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COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS

Sub-Committee of Experts on the Transport of Dangerous Goods

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

(Geneva, 6-15 December 1999)

Addendum 1

Annex to the Report of the Working Group on Gas Receptacles and Multiple-Element Gas Containers (MEGCs)

1. Reference is made to the report of the Working Group on Gas Receptacles and Multiple-Element Gas Containers (MEGCs) (see ST/SG/AC.10/C.3/34, annex 1).

2. The texts proposed by the Working Group are reproduced below (see also ST/SG/AC.10/C.3/34, para. 17).

Proposal 1

Proposed texts: 1.2.1 Definitions

The following definitions should be added at the appropriate places.

Bundles of cylinders are assemblies of cylinders held firmly together and which are interconnected by a manifold and transported as a unit. The total water capacity shall not exceed 3000 litres; bundles intended for the transport of toxic gases of division 2.3 shall be limited to 1000 litres water capacity;

Cylinders are transportable pressure receptacles of a water capacity not exceeding 150 litres;

Cryogenic receptacles are transportable thermally insulated receptacles closed or not for refrigerated liquefied gases of a water capacity of not more than 1000 litres;

Multiple-element gas containers (MEGC's) are multimodal assemblies of cylinders, tubes and bundles of cylinders which are interconnected by a manifold and which are assembled within a framework. The multiple-element gas container includes service equipment and structural equipment necessary for the transport of gases;

Pressure drums are welded transportable pressure receptacles of a water capacity exceeding 150 litres and of not more than[1000] litres, (e.g. cylindrical receptacles equipped with rolling hoops, receptacles on skids and receptacles in frames);

Tubes are seamless transportable pressure receptacles of a water capacity exceeding 150 litres and of not more than 3000 litres;

Pressure receptacles is a collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles and bundles of cylinders";

Filling ratio is the ratio of the mass of liquefied gas introduced in a container to the mass of water at 15°C that would fill the same container fitted ready for use;

Settled pressure is the pressure attained by a gas or gas mixture in a gas receptacle in thermal and diffusive equilibrium;

Working pressure is the settled pressure of a compressed gas at the reference temperature of 15 °C in a full receptacle;

Test pressure is the required pressure applied during a pressure test for qualification or requalification;

[Authorised body]

Proposal 2

2.2.1 Definitions and general provisions

Paragraph 2.2.1.2 shall be replaced with the following text:

"2.2.1.2 The transport condition of a gas is described according to its physical state as:

(a) ***Compressed gas*** **-** a gas which when packaged under pressure for transport is entirely gaseous at -50 °C. This category includes all gases with a critical temperature below -50 °C;

(b) ***Liquefied gas*** - a gas which when packaged under pressure for transport is partially liquid at temperatures above -50 °C. A distinction is made between:

High pressure liquefied gas - gases with a critical temperature between -50 °C and +65 °C,

Low pressure liquefied gas - gases with a critical temperature above +65 °C;

(c) ***Refrigerated liquefied gas*** - a gas which when packaged for transport is made partially liquid because of its low temperature;

(d) ***Gas in solution*** - a gas which when packaged under pressure for transport is dissolved in a solvent."

Proposal 3

4.1.6 Special packing provisions for dangerous goods of Class 2

4.1.6.1 *General requirements*

4.1.6.1.1 Pressure receptacles, including their closures, shall be selected to contain a gas or a mixture of gases according to the requirements of section 6.2.1.2 "Materials of pressure receptacles" and the requirements of the specific packing instructions of section 4.1.4.2. This section also applies to pressure receptacles which are elements of MEGC's. The provisions of ISO 11114-1,-2 shall be met as appropriate.

4.1.6.1.2 Refillable pressure receptacles shall not be filled with a gas or gas mixture different from that previously contained unless the necessary operations for change of gas service have been performed. The provisions of ISO 11621:1997 [or CGA C-10] shall be met. In addition, a pressure receptacle that previously contained liquid substances with corrosive properties shall not be put in class 2 service unless the necessary inspection and testing as defined in 6.2.1.5 have been performed.

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

4.1.6.1.4 Valves shall be protected from damage which could cause release of the contents of the pressure receptacle, if the pressure receptacle falls during storage, transport or handling, by one of the following methods:

(a) Valves are placed inside the neck of the pressure receptacle and protected by a screw-threaded plug or cap;

(b) Valves are protected by caps. Caps shall possess vent-holes of sufficient cross-sectional area to evacuate the gas if leakage occurs at the valves;

(c) Valves are protected by shrouds or guards;

(d) Valves are designed and constructed in such a way that they are inherently able to withstand damage without leakage of product;[ISO 10297, Annex A]

(e) Valves are placed inside a protective frame;

(f) Pressure receptacles are carried in protective boxes or frames.

For pressure receptacles with valves as described in (b) and (c), the requirements of ISO 11117:1998 shall be met; [for unprotected valves as described in (d), the requirements of the annex of ISO 10297 shall be met].

4.1.6.1.5 Pressure receptacles, containing pyrophoric gases and gases with an LC50 lower than or equal to 200ppm shall have their valve openings fitted with gas-tight plugs or cap nuts which shall be made of a material compatible with the contents of the pressure receptacle.

4.1.6.1.6 Pressure receptacles may be transported after the expiry of the time-limit set for the periodic inspection prescribed. Pressure receptacles shall not be charged or filled after they become due for periodic inspection.

4.1.6.1.7 Refillable pressure receptacles shall be periodically inspected according to the provisions of P 200 and P 203.

4.1.6.1.8 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 been examined and found to be in good working order;
(d) unless the markings necessary for filling are legible or;
(e) unless for the purpose of repair in accordance with these regulations.

4.1.6.2 Insert the following packing instructions

P200	**Packing instruction**	**P200**

This packing instruction applies to Class 2 compressed, liquefied gases and gases in solution. The general packing requirements of 4.1.6.1 shall be met.
The following types of pressure receptacles are authorized:
Cylinder, tubes, pressure drums and bundles of cylinders.

200 (a) Pressure receptacles shall be closed and leakproof as to prevent escape of the gases. Pressure receptacles containing toxic gases with a LC50 lower than or equal to 200ppm as specified in the table shall not be equipped with any pressure-relief device. Pressure-relief devices shall be fitted on receptacles intended for the transport of UN 1013 carbon dioxide and UN 1070 nitrous oxide. [Other pressure receptacles shall be fitted with a pressure-relief device where specified by the competent authority. The bursting component of the pressure-relief device shall open automatically at a pressure between 100 and 120% of the test pressure. Where fusible components are used, an appropriate temperature range for functioning shall be specified by the competent authority (see CGA pamphlet S.1.1 and ISO 3807-2 for acetylene cylinders).]

200(b) The following tables:

- identify the types of pressure receptacles authorised for a gas;
- identify the test pressure, the filling ratio and the maximum water capacity for the various gases, as well as restrictions concerning toxic gases with LC_{50} <200 ppm;
- refer to additional requirements that are specific to a gas.

200(c) For compressed gases, the working pressure shall be not more than two thirds of the test pressure of the pressure receptacles. In no case shall the internal pressure at 65 °C exceed the test pressure.

200(d) For high pressure liquefied gases, the filling ratio shall be such that the internal pressure at 65 °C does not exceed the test pressure of the pressure receptacles.

200(e) For high pressure liquefied gases and gas mixtures with insufficient thermo-dynamical and physical data, the maximum filling ratio (FR) shall be determined as follows:

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

where FR = maximum filling ratio
d_g = gas density (at 15 °C, 1 bar)(in g·l^{-1})
Ph = minimum test pressure (in bar)

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

Formula

$$FR \leq \frac{P_e \times MM \times 10^{-3}}{R \times 338}$$

where FR = maximum filling ratio
P_h = minimum test pressure (in bar)
MM = molecular mass (in g·mol^{-1})
R = 8.31451 · 10^{-2} bar·l·mol^{-1}·K^{-1} (gas constant)

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

P200	**Packing instruction (cont'd)**	**P200**

200(f) For low pressure liquefied gases, the maximum mass of contents per litre of capacity (filling factor) equals 0.95 times the density of the liquid phase at 50 °C; in addition, the vapour phase shall not disappear below 60 °C. The test pressure will be at least equal to the vapour pressure (absolute) of the liquid at 65 °C, minus 100 kPa (1 bar).

200(g) For pure low pressure liquefied gases with insufficient thermo-dynamical or physical data the maximum filling ratio shall be determined as follows:

Formula $FR \quad (0.0032 \times BP - 0.24) \times d_1$

where FR = maximum filling ratio
BP = boiling point (in Kelvin)
d_1 = density of the liquid at boiling point (in $g \cdot l^{-1}$)

200(h) For acetylene, dissolved, UN 1001, once equilibrium has been achieved at 15 °C, the working pressure shall not exceed the value prescribed by the competent authority for the porous mass. The quantity of solvent and the quantity of acetylene shall likewise correspond to the figures specified in the approval.

200(i) Refillable pressure receptacles shall be subjected to periodic inspections in accordance with the provisions of section 6.2.

200(j) If special requirements for certain substances do not appear in the table below, periodic inspections shall be carried out:

(a) Every 5 years in the case of receptacles intended for the carriage of gases of division 2.3; for gases with a subsidiary corrosive risk where the moisture content is above […] the period is reduced to 3 years;

(b) Every 10 years in the case of receptacles intended for the carriage of gases of division 2.1 and of division 2.2.

200(k) Keys for the column " receptacles"

(1) Cylinders;
(2) Tubes;
(3) Pressure drums;
(4) MEGC;
(5) Bundles of cylinders.

200(l) Keys for the column "Special requirements":

a: Aluminium alloys shall not be in contact with the gas (see ISO 11114-1).

b: Valves made of copper shall not be used (see ISO 11114-1).

c: Metal parts in contact with the contents shall not contain more than 70% copper (see ISO 11114-1).

d: A pressure receptacle shall not contain more than 5 kg of the gas.

e: The valve outlets shall be fitted with plugs or cap-nuts ensuring gas-tightness.

P200	Packing instruction (cont'd)	P200

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

g: The use of test pressures and filling ratio combinations other than those indicated are permitted provided that the settled pressure at 65 °C does not exceed the test pressure of the receptacle (re. 200(d)).

h: If a non-monolithic material is used as a porous mass, the interval between inspections shall be maximum of 5 years. [Those cylinders will not bear a UN marking]. Receptacles fitted with relief devices or manifolded together shall be transported vertically.

i: The maximum filling ratio shall be in accordance with the figures specified in the approval.

j: The test pressure and filling ratio shall be calculated in accordance with the requirements of 200(d) and 200 (e).

k: The interval between tests may be extended to 10 years when the pressure receptacles are made of aluminium alloys that have been subjected to stress corrosion testing as specified in ISO 7866.

l: Each cylinder within a bundle shall be fitted with an individual valve that shall be closed during transport.

[m: The interval between inspections for steel cylinders may be extended to 15 years:

(a) with the agreement of the competent authority (authorities) of the country (countries) where the periodic inspection and the transport take place; and

(b) in accordance with the requirements of standard ISO/DIS 10464 "Liquefied petroleum gas (LPG) cylinders - Periodic inspection and testing".]

[n: A pressure receptacle with a test pressure greater than or equal to 200 bar shall be used unless the receptacle is shipped in a secondary rigid packaging or calculation shows an equivalent resistance to mechanical impact.]

o: Compatibility with the material shall be checked when steel receptacles with a tensile strength above 950 MPa are to be used (see ISO 11114-1).

z: In the case of pressure receptacles for the transport of gases under an N.O.S. description, the following requirements shall be complied with as applicable:

(1) The materials of which the pressure receptacles and their accessories are made shall be compatible with the contents and shall not form harmful or dangerous compounds therewith.

(2) The test pressure and filling ratio shall be calculated in accordance with the requirements of paragraphs 200 (c), 200 (d) and 200 (e).

(3) Toxic gases and gas mixtures with LC_{50} <200 ppm shall not be transported in tubes and pressure drums.

P200	Packing instruction (cont'd)	P200
	(4) The valves of pressure receptacles for toxic gases and gas mixtures with a LC_{50} less than 200 ppm or for pyrophoric gases or flammable mixtures of gases containing more than 1% of pyrophoric compounds shall be fitted with gas tight plugs or cap-nuts. When these pressure receptacles are manifolded in a bundle, each of the pressure receptacles shall be fitted with an individual valve that shall be closed during transport and the outlet manifold valve shall be plugged.	
	(5) The necessary steps shall be taken to prevent dangerous reactions (i.e. polymerisation, decomposition) during transport. If necessary, stabilisation or addition of an inhibitor is required.	

***Note**: The table will be rearranged in UN number order pending comments on content and layout to be provided by the participants.*

Identi-fication No	Name of the substance or article	Receptacles	TEST			FILLING	Special requir-ements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
1002	AIR, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1006	ARGON, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1046	HELIUM, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1056	KRYPTON, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1065	NEON, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1066	NITROGEN, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1979	RARE GASES MIXTURE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1980	RARE GASES AND OXYGEN MIXTURE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1981	RARE GASES AND NITROGEN MIXTURE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
1982	TETRAFLUOROMETHANE, COMPRESSED (REFRIGERANT GAS R 14, COMPRESSED)	(1),(2),(3),(4),(5)		20	10	0.62	g
		(1),(2),(3),(4),(5)		30		0.94	g
2036	XENON, COMPRESSED	(1),(2),(3),(4),(5)		13	10	1.24	g
2193	HEXAFLUOROETHANE, COMPRESSED (REFRIGERANT GAS R 116, COMPRESSED)	(1),(2),(3),(4),(5)		20	10	1.10	g
1956	COMPRESSED GAS, N.O.S.	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	z
1014	CARBON DIOXIDE AND OXYGEN MIXTURE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
2451	NITROGEN TRIFLUORIDE	(1),(2),(3),(4),(5)		20	10	0.5	g
		(1),(2),(3),(4),(5)		30		0.75	g
3156	COMPRESSED GAS,	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	z

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
	OXIDIZING, N.O.S.						
1049	HYDROGEN, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	o
1957	DEUTERIUM, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	o
1962	ETHYLENE, COMPRESSED	(1),(2),(3),(4),(5)		22.5	10	0.34	g
		(1),(2),(3),(4),(5)		30.0	10	0.37	g
1971 1971	METHANE, COMPRESSED or NATURAL GAS, COMPRESSED with high methane content	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
2034	HYDROGEN AND METHANE MIXTURE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	
2203	SILANE, COMPRESSED **/	(1),(2),(3),(4),(5)		22.5	10	0.32	e,g,l,o
		(1),(2),(3),(4),(5)		25.0	10	0.41	e,g,l,o
1964	HYDROCARBON GAS MIXTURE, COMPRESSED,N.O.S	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	z
1954	COMPRESSED GAS, FLAMMABLE, N.O.S	(1),(2),(3),(4),(5)	1.5		10	2/3 T.P.	z
1612	HEXAETHYL TETRAPHOSPHATE AND COMPRESSED GAS MIXTURE	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
1955	COMPRESSED GAS, TOXIC, N.O.S.	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
1016	CARBON MONOXIDE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	k
1023	COAL GAS, COMPRESSED	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	
1071	OIL GAS, COMPRESSED	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	
1911	DIBORANE, COMPRESSED	(1),(5)		25.0	5	0.072	e,f,l,o
2600	CARBON MONOXIDE AND HYDROGEN MIXTURE, COMPRESSED	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	k,o
1953	COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S.	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
1008	BORON TRIFLUORIDE, COMPRESSED	(1),(2),(3),(4),(5)		22.5	5	0.715	g
		(1),(2),(3),(4),(5)		30.0		0.86	g
1859	SILICON TETRAFLUORIDE, COMPRESSED	(1),(2),(3),(4),(5)		20	5	0.74	g
		(1),(2),(3),(4),(5)		30		1.1	g
2198	PHOSPHORUS PENTAFLUORIDE, COMPRESSED	(1),(5)		20	5	0.9	e,g,l

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
		(1),(5)		30		1.34	e,g,l
2417	CARBONYL FLUORIDE, COMPRESSED	(1),(2),(3),(4),(5)		20	5	0.47	g
		(1),(2),(3),(4),(5)		30		0.7	g
3304	COMPRESSED GAS, TOXIC, CORROSIVE, N.O.S.	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
3303	COMPRESSED GAS, TOXIC, OXIDIZING, N.O.S.	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
3305	COMPRESSED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
1045	FLUORINE, COMPRESSED	(1),(5)		20.0	5	2.8 MPa	a,d,e,l
1660	NITRIC OXIDE, COMPRESSED	(1),(5)	1.5		5	2/3 T.P.	e,l
2190	OXYGEN DIFLUORIDE	(1),(5)		20.0	5	2.8 MPa	a,d,e,l,n
3306	COMPRESSED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	(1),(2),(3),(4),(5)	1.5		5	2/3 T.P.	z
1009	BROMOTRIFLUORO-METHANE (REFRIGERANT GAS R 13B1)	(1),(2),(3),(4),(5)		4.2	10	1.13	g
		(1),(2),(3),(4),(5)		12.0	10	1.44	g
		(1),(2),(3),(4),(5)		25.0	10	1.60	g
1013	CARBON DIOXIDE	(1),(2),(3),(4),(5)		19.0	10	0.66	g
		(1),(2),(3),(4),(5)		25.0	10	0.75	g
1015	CARBON DIOXIDE AND NITROUS OXIDE MIXTURE	(1),(3),(5)		25.0	10	0.75	g
1018	CHLORODIFLUORO-METHANE (REFRIGERANT GAS R 22)	(1),(2),(3),(4),(5)		2.9	10	1.03	
1020	CHLOROPENTAFLUORO-ETHANE (REFRIGERANT GAS R 115)	(1),(2),(3),(4),(5)		2.5	10	1.08	
1021	1-CHLORO-1,2,2,2-TETRA-FLUOROETHANE (REFRIGERANT GAS R 124)	(1),(2),(3),(4),(5)		1.2	10	1.2	
1022	CHLOROTRIFLUORO-METHANE (REFRIGERANT GAS R 13)	(1),(2),(3),(4),(5)		10.0	10	0.83	g
		(1),(2),(3),(4),(5)		12.0	10	0.90	g
		(1),(2),(3),(4),(5)		19.0	10	1.04	g
		(1),(2),(3),(4),(5)		25.0	10	1.10	g
1028	DICHLORODIFLUORO-	(1),(2),(3),(4),(5)		1.8	10	1.15	

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
	METHANE (REFRIGERANT GAS R 12)						
1029	DICHLOROFLUORO-METHANE (REFRIGERANT GAS R 21)	(1),(2),(3),(4),(5)		1.0	10	1.23	
1058	LIQUEFIED GASES, non-flammable, charged with nitrogen, carbon dioxide or air	(1),(2),(3),(4),(5)	1.5		10		j
1080	SULPHUR HEXAFLUORIDE	(1),(2),(3),(4),(5)		7.0	10	1.04	g
		(1),(2),(3),(4),(5)		14.0	10	1.33	g
		(1),(2),(3),(4),(5)		16.0	10	1.37	g
1858	HEXAFLUOROPROPYLENE (REFRIGERANT GAS R 1216)	(1),(2),(3),(4),(5)		2.2	10	1.11	
1952	CARBON DIOXIDE AND ETHYLENE OXIDE MIXTURE	(1),(2),(3),(4),(5)		19	10	0.66	
	with not more than 9% ethylene oxide	(1),(2),(3),(4),(5)		25	10	0.75	
1958	DICHLOROTETRAFLUORO-ETHANE (REFRIGERANT GAS R 114)	(1),(2),(3),(4),(5)		1.0	10	1.30	
1973	CHLORODIFLUORO-METHANE AND CHLOROPENTAFLUORO-ETHANE MIXTURE with fixed boiling point, with approximately 49% chlorodifluoromethane (REFRIGERANT GAS R 502)	(1),(2),(3),(4),(5)		3.1	10	1.05	
1974	CHLORODIFLUOROBROMO-METHANE (REFRIGERANT GAS R 12B1)	(1),(2),(3),(4),(5)		1.0	10	1.61	
1976	OCTAFLUOROCYCLO-BUTANE (REFRIGERANT GAS RC 318)	(1),(2),(3),(4),(5)		1.1	10	1.34	
1983	1-CHLORO-2,2,2-TRIFLUORO-ETHANE (REFRIGERANT GAS R 133a)	(1),(2),(3),(4),(5)		1.0	10	1.18	
1984	TRIFLUOROMETHANE (REFRIGERANT GAS R 23)	(1),(2),(3),(4),(5)		19.0	10	0.87	g
		(1),(2),(3),(4),(5)		25.0	10	0.95	g
2422	OCTAFLUOROBUT-2-ENE (REFRIGERANT GAS R 1318)	(1),(2),(3),(4),(5)		1.2	10	1.34	
2424	OCTAFLUOROPROPANE (REFRIGERANT GAS R 218)	(1),(2),(3),(4),(5)		2.5	10	1.09	
2599	CHLOROTRIFLUORO-METHANE AND	(1),(2),(3),(4),(5)		4.2 10.0	10 10	0.20 0.66	

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
	TRIFLUOROMETHANE, AZEOTROPIC MIXTURE with approximately 60% chlorotrifluoromethane (REFRIGERANT GAS R 503)			10.0	10	0.66	
2602	DICHLORODIFLUORO-METHANE AND 1,1-DIFLUOROETHANE , AZEOTROPIC MIXTURE with approximately 74% dichlorodifluoromethane (REFRIGERANT GAS R 500)	(1),(2),(3),(4),(5)		2.2	10	1.01	
3070	ETHYLENE OXIDE AND DICHLORODIFLUORO-METHANE MIXTURE with not more than 12,5% ethylene oxyde	(1),(2),(3),(4),(5)		1.8	10	1.09	
3159	1,1,1,2-TETRAFLUORO-ETHANE (REFRIGERANT GAS R 134a)	(1),(2),(3),(4),(5)		2.2	10	1.04	
3220	PENTAFLUOROETHANE (REFRIGERANT GAS R 125)	(1),(2),(3),(4),(5)		3.4 3.6	10 10	0.95 0.72	g g
3296	HEPTAFLUOROPROPANE (REFRIGERANT GAS R 227)	(1),(2),(3),(4),(5)		1.5	10	1.2	
3297	ETHYLENE OXIDE AND CHLOROTETRAFLUORO-ETHANE MIXTURE, with not more than 8,8% ethylene oxide	(1),(2),(3),(4),(5)		1.0	10	1.16	
3298	ETHYLENE OXIDE AND PENTAFLUOROETHANE MIXTURE, with not more than 7,9% ethylene oxide	(1),(2),(3),(4),(5)		2.6	10	1.02	
3299	ETHYLENE OXIDE AND TETRAFLUOROETHANE MIXTURE, with not more than 5,6% ethylene oxide	(1),(2),(3),(4),(5)		1.7	10	1.03	
3337	REFRIGERANT GAS R 404A	(1),(2),(3),(4),(5)		3.6	10	0.82	
3338	REFRIGERANT GAS R 407A	(1),(2),(3),(4),(5)		3.6	10	0.94	
3339	REFRIGERANT GAS R 407B	(1),(2),(3),(4),(5)		3.8	10	0.93	
3340	REFRIGERANT GAS R 407C	(1),(2),(3),(4),(5)		3.5	10	0.95	
1078	REFRIGERANT GASES, N.O.S.	(1),(2),(3),(4),(5)			10		z
1968	INSECTICIDE GAS, N.O.S.	(1),(2),(3),(4),(5)			10		z
3163	LIQUEFIED GAS, N.O.S.	(1),(2),(3),(4),(5)			10		z
1070	NITROUS OXIDE	(1),(2),(3),(4),(5)		18.0	10	0.68	g
		(1),(2),(3),(4),(5)		22.5	10	0.74	g
		(1),(2),(3),(4),(5)		25.0	10	0.75	g

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
3157	LIQUEFIED GAS, OXIDIZING, N.O.S.	(1),(2),(3),(4),(5)			10		z
1010	1.2-BUTADIENE, INHIBITED or	(1),(2),(3),(4),(5)		1.0	10	0.59	f
1010	1.3-BUTADIENE, INHIBITED or	(1),(2),(3),(4),(5)		1.0	10	0.55	f
1010	MIXTURES OF 1,3-BUTADIENE AND HYDROCARBONS, INHIBITED	(1),(2),(3),(4),(5)			10	0.5	f,j
1011	BUTANE	(1),(2),(3),(4),(5)		1.0	10	0.51	
1012	BUTYLENES MIXTURE or	(1),(2),(3),(4),(5)			10	0.5	j
1012	1-BUTYLENE or	(1),(2),(3),(4),(5)		1.0	10	0.53	
1012	CIS-2-BUTENE or	(1),(2),(3),(4),(5)		1.0	10	0.55	
1012	TRANS-2-BUTYLENE	(1),(2),(3),(4),(5)		1.0	10	0.54	
1027	CYCLOPROPANE	(1),(2),(3),(4),(5)		2.0	10	0.53	
1030	1,1-DIFLUOROETHANE (REFRIGERANT GAS R 152a)	(1),(2),(3),(4),(5)		1.8	10	0.79	
1032	DIMETHYLAMINE, ANHYDROUS	(1),(2),(3),(4),(5)		1.0	10	0.59	b
1033	DIMETHYL ETHER	(1),(2),(3),(4),(5)		1.8	10	0.58	
1035	ETHANE	(1),(2),(3),(4),(5)		9.5	10	0.25	g
		(1),(2),(3),(4),(5)		12	10	0.29	g
		(1),(2),(3),(4),(5)		30.0	10	0.39	g
1036	ETHYLAMINE	(1),(2),(3),(4),(5)		1.0	10	0.61	b
1037	ETHYL CHLORIDE	(1),(2),(3),(4),(5)		1.0	10	0.80	a
1039	ETHYL METHYL ETHER	(1),(2),(3),(4),(5)		1	10	0.64	
1041	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE, with more than 9% ethylene oxide but not more than 87%	(1),(2),(3),(4),(5)		19 25	10 10	0.66 0.75	g g
1055	ISOBUTYLENE	(1),(2),(3),(4),(5)		1.0	10	0.52	
1060	METHYLACETYLENE AND PROPADIENE MIXTURE, STABILIZED	(1),(2),(3),(4),(5)			10		c,f,j
	Propadiene with 1% to 4% methylacetylene	(1),(2),(3),(4),(5)		2.2	10	0.50	c,f
1061	METHYLAMINE, ANHYDROUS	(1),(2),(3),(4),(5)		1.3	10	0.58	b
1063	METHYL CHLORIDE (REFRIGERANT GAS R 40)	(1),(2),(3),(4),(5)		1.7	10	0.81	a
1077	PROPYLENE	(1),(2),(3),(4),(5)		3.0	10	0.43	
1081	TETRAFLUOROETHYLENE,	(1),(2),(3),(4),(5)		20.0	10	0.5 MPa	f

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
	INHIBITED						
1083	TRIMETHYLAMINE, ANHYDROUS	(1),(2),(3),(4),(5)		1.0	10	0.56	b
1085	VINYL BROMIDE, INHIBITED	(1),(2),(3),(4),(5)		1.0	10	1.37	a,f
1086	VINYL CHLORIDE, INHIBITED	(1),(2),(3),(4),(5)		1.2	10	0.81	a,f
1087	VINYL METHYL ETHER, INHIBITED	(1),(2),(3),(4),(5)		1.0	10	0.67	f
1860	VINYL FLUORIDE, INHIBITED	(1),(2),(3),(4),(5)		25.0	10	0.64	a,f,g
1912	METHYLCHLORIDE AND METHYLENE CHLORIDE MIXTURE	(1),(2),(3),(4),(5)		1.7	10	0.81	a
1959	1,1-DIFLUOROETHYLENE (REFRIGERANT GAS R 1132a)	(1),(2),(3),(4),(5)		25	10	0.77	g
1969	ISOBUTANE	(1),(2),(3),(4),(5)		1.0	10	0.49	m
1978	PROPANE	(1),(2),(3),(4),(5)		2.5	10	0.42	m
2035	1,1,1-TRIFLUOROETHANE (REFRIGERANT GAS R 143a)	(1),(2),(3),(4),(5)		3.5	10	0.75	
2044	2,2-DIMETHYLPROPANE	(1),(2),(3),(4),(5)		1.0	10	0.53	
2200	PROPADIENE, INHIBITED	(1),(2),(3),(4),(5)		2.2	10	0.50	f
2419	BROMOTRIFLUORO-ETHYLENE	(1),(2),(3),(4),(5)		1.0	10	1.19	
2452	ETHYLACETYLENE, INHIBITED	(1),(2),(3),(4),(5)		1.0	10	0.57	c,f
2453	ETHYL FLUORIDE (REFRIGERANT GAS R 161)	(1),(2),(3),(4),(5)		3.0	10	0.57	
2454	METHYL FLUORIDE (REFRIGERANT GAS R 41)	(1),(2),(3),(4),(5)		30.0	10	0.36	
2517	1-CHLORO-1,1-DIFLUORO-ETHANE (REFRIGERANT GAS R 142b)	(1),(2),(3),(4),(5)		1.0	10	0.99	
2601	CYCLOBUTANE	(1),(2),(3),(4),(5)		1.0	10	0.63	
3153	PERFLUORO(METHYL VINYL ETHER)	(1),(2),(3),(4),(5)		2.0	10	0.75	
3154	PERFLUORO(ETHYL VINYL ETHER)	(1),(2),(3),(4),(5)		1.0	10	0.98	
3252	DIFLUOROMETHANE (REFRIGERANT GAS R 32)	(1),(2),(3),(4),(5)		4.8	10	0.78	
1965	HYDROCARBON GAS MIXTURE, LIQUEFIED N.O.S.	(1),(2),(3),(4),(5)			10	**/	m, z
3354	INSECTICIDE GAS, FLAMMABLE, N.O.S	(1),(2),(3),(4),(5)			10		z
	LIQUEFIED GAS,						

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
3161	FLAMMABLE, N.O.S.	(1),(2),(3),(4),(5)			10		z
1062	METHYL BROMIDE	(1),(2),(3),(4),(5)		1.0	5	1.51	a
1581	CHLOROPICRIN AND METHYL BROMIDE MIXTURE	(1),(2),(3),(4),(5)		1.0	5	1.51	a
1582	CHLOROPICRIN AND METHYL CHLORIDE MIXTURE	(1),(2),(3),(4),(5)		1.7	5	0.81	a
2191	SULPHURYL FLUORIDE	(1),(2),(3),(4),(5)		5.0	5	1.10	k
1967	INSECTICIDE GAS, TOXIC, N.O.S.	(1),(2),(3),(4),(5)			5		z
3162	LIQUEFIED GAS, TOXIC, N.O.S.	(1),(2),(3),(4),(5)			5		z
1026	CYANOGEN	(1),(2),(3),(4),(5)		10.0	5	0.70	k
1040	ETHYLENE OXIDE, or ETHYLENE OXIDE WITH NITROGEN up to a total pressure of 1MPa (10 bar) at 50 °C	(1),(2),(3),(4),(5)		1.5	5	0.78	f
1053	HYDROGEN SULPHIDE	(1),(2),(3),(4),(5)		5.5	5	0.67	k,o
1064	METHYL MERCAPTAN	(1),(2),(3),(4),(5)		1.0	5	0.78	k,o
1082	TRIFLUOROCHLOROETHYLENE, INHIBITED	(1),(2),(3),(4),(5)		1.9	5	1.13	f,k
2188	ARSINE	(1),(5)		4.2	5	1.10	e,l,o
2192	GERMANE ***/	(1),(5)		25.0	5	1.02	e,g,l,o
2199	PHOSPHINE ***/	(1),(5)		25.0	5	0.51	e,g,l,o
		(1),(5)		25.0	5	0.51	e,g,l,o
2202	HYDROGEN SELENIDE, ANHYDROUS	(1),(5)		3.1	5	1.60	e,l
2204	CARBONYL SULPHIDE	(1),(2),(3),(4),(5)		2.6	5	0.84	k
2676	STIBINE	(1),(5)		2.0	5	1.2	e,l
3300	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with more than 87% ethylene oxide	(1),(2),(3),(4),(5)		2.8	5	0.73	f
3355	INSECTICIDE GAS, TOXIC, FLAMMABLE N.O.S.	(1),(2),(3),(4),(5)			5		z
3160	LIQUEFIED GAS, TOXIC, FLAMMABLE N.O.S.	(1),(2),(3),(4),(5)			5		z
1005	AMMONIA, ANHYDROUS	(1),(2),(3),(4),(5)		3.3	5	0.53	b
1017	CHLORINE	(1),(2),(3),(4),(5)		2.2	5	1.25	a
1048	HYDROGEN BROMIDE, ANHYDROUS	(1),(2),(3),(4),(5)		6.0	5	1.54	a,o
1050	HYDROGEN CHLORIDE, ANHYDROUS	(1),(2),(3),(4),(5)		10.0	5	0.30	a,g,o
		(1),(2),(3),(4),(5)		12.0	5	0.56	a,g,o
		(1),(2),(3),(4),(5)		15.0	5	0.67	a,g,o

Identification No	Name of the substance or article	Receptacles	TEST			FILLING	Special requirements
			PRESSURE		PERIOD (years) */	MAX. FILL. ratio kg/l or MPa or Vol %	
			X working pressure	MPa			
		(1),(2),(3),(4),(5)		20.0	5	0.74	a,g,o
1069	NITROSYL CHLORIDE	(1),(5)		1.3	5	1.10	e,l
1076	PHOSGENE	(1),(3),(5)		2.0	5	1.23	e,l
1079	SULPHUR DIOXIDE	(1),(2),(3),(4),(5)		1.4	5	1.23	
1589	CYANOGEN CHLORIDE, INHIBITED	(1),(5)		2.0	5	1.03	e,f,l
1741	BORON TRICHLORIDE	(1),(2),(3),(4),(5)		1.0	5	1.19	
2194	SELENIUM HEXAFLUORIDE	(1),(5)		3.6	5	1.46	e,g,l
2195	TELLURIUM HEXAFLUORIDE	(1),(5)		2.0	5	1.0	e,l
2196	TUNGSTEN HEXAFLUORIDE	(1),(5)		1.0	5	2.70	a,e,l
2197	HYDROGEN IODIDE, ANHYDROUS	(1),(2),(3),(4),(5)		2.3	5	2.25	a,o
2418	SULPHUR TETRAFLUORIDE	(1),(5)		3	5	0.91	e,l
2420	HEXAFLUOROACETONE	(1),(2),(3),(4),(5)		2.2	5	1.08	
3057	TRIFLUOROACETYL CHLORIDE	(1),(2),(3),(4),(5)		1.7	5	1.17	
3308	LIQUEFIED GAS, TOXIC, CORROSIVE N.O.S.	(1),(2),(3),(4),(5)			5		z
3083	PERCHLORYL FLUORIDE	(1),(2),(3),(4),(5)		3.3	5	1.21	e,k,l
3307	LIQUEFIED GAS, TOXIC, OXIDIZING N.O.S.	(1),(2),(3),(4),(5)			5		z
2189	DICHLOROSILANE	(1),(2),(3),(4),(5)		1	5	0.90	
2534	METHYLCHLOROSILANE	(1),(2),(3),(4),(5)			5		j
3309	LIQUEFIED GAS, TOXIC, FLAMMABLE, CORROSIVE N.O.S.	(1),(2),(3),(4),(5)			5		z
1067	DINITROGEN TETROXIDE (NITROGEN DIOXIDE)	(1),(3),(5)		1.0	5	1.30	e,l
1749	CHLORINE TRIFLUORIDE	(1),(2),(3),(4),(5)		3.0	5	1.40	a
1975	NITRIC OXIDE AND DINITROGEN TETROXIDE MIXTURE (NITRIC OXIDE AND NITROGEN DIOXIDE MIXTURE)	(1),(3),(5)			5		e,j,l
2548	CHLORINE PENTAFLUORIDE	(1),(5)		1.3	5	1.49	a,e,l
2901	BROMINE CHLORIDE	(1),(2),(3),(4),(5)		1.0	5	1.5	a
3310	LIQUEFIED GAS, TOXIC, OXIDIZING, CORROSIVE N.O.S.	(1),(2),(3),(4),(5)			5		z
2073	AMMONIA SOLUTION, relative density less than 0.88 at 15 °C						
	with more than 35% and not more than 40% ammonia	(1),(2),(3),(4),(5)		1.0	5	0.80	
	with more than 40% and not more than 50% ammonia	(1),(2),(3),(4),(5)		1.2	5	0.77	
1001	ACETYLENE , DISSOLVED	(1),(5)		6.0	10		c,h,i
3318	AMMONIA SOLUTION, relative density less than 0.880 at 15 °C in water, with more than 50% ammonia	(1),(2),(3),(5)			5		j

P 201	Packing instruction	P201

Type of packages

Gas samples of class 2

The general packing requirements of 4.1.4.1 when applicable shall be met.

201(a) Gas samples shall be at a pressure corresponding to ambient atmospheric pressure at the time the containment system is closed and this shall not exceed 105 kPa absolute.

201(b) The gases shall be contained in hermetically sealed glass or metal inner packagings with a maximum net quantity per package of 5 litres for flammable gases and 1 litre for toxic gases.

201(c) The outer packagings shall meet the packing group III performance level.

P 202	Packing instruction	P202

Type of packages

Air bag inflators, modules and seat pretensioners

see text as proposed in ST/SG/AC.10/C.3/1998/19)

P 203	Packing instruction	P203

[Type of receptacles

Cryogenic receptacles

The general packing requirements of 4.1.4.1 shall be met.

Particular instructions for closed cryogenic receptacles:

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

203(b) For flammable refrigerated liquefied gases the degree of filling shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the opening pressure of the relief valve, the volume would reach 95% of the capacity at that temperature.

203(c) In the case of receptacles intended for the carriage of oxidising gases, the substances used to ensure the leakproofness of the joints or for the maintenance of the closures shall be compatible with the contents.

203(d) Receptacles shall be subjected to periodic inspections in accordance with the provisions of 6.2.1.5.

203(e) Periodic inspections shall be carried out every 10 years.

By derogation from this paragraph, the periodic inspection of receptacles which make use of composite materials (composite receptacles) shall be carried out at intervals determined by the competent authority which has approved the technical code for the design and construction.

P 203	Packing instruction (cont'd)	P203
Particular instructions for open cryogenic receptacles:		
203(f)	The receptacles shall be so insulated that they cannot become coated with dew or hoarfrost.	
203(g)	Open cryogenic receptacles are not allowed for refrigerated liquefied gases of Division 2.1, carbon dioxide, refrigerated liquid (UN 2187) and its mixtures.	
203(h)	Glass receptacles shall be protected by iron-wire baskets and placed in metal cases. The metal cases for the glass receptacles and the other receptacles shall be fitted with means of handling. Receptacles in glass are not allowed for [...] [?]	
203(i)	The openings of the receptacles shall be fitted with devices allowing gases to escape, preventing any splashing out of the liquid, and so fixed that they cannot fall out.	
203(j)	In the case of refrigerated liquid oxygen (UN 1073) of Division 2.2 and mixtures thereof, the devices referred to above and the absorbent insulating material surrounding the glass receptacles shall be made of non-combustible materials.]	

Proposal 4

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 recognizing that pressure receptacles other than those that are marked with a UN certification marking may be used on a national or regional basis, pressure receptacles conforming to requirements other than those specified in these Model Regulations may be used if approved by the competent authority 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 of high 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;

(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:

- All the mechanical and technological characteristics of the metal used shall be established for each pressure receptacle at the initial inspection; with regard to the impact strength and the bending coefficient;

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

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. This requirement is met by complying with the following standards:

EN ISO 11114-1:1997	Compatibility of cylinder and valve materials with gas contents - Part 1: Metallic materials
prEN ISO/ DIS 11114-2	Compatibility of cylinder and valve materials with gas contents - Part 2: Non-metallic materials

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

6.2.1.3 Service equipment

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

6.2.1.3.2 Service equipment shall be so arranged as to be protected against the risk of 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 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 receptacle.

6.2.1.3.4 [When fitted], safety 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. 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 Cryogenic receptacles, closed, shall be fitted with one or more pressure-relief devices to protect the vessel 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 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 receptacles shall be so designed as to prevent the liquid from splashing out.]

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

6.2.1.3.7 The following standards pertain to closures and their protection:

ISO/AWI 14245	Specification and testing for liquefied petroleum gas (LPG) valves self closing
ISO/AWI 15995	Specifications and testing for manually operated liquefied petroleum gas valves
ISO/FDIS 11117	Gas cylinders - Valve protection caps and valve guards for industrial and medical gas cylinders- design, construction and tests
EN/ISO 13340	Gas cylinder valves –Valves for non-refillable cylinders
ISO/DIS 10297.2	Gas cylinder valves - Specification and type testing. All gases except LPG

6.2.1.4 Requirements for manufacturers

6.2.1.4.1 The manufacturer shall be technically able and shall possess all suitable means 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;

(c) to carry out the relevant tests.

6.2.1.4.2 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. The particular certification process the manufacturer intends to apply shall be taken into consideration.

6.2.1.5 Requirements for testing and certifying bodies

6.2.1.5.1 Testing and certifying bodies shall be independent from manufacturing enterprises and technologically competent to the degree required.

6.2.1.6 Design and construction requirements for multi-modal transport

[6.2.1.6.1 Pressure receptacles designed, constructed, inspected, tested and approved to requirements other than those specified in these Model Regulations shall not be marked with the UN certification marking specified in this Chapter. For international transport, pressure receptacles approved under the provisions of this paragraph shall also be approved by the applicable competent authorities of the countries where the pressure receptacles will be used and transported.

[6.2.1.6.2 The following standards apply for the design and construction of UN marked and certified gas cylinders:]

ISO/DIS 9809-1	Transportable seamless steel gas cylinders - Design, construction and testing - Part 1: Quenched and tempered steel cylinders with tensile strength less than 1100 MPa ***Note**: The design stress factor F shall not be variable.*
ISO/DIS 9809-2	Transportable 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	Transportable seamless steel gas cylinders - Design, construction and testing - Part 3: Normalised steel cylinders
ISO/DIS 7866	Refillable transportable seamless aluminium alloy for world-wide usage - Design, manufactured and acceptance ***Note**: the design stress factor F shall not be variable.* *Aluminium alloy 6351A is not authorised.*
ISO/CD 11119-1	Gas cylinders of composite material - specifications and test methods - Part 1: Hoop wrapped, metallic
ISO/CD 11119-1	Gas cylinders of composite material - specifications and test methods - Part 2: Fully wrapped, metallic
ISO/CD 11119-1	Gas cylinders of composite material - specifications and test methods - Part 3: Fully wrapped, non metallic
ISO/CD 3807-1	Dissolved acetylene cylinders - Basic requirements - Part 1 Cylinders without fusible plugs
ISO/CD 3807-2	Dissolved acetylene cylinders - Basic requirements - Part 2 Cylinders with fusible plugs
ISO/DIS 11118	Non-refillable gas cylinders - Specifications and test methods

[6.2.1.6.3 The following standards apply for the design and construction of UN marked and certified tubes:]

prEN ISO/DIS 11120	Gas cylinders - Refillable seamless steel gas cylinders, capacity between 150*l* and 3000*l* - Design and testing ***Note**: The design stress factor F shall not be variable.*

6.2.1.7 Requirements for pressure receptacles not designed, constructed and tested according to standards

6.2.1.7.1 Pressure receptacles not designed, constructed and tested according to standards listed in the table of 6.2.1.6.2 shall be designed, constructed and tested in accordance with the provisions of a technical code recognised by the competent authority and the requirements of 6.2.1 1 through 6.2.1.5 of this section.

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

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

6.2.1.7.3 [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]

[6.2.1.8 Approval of pressure receptacles

6.2.1.8.1 [The conformity of pressure receptacles shall be assessed to the requirements of the competent authority. Pressure receptacles shall be examined, 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 quality assurance systems shall be deemed to be complied with, if they conform to the requirements of the competent authority.]

6.2.1.9 Initial inspection and tests

6.2.1.9.1 New pressure receptacles shall be subjected to testing and inspection 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 condition of the pressure receptacles;

For all pressure receptacles:

(d) A hydraulic pressure test. Pressure receptacles shall withstand the test pressure without undergoing permanent deformation or exhibiting 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.

6.2.1.9.2 Aluminium alloy shall be checked for intercrystalline corrosion.

6.2.1.10 Periodic inspection

6.2.1.10.1 Refillable pressure receptacles, with the exception of open cryogenic receptacles, shall be subjected to periodic inspections under the supervision of 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);

(c) The 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.*

6.2.1.10.2 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.

6.2.1.10.3 By derogation from paragraph 6.2.1.5.1(c) closed cryogenic pressure receptacles shall be subjected to external inspection and to a leakproofness test. 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.

6.2.1.10.4 The following standards pertain to the periodic inspection and testing of cylinders:

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 10462:1993	Cylinders for dissolved acetylene - Periodic inspection and testing
ISO 10464:1993	Liquefied petroleum gas cylinders - Periodic inspection and testing
PrEN ISO/DIS 11623	Composite gas cylinders - Periodic inspection and testing

6.2.1.11 Marking of receptacles

6.2.1.11.1 Refillable pressure receptacles shall be marked clearly, legibly and permanently, as follows:

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

(b) The receptacles specification (the type specification or the standard used for the design);

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

(d) The mass of the receptacle**;**

(e) The test pressure;

(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) 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 receptacle, the fittings and accessories, the porous material and the solvent;

(i) The water capacity in litres;

(j) The working pressure in the case of compressed gases;

(k) The letter "H" showing 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 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.

6.2.1.11.2 In addition to the markings specified in section 6.2.1.6.1, each refillable pressure receptacle shall be marked indicating the date (year and month) of the last periodic inspection and the registered mark of the test body authorized by the competent authority of the country of use.

6.2.1.11.3 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.

6.2.1.11.4 Non-refillable pressure receptacles shall be marked clearly, legibly, and durably, as follows:

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

(b) The pressure receptacles specification (the type specification or the standard used for the design);

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

(d) The test pressure;

(e) The date (year and month) of manufacturing;

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

(g) 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.

6.2.1.11.5 [Pressure receptacles designed, manufactured and tested according 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.]

Proposal 5

Proposed text for Part 5

5.2.2.2.1.2 Gas cylinders for Class 2 may, on account of their shape, orientation and securing mechanisms for transport, bear labels representative of those specified in this section, which have been reduced in size **according to ISO 7225**, for display on the non-cylindrical part (shoulder) of such cylinders.

For gas cylinders with an outside diameter lower or equal to 75mm, the cylindrical part may also be used.

Proposal 6

Proposed texts for MEGC's in Part 4

The existing 4.2.4 should be renumbered as 4.2.5 and replaced by the following text.

4.2.4 General provisions for the use of multiple-element gas containers (MEGCs)

4.2.4.1 This section provides general requirements applicable to the use of multiple-element gas containers (MEGCs) for the transport of non-refrigerated gases.

4.2.4.2 MEGCs shall conform to the design, construction, inspection and testing requirements detailed in 6.7.5. The elements of MEGC's shall be periodically inspected according to the provisions set out in P200 and in 6.2.

4.2.4.3 During transport, MEGCs shall be adequately protected against damage to the elements and service equipment resulting from lateral and longitudinal impact and overturning. If the elements and service equipment are so constructed as to withstand impact or overturning they need not be protected in this way. Examples of such protection are given in **6.7.5.10.4**.

4.2.4.4 Toxic gases and gas mixtures with an $LC_{50} \leq 200$ ppm shall not be authorised for transport in MEGCs.

4.2.4.5 Empty MEGCs not cleaned and not gas-free shall comply with the same requirements as MEGCs filled with the previous gas.

4.2.4.6 MEGC's shall not be charged or filled after they become due for periodic inspection. MEGC's may be transported after the expiry of the time limit set for the periodic inspection prescribed.

4.2.5 Filling

4.2.5.1 Prior to filling the shipper shall ensure that the MEGC is authorized for the gas to be transported.

4.2.5.2 Elements of MEGC's shall be filled according to the filling ratios determined in packing instruction P200.

4.2.5.3 MEGC's shall not be filled above their maximum permissible gross mass.

4.2.5.4 The isolation valves shall be closed after filling and remain closed during transport. Toxic gases of division 2.3 shall only be transported in multiple-element gas containers where each element is equipped with an isolation valve.

4.2.5.5 The opening(s) for filling shall be closed by caps or plugs. The leakproofness of the closures and equipment shall be verified by the consignor after filling.

4.2.5.6 MEGCs shall not be offered for transport or filling:

(a) when leaking;
(b) when damaged to such an extent that the integrity of the elements, 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;
(d) unless the markings necessary for filling are legible or;
(e) unless for the purpose of repair in accordance with these regulations.

Proposal 7

Proposed texts for MEGC's in Part 6

6.7.5 Requirements for the design, construction, inspection and testing of multiple-element gas containers (MEGC's) intended for the transport of non-refrigerated gases

6.7.5.1 ***Definitions***

For the purposes of this section:

*Element*s are restricted to cylinders, tubes or bundle of cylinders;

Manifold means an assembly of piping and valves connecting the filling/discharge openings of the elements;

Service equipment means measuring instruments and filling, discharge, venting and safety devices;

Structural equipment means the reinforcing, fastening, protective and stabilizing members external to the elements;

Leakproofness test means a test using gas subjecting the elements and its service equipment to an effective internal pressure of not less than 20% of the test pressure;

Maximum permissible gross mass (MPGM) means the sum of the tare mass of the multiple-element gas container and the heaviest load authorized for transport.

6.7.5.2 ***General design and construction requirements***

6.7.5.2.1 The multiple-element gas container shall be capable of being loaded and discharged without the removal of its structural equipment. It shall possess stabilizing members external to the elements, and shall be capable of being lifted also when full. It shall be designed primarily to be loaded onto a transport vehicle or ship and shall be equipped with skids, mountings or accessories to facilitate mechanical handling.

6.7.5.2.2 MEGC's shall be designed, manufactured, tested and equipped in such a way as to withstand all conditions to which they will subjected during their normal use and during normal transport conditions. The design shall take into account the effects of dynamic loading and fatigue.

6.7.5.2.3 Elements of a MEGC shall be made of seamless steel and be constructed according to section 6.2. Elements shall be of the same design type.

6.7.5.2.4 Elements of MEGC's, fittings and pipework shall be constructed of materials which are:

(a) substantially immune to attack by the gas(es) intended to be transported(see ISO 11114); or

(b) properly passivated or neutralized by chemical reaction.

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

6.7.5.2.6 The materials of the MEGC, including any devices, gaskets, and accessories, shall not adversely affect the gases intended for transport in the MEGC.

6.7.5.2.7 MEGC's shall be designed and constructed with supports to provide a secure base during transport and with suitable lifting and tie-down attachments.

6.7.5.2.8 MEGC's shall be designed to withstand, without loss of contents, at least the internal pressure due to the contents, and the static, dynamic and thermal loads during normal conditions of handling and transport. The design shall demonstrate that the effects of fatigue, caused by repeated application of these loads through the expected life of the multiple-element gas container, have been taken into account.

6.7.5.2.9 MEGC's and their fastenings shall, under the maximum permissible load, be capable of absorbing the following separately applied static forces:

(a) in the direction of travel: twice the MPGM multiplied by the acceleration due to gravity (g) */;

(b) horizontally at right angles to the direction of travel: the MPGM (when the direction of travel is not clearly determined, the forces shall be equal to twice the MPGM) multiplied by the acceleration due to gravity (g) */;

(c) vertically upwards: the MPGM multiplied by the acceleration due to gravity (g) */; and

(d) vertically downwards: twice the MPGM (total loading including the effect of gravity) multiplied by the acceleration due to gravity (g) */.

6.7.5.2.10 Under the stresses defined above, the stress at the most severely stressed point of the elements shall not exceed the values given in the relevant standards of section 6.2.1.6 or if or, if the elements are not designed, constructed and tested according to those standards, in section 6.2.1.7.

6.7.5.2.11 Under each of the forces in 6.7.5.2.9, the safety factor for the framework and fastenings to be observed shall be as follows:

(a) for steels having a clearly defined yield point, a safety factor of 1.5 in relation to the guaranteed yield strength; or

(b) for steels with no clearly defined yield point, a safety factor of 1.5 in relation to the guaranteed 0.2% proof strength and, for austenitic steels, the 1% proof strength.

6.7.5.2.12 MEGC's intended for the transport of flammable gases shall be capable of being electrically earthed.

6.7.5.2.13 The elements shall be secured in a manner that prevents undesired movement in relation to the structure and the concentration of local stresses.

6.7.5.3 ***Service equipment***

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*/ *For calculation purposes* $g = 9{,}81\ m/s^2$.

6.7.5.3.1 Service equipment shall be so arranged as to be protected against the risk of being wrenched off or damaged during handling and transport. When the connection between the frame and the elements allows relative movement between the sub-assemblies, the equipment shall be so fastened as to permit such movement without risk of damage to working parts. The manifolds, the discharge fittings (pipe sockets, shut-off devices), the stop-valves shall be protected against the danger of being wrenched off by external forces. Manifold piping leading to shut-off valves shall be sufficiently flexible to protect the valves and the piping from shearing. The filling and discharge devices (including flanges or threaded plugs) and any protective caps shall be capable of being secured against unintended opening.

6.7.5.3.2 Each element intended for the transport of toxic gases division 2.3 shall be fitted with a valve. The manifold for liquefied toxic gases division 2.3 shall be so designed that the elements can be filled separately and be kept isolated by a valve capable of being sealed. For the transport of flammable gases of division 2.1, the elements shall be isolated by a valve into assemblies of not more than 3000 litres.

6.7.5.3.3 For filling and discharge openings of the MEGC two valves in series shall be placed in an accessible position on each discharge and filling pipe. One of the valves may be a non-return valve. The filling and discharge devices may be fitted to a manifold. For sections of piping which can be closed at both ends and where liquid product can be trapped a pressure-relief valve shall be provided to prevent excessive pressure build-up.

6.7.5.3.4 The main isolation valves on a multiple-element gas container shall be clearly marked to indicate its direction of closure.

6.7.5.3.5 Each stop-valve or other means of closure shall be designed and constructed to withstand a pressure equal to or greater than 1.5 times the test pressure of the MEGC. All stop-valves with screwed spindles shall close by a clockwise motion of the handwheel. For other stop-valves the position (open or closed) and direction of closure shall be clearly indicated. All stop-valves shall be designed and positioned to prevent unintentional opening.

6.7.5.3.6 Piping shall be designed, constructed and installed so as to avoid the risk of damage due to expansion and contraction, mechanical shock and vibration. The relevant provisions of [prENWI70] shall be met.

6.7.5.3.7 Joints in tubing shall be brazed or have an equally strong metal union. The melting point of brazing materials shall be no lower than 525 °C.

6.7.5.3.8 The rated pressure of the service equipment and of the manifold shall be not less than two thirds of the test pressure of the elements.

Ductile metals shall be used in the construction of valves or accessories.

6.7.5.4 ***Pressure-relief devices***

6.7.5.4.1 MEGCs used for the transport of of non-flammable, non-toxic, high-pressure liquefied gases may be provided with one or more pressure-relief devices. Every element or group of elements of a multiple-element gas container that can be isolated shall then be fitted with one or more pressure relief-devices. The pressure-relief devices shall open automatically at a pressure between 100 and 120 percent of the test pressure. The pressure-relief devices shall be of a type that will resist dynamic forces including liquid surge (see for example CGA S-1.1-1994).

6.7.5.4.2 Pressure-relief devices, when fitted, shall be designed to prevent the entry of foreign matter, the leakage of gas and the development of any dangerous excess pressure.

6.7.5.4.3 MEGC's used for the transport of certain non-refrigerated gases identified in instructions T50 in 4.2.5.2.8 {shall/may} have a pressure-relief device approved by the competent authority. Unless a multiple-element gas container in dedicated service is fitted with an approved relief device constructed of materials compatible with the load, such device (shall) comprise a frangible disc preceding a spring-loaded device. The space between the frangible disc and the device may be provided with a pressure gauge or a suitable telltale indicator. This arrangement permits the detection of disc rupture, pinholing or leakage which could cause a malfunction of the pressure-relief device. The frangible discs shall rupture at a nominal pressure 10% above the start-to-discharge pressure of the spring-loaded relief device.

6.7.5.4.4 In the case of multi-purpose MEGCs used for the transport of low-pressure liquefied gases, the pressure-relief devices shall open at a pressure indicated in 6.7.3.7.1 for the gas having the highest maximum allowable pressure of the gases allowed to be transported in the MEGC.

6.7.5.5 ***Capacity of relief devices*** *(sub-section to be reviewed by CGA before next meeting)*

6.7.5.5.1 The combined delivery capacity of the relief devices when fitted shall be sufficient that, in the event of total fire engulfment, the pressure (including accumulation) inside the elements intended for the transport of gases does not exceed 120% of the set pressure of the relief device. Spring-loaded relief devices may be used to achieve the full relief capacity prescribed in the case of low pressure liquefied gases. In the case of multi-purpose elements, the combined delivery capacity of the pressure-relief devices shall be taken for the gas which requires the highest delivery capacity of the gases allowed to be transported in MEGCs.

6.7.5.5.2 To determine the total required capacity of the relief devices installed on the elements for the transport of low pressure liquefied gases, the thermodynamic properties of the gas have to be considered (see for example CGA S-1.2-1995).

6.7.5.5.3 To determine the total required capacity of the relief devices installed on the elements for the transport of high pressure liquefied gases, the thermodynamic properties of the gas have to be considered (see for example CGA S-1.1-1994).

6.7.5.6 ***Marking of pressure-relief devices*** *(sub-section to be reviewed by CGA before next meeting)*

6.7.5.6.1 Spring loaded pressure-relief devices [shall be plainly and permanently marked with the following:

(a) the pressure (in bar or kPa) at which it is set to discharge;

(b) the allowable tolerance at the discharge pressure;

(c) the rated flow capacity of the device in standard cubic meters of air per second (m^3/s);

When practicable, the following information shall also be shown:

(d) the manufacturer's name and relevant catalogue number.

6.7.5.6.2 The rated flow capacity marked on the frangible disk shall be determined according to CGA S-1.1-1994.

6.7.5.6.3 The rated flow capacity marked on the pressure-relief devices for low pressure liquefied gases shall be determined according to ISO 4126-1:1996.

6.7.5.7 ***Connections to pressure-relief devices*** *(sub-section to be reviewed by CGA before next meeting)*

6.7.5.7.1 Connections to pressure-relief devices shall be of sufficient size to enable the required discharge to pass unrestricted to the safety device. No stop-valve shall be installed between the element and the pressure-relief devices except when duplicate devices are provided for maintenance or other reasons and the stop-valves serving the devices actually in use are locked open or the stop-valves are interlocked so that at least one of the duplicate devices is always operable and capable of meeting the requirements of 6.6.5.6. There shall be no obstruction in an opening leading to a vent or pressure-relief device which might restrict or cut-off the flow from the element to that device. Vents from the pressure-relief devices, when used, shall deliver the relieved vapour or liquid to the atmosphere in conditions of minimum backpressure on the relieving device.

6.7.5.8 ***Siting of pressure-relief devices*** *(sub-section to be reviewed by CGA before next meeting)*

6.7.5.8.1 All pressure-relief devices shall under maximum filling conditions be situated in the vapour space of the elements for the transport of liquefied gases.
The devices when fitted shall be so arranged as to ensure that the escaping vapour is discharged upwards and unrestrictedly. For flammable and oxidising gases, the escaping gas shall be directed away from the element in such a manner that it cannot impinge upon the other elements. Protective devices which deflect the flow of gas are permissible provided the required relief-device capacity is not reduced.

6.7.5.8.2 Arrangements shall be made to prevent access to the pressure-relief devices by unauthorized persons and to protect the devices from damage caused by the MEGC overturning.

6.7.5.9 ***Gauging devices***

6.7.5.9.1 When a MEGC is intended to be filled by mass/weight it shall be equipped with one or more gauging devices. Level-gauges made of glass or other fragile material shall not be used.

6.7.5.10 ***MEGC supports, frameworks, lifting and tie-down attachments***

6.7.5.10.1 MEGCs shall be designed and fabricated with a support structure to provide a secure base during transport. The forces specified in 6.7.5.2.8 and the safety factor specified in 6.7.5.2.9 shall be considered in this aspect of the design. Skids, frameworks, cradles or other similar structures are acceptable.
6.7.5.10.2 The combined stresses caused by element mountings (e.g. cradles, frameworks, etc.) and MEGC lifting and tie-down attachments shall not cause excessive stress in any element. Permanent lifting and tie-down attachments shall be fitted to all MEGCs. In no case shall mountings or attachments be welded onto the elements.

6.7.5.10.3 In the design of supports and frameworks the effects of environmental corrosion shall be taken into account.

6.7.5.10.4 When MEGCs are not protected during transport, according to 4.2.4.3, the elements and service equipment shall be protected against damage resulting from lateral or longitudinal impact or overturning. External fittings shall be protected so as to preclude the release of the elements contents upon

impact or overturning of the MEGC on its fittings. Particular attention shall be paid to the protection of the manifold. Examples of protection include:

(a) protection against lateral impact which may consist of longitudinal bars;

(b) protection against overturning which may consist of reinforcement rings or bars fixed across the frame;

(c) protection against rear impact which may consist of a bumper or frame;

(d) protection of the elements and service equipment against damage from impact or overturning by use of an ISO frame in accordance with the relevant provisions of ISO 1496-3:1995.

6.7.5.11 ***Design approval***

6.7.5.11.1 The competent authority or its authorized body shall issue a design approval certificate for any new design of a MEGC. This certificate shall attest that the MEGC has been surveyed by that authority, is suitable for its intended purpose and meets the requirements of this Chapter and when appropriate the provisions for gases provided in instructions P200. When a series of MEGC's are manufactured without change in the design, the certificate shall be valid for the entire series. The certificate shall refer to the prototype test report, the materials of construction of the manifold, the standards to which the elements are made and an approval number. The approval number shall consist of the distinguishing sign or mark of the State in whose territory the approval was granted, i.e. the distinguishing sign for use in international traffic, as prescribed by the Convention on Road Traffic, Vienna 1968, and a registration number. Any alternative arrangements according to 6.6.1.2 shall be indicated on the certificate. A design approval may serve for the approval of smaller MEGC's made of materials of the same kind and thickness, by the same fabrication techniques and with identical supports, equivalent closures and other appurtenances.

6.7.5.11.2 The prototype test report for the design approval shall include at least the following:

(a) the results of the applicable framework test specified in ISO 1496-3:1995;

(b) the results of the initial inspection and test in 6.7.5.12.3;

(c) the results of the impact test in 6.7.5.12.1; and

(d) certification documents verifying that cylinders and tubes comply with the applicable standards.

6.7.5.12 ***Inspection and testing***

6.7.5.12.1 For MEGCs meeting the definition of container in the CSC, a prototype representing each design shall be subjected to an impact test. The prototype MEGC shall be shown to be capable of absorbing the forces resulting from an impact not less than 4 times (4 g) the MPGM of the fully loaded MEGC at a duration typical of the mechanical shocks experienced in rail transport. The following is a listing of standards describing methods acceptable for performing the impact test:

Association of American Railroads,
Manual of Standards and Recommended Practices,
Specifications for Acceptability of Tank Containers (AAR.600), 1992

Canadian Standards Association (CSA),
Highway Tanks and Portable Tanks for the Transportation of Dangerous Goods
(B620-1987)

Deutsche Bahn AG
Zentralbereich Technik, Minden
Transportable tanks, longitudinal dynamic impact test

Société Nationale des Chemins de Fer Français
C.N.E.S.T. 002-1966.
Tank containers, longitudinal external stresses and dynamic impact tests

Spoornet, South Africa
Engineering Development Centre (EDC)
Testing of ISO Tank Containers
Method EDC/TES/023/000/1991-06

6.7.5.12.2 The elements and items of equipment of each MEGC shall be inspected and tested before being put into service for the first time (initial inspection and test). Thereafter MEGC shall be inspected at no more than five-year intervals An exceptional inspection and test shall be performed regardless of the last periodic inspection and test when necessary according to 6.7.5.12.5.

6.7.5.12.3 The initial inspection and test of a MEGC shall include a check of the design characteristics, an external examination of the MEGC and its fittings with due regard to the gases to be transported, and a pressure test referring to the test pressures according to P 200. The pressure test of the manifold may be performed as a hydraulic test or by using another liquid or gas with the agreement of the competent authority or its authorized body. Before the MEGC is placed into service, a leakproofness test and a test of the satisfactory operation of all service equipment shall also be performed. When the elements and their fittings have been pressure-tested separately, they shall be subjected together after assembly to a leakproofness test.

6.7.5.12.4 The 5 year periodic inspection shall include an external examination of the structure, the elements and the service equipment in accordance with 6.7.5.12.6. The elements and the piping shall be tested at the periodicity defined in P200 and in accordance with the provisions described in 6.2.1.5. When the elements and equipment have been pressure-tested separately, they shall be subjected together after assembly to a leakproofness test.

6.7.5.12.5 An exceptional inspection and test is necessary when the MEGC shows evidence of damaged or corroded areas, or leakage, or other conditions that indicate a deficiency that could affect the integrity of the MEGC. The extent of the exceptional inspection and test shall depend on the amount of damage or deterioration of the MEGC. It shall include at least the inspection required under 6.7.5.12.6

6.7.5.12.6 The examinations shall ensure that:

(a) the elements are inspected externally for pitting, corrosion, or abrasions, dents, distortions, defects in welds or any other conditions, including leakage, that might render the MEGC unsafe for transport;

(b) the piping, valves, and gaskets are inspected for corroded areas, defects, and other conditions, including leakage, that might render the MEGC unsafe for filling, discharge or transport;

(c) missing or loose bolts or nuts on any flanged connection or blank flange are replaced or tightened;

(d) all emergency devices and valves are free from corrosion, distortion and any damage or defect that could prevent their normal operation. Remote closure devices and self-closing stop-valves shall be operated to demonstrate proper operation;

(e) required markings on the MEGC are legible and in accordance with the applicable requirements; and

(f) the framework, the supports and the arrangements for lifting the MEGC are in satisfactory condition.

6.7.5.12.7 The inspections and tests in 6.7.5.12.1, 6.7.5.12.3, 6.7.5.12.4 and 6.7.5.12.5 shall be performed or witnessed by a body authorized by the competent authority. When the pressure test is a part of the inspection and test, the test pressure shall be the one indicated on the data plate of the MEGC. While under pressure, the MEGC shall be inspected for any leaks in the elements, piping or equipment.

6.7.5.12.8 When evidence of any unsafe condition is discovered, the MEGC shall not be returned to service until it has been corrected and the applicable tests and verifications are passed.

6.7.5.13 ***Marking***

6.7.5.13.1 Every MEGC shall be fitted with a corrosion resistant metal plate permanently attached to the MEGC in a conspicuous place readily accessible for inspection. The elements shall be marked in accordance with 6.2. As a minimum at least the following information shall be marked on the plate by stamping or by any other similar method.

Country of manufacture

U Approval

N Country Number "AA"

Manufacturer's name or mark

Manufacturer's serial number

Authorized body for the design approval

Year of manufacture: year and month

Test pressure: _____bar/kPa gauge */

Design temperature range_____ °C to _____°C

Number of elements_____

Total water capacity _____litres

Initial pressure test date and [witness] identification

Date and type of most recent periodic tests

Year_____ Month_____

Stamp of expert who performed or witnessed the most recent test]

NOTE*: No metal plate may be fixed to the elements.*

[6.6.5.13.2 The following information shall be marked on a metal plate firmly secured to the MEGC:

Name of the operator

Maximum permissible load mass _____kg

Working pressure at 15°C: _____bar gauge

Maximum permissible gross mass (MPGM)_____kg

Unladen (tare) mass _____kg

*/ *The unit used shall be marked.*