the relevant pressure receptacle standard. This additional approval shall be given in the form of an amendment to the original design type approval certificate.

6.2.2.5.4.11 Upon request, the competent authority shall communicate to any other competent authority, information concerning design type approval, modifications of approvals and withdrawn approvals.

6.2.2.5.5 Production inspection and certification

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

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

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

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

A certificate of compliance, signed by the inspection body and the manufacturer, shall be issued before the pressure receptacles are filled.

6.2.2.5.6 *Records*

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

6.2.2.6 *Approval system for periodic inspection and test of pressure receptacles bearing the UN mark*

6.2.2.6.1 Definition

For the purposes of this section:

Approval system means a system for competent authority approval of a body performing periodic inspection and test of pressure receptacles (hereinafter referred to as "periodic inspection and test body"), including approval of that body's quality system.

6.2.2.6.2 General requirements

Competent authority

6.2.2.6.2.1 The competent authority shall establish an approval system for the purpose of ensuring that the periodic inspection and test of pressure receptacles conform to the requirements of these Regulations. In instances where the competent authority that approves a body performing periodic inspection and test of a pressure receptacle is not the competent authority of the country approving the manufacture of the pressure receptacle, the marks of the approval country of periodic inspection and test shall be indicated in the pressure receptacle marking (see 6.2.2.7).

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

The competent authority of the country of approval may terminate the approval certificate referred to in 6.2.2.6.4.1, upon evidence demonstrating non-compliance with the approval system.

6.2.2.6.2.2 The competent authority may delegate its functions in this approval system, in whole or in part.

6.2.2.6.2.3 The competent authority shall ensure that a current list of approved periodic inspection and test bodies and their identity marks is available.

Periodic inspection and test body

6.2.2.6.2.4 The periodic inspection and test body shall be approved by the competent authority and shall:

- (a) have a staff with an organisational structure, capable, trained, competent, and skilled, to satisfactorily perform its technical functions;
- (b) have access to suitable and adequate facilities and equipment;
- (c) operate in an impartial manner and be free from any influence which could prevent it from doing so;
- (d) ensure commercial confidentiality;
- (e) maintain clear demarcation between actual periodic inspection and test body functions and unrelated functions;
- (f) operate a documented quality system accordance with 6.2.2.6.3;
- (g) apply for approval in accordance with 6.2.2.6.4;
- (h) ensure that the periodic inspections and tests are performed in accordance with 6.2.2.6.5; and
- (i) maintain an effective and appropriate report and record system in accordance with 6.2.2.6.6.

6.2.2.6.3 Quality system and audit of the periodic inspection and test body

6.2.2.6.3.1 Quality system

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

The quality system shall include:

- (a) a description of the organisational structure and responsibilities;

- (b) the relevant inspection and test, quality control, quality assurance, and process operation instructions that will be used;
- (c) quality records, such as inspection reports, test data, calibration data and certificates;
- (d) management reviews to ensure the effective operation of the quality system arising from the audits performed in accordance with 6.2.2.6.3.2;
- (e) a process for control of documents and their revision;
- (f) a means for control of non-conforming pressure receptacles; and
- (g) training programmes and qualification procedures for relevant personnel.

6.2.2.6.3.2 Audit

The periodic inspection and test body and its quality system shall be audited in order to determine whether it meets the requirements of these Regulations to the satisfaction of the competent authority.

An audit shall be conducted as part of the initial approval process (see 6.2.2.6.4.3). An audit may be required as part of the process to modify an approval (see 6.2.2.6.4.6).

Periodic audits shall be conducted, to the satisfaction of the competent authority, to ensure that the periodic inspection and test body continues to meet the requirements of these Regulations.

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

6.2.2.6.3.3 Maintenance of the quality system

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

The periodic inspection and test body shall notify the competent authority that approved the quality system, of any intended changes, in accordance with the process for modification of an approval in 6.2.2.6.4.6.

6.2.2.6.4 Approval process for periodic inspection and test bodies

Initial approval

6.2.2.6.4.1 A body desiring to perform periodic inspection and test of pressure receptacles in accordance with a pressure receptacle standard and these Regulations shall apply for, obtain, and retain an approval certificate issued by the competent authority.

This written approval shall, on request, be submitted to the competent authority of a country of use.

6.2.2.6.4.2 An application shall be made for each periodic inspection and test body and shall include:

- (a) the name and address of the periodic inspection and test body and, if the application is submitted by an authorised representative, its name and address;
- (b) the address of each facility performing periodic inspection and test;
- (c) the name and title of the person(s) responsible for the quality system;
- (d) the designation of the pressure receptacles, the periodic inspection and test methods, and the relevant pressure receptacle standards met by the quality system;
- (e) documentation on each facility, the equipment, and the quality system as specified under 6.2.2.6.3.1;
- (f) the qualifications and training records of the periodic inspection and test personnel; and
- (g) details of any refusal of approval of a similar application by any other competent authority.

6.2.2.6.4.3 The competent authority shall:

- (a) examine the documentation to verify that the procedures are in accordance with the requirements of the relevant pressure receptacle standards and these Regulations; and
- (b) conduct an audit in accordance with 6.2.2.6.3.2 to verify that the inspections and tests are carried out as required by the relevant pressure receptacle standards and these Regulations, to the satisfaction of the competent authority.

6.2.2.6.4.4 After the audit has been carried out with satisfactory results and all applicable requirements of 6.2.2.6.4 have been satisfied, an approval certificate shall be issued. It shall include the name of the periodic inspection and test body, the registered mark, the address of each facility, and the necessary data for identification of its approved activities (e.g. designation of pressure receptacles, periodic inspection and test method and pressure receptacle standards).

6.2.2.6.4.5 If the periodic inspection and test body is denied approval, the competent authority shall provide written detailed reasons for such denial.

Modifications to periodic inspection and test body approvals

6.2.2.6.4.6 Following approval, the periodic inspection and test body shall notify the issuing competent authority of any modifications to the information submitted under 6.2.2.6.4.2 relating to the initial approval.

The modifications shall be evaluated in order to determine whether the requirements of the relevant pressure receptacle standards and these Regulations will be satisfied. An audit in accordance with 6.2.2.6.3.2 may be required. The competent authority shall accept or reject these modifications in writing, and an amended approval certificate shall be issued as necessary.

6.2.2.6.4.7 Upon request, the competent authority shall communicate to any other competent authority, information concerning initial approvals, modifications of approvals, and withdrawn approvals.

6.2.2.6.5 Periodic inspection and test and certification

The application of the periodic inspection and test marking to a pressure receptacle shall be considered a declaration that the pressure receptacle complies with the applicable pressure receptacle standards and the requirements of these Regulations. The periodic inspection and test body shall affix the periodic inspection and test marking, including its registered mark, to each approved pressure receptacle (see 6.2.2.7).

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

6.2.2.6.6 Records

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

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

6.2.2.7 Marking of refillable-UN pressure receptacles

Refillable-UN pressure receptacles shall be marked clearly and legibly with certification, operational and manufacturing 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 packaging symbol, the minimum size of the marks shall be 5 mm 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 packaging

symbol shall be 10 mm for pressure receptacles with a diameter greater than or equal to 140 mm and 5 mm for pressure receptacles with a diameter less than 140 mm.

6.2.2.7.1 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 Regulations~~ ADR/RID for UN pressure receptacles.

- (b) The technical standard (e.g. ISO 9809-1) used for design, manufacture and testing as listed in 6.2.2 or the approval number;
- (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 the marking;
- (e) The date of the initial inspection, the year (four digits) followed by the month (two digits) separated by a slash (i.e. "/").

6.2.2.7.2 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 mass of the empty pressure receptacle including all permanently attached integral parts (e.g. neck ring, foot ring, etc.) in kilograms, followed by the letters "KG". With the exception of pressure receptacles of UN No. 1965 hydrocarbon gas mixture, liquefied, n.o.s., ~~†~~this mass shall not include the mass of valve, valve cap or valve guard, any coating, or porous mass for acetylene. The 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 of UN No. 1965 hydrocarbon gas mixture, liquefied, n.o.s., nor 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 for 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 pressure receptacles for liquefied gases and refrigerated liquefied gases, the water capacity in litres expressed to three significant digits rounded down to the last digit, followed by the letter "L". If the value of the minimum or nominal water capacity is an integer, the figures after the decimal point may be neglected;

(Comment: A transitional provision is needed for closed cryogenic receptacle stampmarks!)

- (k) In the case of pressure receptacles for UN 1001 acetylene, dissolved, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling, the porous 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 pressure receptacles for UN 3374 acetylene, solvent free, the total of the mass of the empty receptacle, the fittings and accessories not removed during filling and the porous mass expressed to two significant figures rounded down to the last digit followed by the letters "KG";

6.2.2.7.3 The following manufacturing marks shall be applied:

- (m) Identification of the cylinder thread (e.g. 25E). This mark is not required for pressure receptacles of UN No. 1965 hydrocarbon gas mixture, liquefied, n.o.s. and 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.

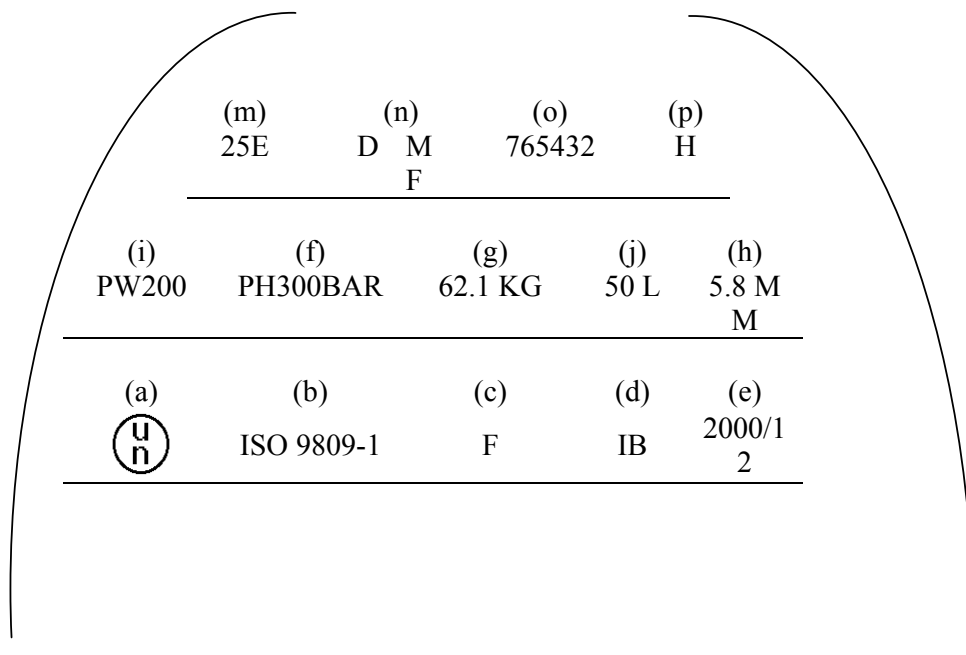
(p) In the case of steel pressure receptacles and composite pressure receptacles with steel liner intended for the ~~transport~~carriage of gases with a risk of hydrogen embrittlement, the letter "H" showing compatibility of the steel (see ISO 11114-1:1997);

6.2.2.7.4 The above marks shall be placed in three groups:

- Manufacturing marks shall be the top grouping and shall appear consecutively in the sequence given in 6.2.2.7.3.

- The operational marks in 6.2.2.7.2 shall be the middle grouping and the test pressure (f) 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 6.2.2.7.1.

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



6.2.2.7.5 Other marks are allowed in areas other than the side wall, provided they are made in low stress areas and are not of a size and depth that will create harmful stress concentrations. In the case of closed cryogenic receptacles, such marks may be on a separate plate attached to the outer jacket. Such marks shall not conflict with required marks.

6.2.2.7.6 In addition to the preceding marks, each refillable pressure receptacle that meets the periodic and test requirements of 6.2.1.5 or 6.2.2.4, as appropriate, 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.

NOTE: The month need not be indicated for gases for which the interval between periodic inspections is ten years or more [see 4.1.4.1 packing instructions P200(8) and P203 (9)].

6.2.2.7.7 For acetylene cylinders, with the agreement of the competent authority, the date of the most recent periodic inspection and the stamp of the expert may be engraved on a ring affixed to the cylinder when the valve is installed and which is removable only by disconnecting the valve from the cylinder.

6.2.2.8 Marking of non-refillable ~~UN~~ pressure receptacles

Non-refillable ~~UN~~-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. stencilled, stamped, engraved, or etched) on the pressure receptacle. Except when stencilled, 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). Except for the "UN" mark and the "DO NOT REFILL" mark, the minimum size of the marks shall be 5 mm 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 shall be 10 mm for pressure receptacles with a diameter greater than or equal to 140 mm and 5 mm for pressure receptacles with a diameter less than 140 mm. The minimum size of the "DO NOT REFILL" mark shall be 5 mm.

6.2.2.8.1 The marks listed in 6.2.2.7.1 to 6.2.2.7.3 shall be applied with the exception of (g), (h), and (m). The serial number (o) may be replaced by the batch number. In addition, the words "DO NOT REFILL" in letters of at least 5 mm in height are required.

6.2.2.8.2 The requirements of 6.2.2.7.4 shall apply.

NOTE: *Non-refillable pressure receptacles may, on account of their size, substitute this marking by a label (see 5.2.2.2.1.2).*

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

6.2.3 Requirements for ~~non-UN~~ pressure receptacles not designed, constructed and tested according to standards

~~6.2.3.1~~ Pressure receptacles not designed, constructed, inspected, and tested ~~and approved~~ according to the requirements of 6.2.2 shall be designed, constructed, inspected, tested and

approved in accordance with the provisions of a technical code providing the same level of safety and recognised by the competent authority. ~~and the general requirements of 6.2.1 and the following requirements however shall be met:~~

~~6.2.3.2~~ Pressure receptacles designed, constructed, inspected, tested and approved under the provisions of this section shall not be marked with the UN packaging symbol.

~~6.2.3.3~~ For ~~metallic cylinders, tubes, pressure drums and bundles of cylinders, the construction shall be such that the minimum burst ratio (burst pressure divided by test pressure) is:~~

- ~~1.50 for refillable pressure receptacles,~~
- ~~2.00 for non-refillable pressure receptacles.~~

~~6.2.3.4~~ Marking shall be in accordance with the requirements of the competent authority of the country of use.

6.2.3.1 Metal cylinders, tubes, pressure drums and bundles of cylinders

At the test pressure, the stress in the metal at the most severely stressed point of the pressure receptacle shall not exceed 77% of the guaranteed minimum yield stress (Re).

"Yield stress" means the stress at which a permanent elongation of 2 per thousand (i.e. 0.2%) or, for austenitic steels, 1% of the gauge length on the test-piece, has been produced.

NOTE: In the case of sheet-metal the axis of the tensile test-piece shall be at right angles to the direction of rolling. The permanent elongation at fracture, shall be measured on a test-piece of circular cross-section in which the gauge length "l" is equal to five times the diameter "d" (l=5d); if test pieces of rectangular cross-section are used, the gauge length "l" shall be calculated by the formula:

$$l = 5.65 \sqrt{F_0}$$

where F_0 indicates the initial cross-sectional area of the test-piece.

Pressure receptacles and their closures shall be made of suitable materials which shall be resistant to brittle fracture and to stress corrosion cracking between – 20 °C and +50 °C.

Welds shall be skilfully made and shall afford the fullest safety.

6.2.3.2 Additional provisions relating to aluminium-alloy pressure receptacles for compressed gases, liquefied gases, dissolved gases and non pressurized gases subject to special requirements (gas samples) as well as articles containing gas under pressure other than aerosol dispensers and small receptacles containing gas (gas cartridges)

6.2.3.2.1 The materials of aluminium-alloy pressure receptacles which are to be accepted shall satisfy the following requirements:

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
<u>Tensile strength, Rm, in MPa (=N/mm²)</u>	<u>49 to 186</u>	<u>196 to 372</u>	<u>196 to 372</u>	<u>343 to 490</u>
<u>Yield stress, Re, in MPa (=N/mm²) (permanent set λg = 0.2%)</u>	<u>10 to 167</u>	<u>59 to 314</u>	<u>137 to 334</u>	<u>206 to 412</u>
<u>Permanent elongation at fracture (l = 5d) in per cent</u>	<u>12 to 40</u>	<u>12 to 30</u>	<u>12 to 30</u>	<u>11 to 16</u>
<u>Bend test (diameter of former d = n × e, where e is the thickness of the test piece)</u>	<u>n=5(Rm ≤ 98)</u> <u>n=6(Rm > 98)</u>	<u>n=6(Rm ≤ 325)</u> <u>n=7(Rm > 325)</u>	<u>n=6(Rm ≤ 325)</u> <u>n=7(Rm > 325)</u>	<u>n=7(Rm ≤ 392)</u> <u>n=8(Rm > 392)</u>
<u>Aluminium Association Series Number^a</u>	<u>1 000</u>	<u>5 000</u>	<u>6 000</u>	<u>2 000</u>

^a See "Aluminium Standards and Data", Fifth edition, January 1976, published by the Aluminium Association, 750 Third Avenue, New York.

The actual properties will depend on the composition of the alloy concerned and on the final treatment of the pressure receptacle, but whatever alloy is used the thickness of the pressure receptacle shall be calculated by one of the following formulae:

$$e = \frac{P_{\text{MPa}} D}{\frac{2Re}{1.3} + P_{\text{MPa}}} \quad \text{or} \quad e = \frac{P_{\text{bar}} D}{\frac{20Re}{1.3} + P_{\text{bar}}}$$

where e = minimum thickness of pressure receptacle wall, in mm;

P_{MPa} = test pressure, in MPa

P_{bar} = test pressure, in bar

D = nominal external diameter of the pressure receptacle, in mm;
and
Re = guaranteed minimum proof stress with 0.2% proof stress,
in MPa (=N/mm²)

In addition, the value of the minimum guaranteed proof stress (Re) introduced into the formula is in no case to be greater than 0.85 times the guaranteed minimum tensile strength (Rm), whatever the type of alloy used.

NOTE 1: The above characteristics are based on previous experience with the following materials used for pressure receptacles:

Column A: Aluminium, unalloyed, 99.5 g pure;

Column B: Alloys of aluminium and magnesium;

Column C: Alloys of aluminium, silicon and magnesium, such as ISO/R209-Al-Si-Mg (Aluminium Association 6351);

Column D: Alloys of aluminium, copper and magnesium;

NOTE 2: The permanent elongation at fracture is measured by means of test-pieces of circular cross-section in which the gauge length "l" is equal to five times the diameter "d" (l= 5d); if test-pieces of rectangular section are used the gauge length shall be calculated by the formula:

$$l = 5.65 \sqrt{F_0}$$

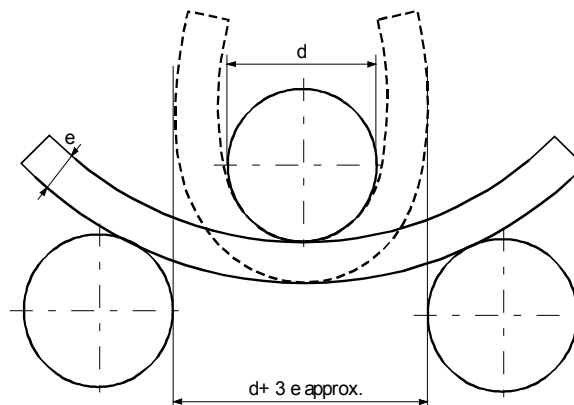
where F_0 is the initial cross-section area of the test-piece.

NOTE 3: (a) The bend test (see diagram) shall be carried out on specimens obtained by cutting into two equal parts of width 3e, but in no case less than 25 mm, an annular section of a cylinder. The specimens shall not be machined elsewhere than on the edges.

(b) The bend test shall be carried out between a mandrel of diameter (d) and two circular supports separated by a distance of (d + 3e). During the test the inner faces shall be separated by a distance not greater than the diameter of the mandrel.

(c) The specimen shall not exhibit cracks when it has been bent inwards around the mandrel until the inner faces are separated by a distance not greater than the diameter of the mandrel.

(d) The ratio (n) between the diameter of the mandrel and the thickness of the specimen shall conform to the values given in the table.

Diagram of bend test

6.2.3.2.2 A lower minimum elongation value is acceptable on condition that an additional test approved by the competent authority of the country in which the pressure receptacles are made proves that safety of carriage is ensured to the same extent as in the case of pressure receptacles constructed to comply with the characteristics given in the table in 6.2.3.2.1 (see also EN 1975:1999 + A1:2003).

6.2.3.2.3 The wall thickness of the pressure receptacles at the thinnest point shall be the following:

- where the diameter of the pressure receptacle is less than 50 mm: not less than 1.5 mm;
- where the diameter of the pressure receptacle is from 50 to 150 mm: not less than 2 mm; and
- where the diameter of the pressure receptacle is more than 150 mm: not less than 3 mm.

6.2.3.2.4 The ends of the pressure receptacles shall have a semicircular, elliptical or "basket-handle" section; they shall afford the same degree of safety as the body of the pressure receptacle.

6.2.3.3 **Pressure receptacles in composite materials**

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

- 1.67 for hoop wrapped pressure receptacles;

- 2.00 for fully wrapped pressure receptacles.

6.2.3.4 Closed cryogenic receptacles

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

6.2.3.4.1 If non-metallic materials are used, they shall resist brittle fracture at the lowest working temperature of the pressure receptacle and its fittings;

6.2.3.4.2 Pressure receptacles shall be fitted with a safety valve which shall be capable of opening at the working pressure shown on the pressure receptacle. The valves shall be so constructed as to work perfectly even 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;

6.2.3.4.3 The vents and safety valves of pressure receptacles shall be so designed as to prevent the liquid from splashing out;

NOTE: The marking requirements for refillable pressure receptacles are given in 6.2.2.7.

6.2.4 Insert 6.2.4 of ADR unchanged;

(6.2.5 of ADR is not needed)

Annex

Parts of ADR/RID not carried forward in the new proposal

6.2.1.1 Material characteristics to be considered are, when applicable:

- yield stress;
- tensile strength;
- time-dependent strength;
- fatigue data;
- Young's modulus (modulus of elasticity);
- appropriate amount of plastic strain;
- impact strength;
- fracture resistance.

6.2.1.3.2 Fittings

- (a) If cylinders are fitted with a device to prevent rolling, this device shall not be integral with the valve cap;