No. 8940. EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR). DONE AT GENEVA, ON 30 SEPTEMBER 1957[1]

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ENTRY INTO FORCE of amendments to annexes A and B of the above-mentioned Agreement

The amendments were proposed by the Government of the United Kingdom of Great Britain and Northern Ireland and circulated by the Secretary-General on 4 May 1987. They came into force on 1 January 1988 in accordance with the provisions of article 14 (3) of the Agreement.

Amendments to annexes A and B of ADR, as amended[2]

Appendix B.1 *a*,

Appendix B.1 *b*,

Appendix B.1 *d*,

Amendments to cover the transport of wastes,

Miscellaneous amendments to Annexes A and B.

## APPENDIX B.1 *a*

### PROVISIONS CONCERNING FIXED TANKS (TANK-VEHICLES), DEMOUNTABLE TANKS AND BATTERIES OF RECEPTACLES

NOTE. Part I sets out the requirements applicable to fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles intended for the carriage of substances of any Class. Part II contains special requirements supplementing or modifying the requirements of Part I.

### PART I. REQUIREMENTS APPLICABLE TO ALL CLASSES

211 000-
211 099

*Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

NOTE. In accordance with the provisions of marginal 10 121 (1), the carriage of dangerous substances in fixed or demountable tanks or batteries of receptacles is permitted only where this mode of carriage is expressly authorized for such substances in each Section 1 of Part II of this Appendix.

211 100 These requirements shall apply to fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles used for the carriage of liquid, gaseous, powdery or granular substances.

211 101 (1) In addition to the vehicle proper, or the units of running gear used in its stead, a tank-vehicle comprises one or more shells, their items of equipment and the fittings for attaching them to the vehicle or to the running-gear units.

(2) When attached to the carrier vehicle, the demountable tank or battery of receptacles shall meet the requirements prescribed for tank-vehicles.

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[1] United Nations, *Treaty Series*, vol. 619, p. 77; for subsequent actions, see references in Cumulative Indexes Nos. 9 and 11 to 15, as well as annex A in volumes 951, 966, 973, 982, 987, 995, 1003, 1023, 1035, 1074, 1107, 1129, 1141, 1161, 1162, 1237, 1259, 1279, 1283, 1297, 1344, 1394, 1395 and 1430.

[2] *Ibid.*, vol. 731, p. 3, and annex A in volumes 774, 828, 883, 907, 921, 922, 926, 951, 982, 987, 1003, 1023, 1035, 1074, 1107, 1161, 1162, 1259, 1279, 1283, 1297, 1344 and 1395.

211 102 In the following requirements:

(1) (*a*) "Shell" means the tank proper (including the openings and their closures);

(*b*) "Service equipment of the shell" means the filling, discharge, venting, safety, heating and heat-insulating devices and the measuring instruments;

(*c*) "Structural equipment" means the internal or external reinforcing, fastening, protective or stabilizing members of the shell.

(2) (*a*) "Calculation pressure" means a theoretical pressure at least equal to the test pressure which, according to the degree of danger exhibited by the substance being carried, may to a greater or lesser degree exceed the working pressure. It is used solely to determine the thickness of the walls of the shell, independently of any external or internal reinforcing device;

(*b*) "Test pressure" means the highest effective pressure which arises in the shell during the pressure test;

(*c*) "Filling pressure" means the maximum pressure actually built up in the shell when it is being filled under pressure;

(*d*) "Discharge pressure" means the maximum pressure actually built up in the shell when it is being discharged under pressure;

(*e*) "Maximum working pressure (gauge pressure)" means the highest of the following three pressures:

(i) The highest effective pressure allowed in the shell during filling ("maximum filling pressure allowed");

(ii) The highest effective pressure allowed in the shell during discharge ("maximum discharge pressure allowed"); and

(iii) The effective gauge pressure to which the shell is subjected by its contents (including such extraneous gases as it may contain) at the maximum working temperature.

Unless the special requirements for each Class provide otherwise, the numerical value of this working pressure (gauge pressure) shall not be lower than the vapour pressure (absolute pressure) of the filling substance at 50°C.

For shells equipped with safety valves (with or without bursting disc), the maximum working pressure (gauge pressure) shall however be equal to the prescribed opening pressure of such safety valves.

(3) "Leakproofness test" means a test which consists in subjecting the shell to an effective internal pressure equal to the maximum working pressure, but not less than 20 kPa (0.2 bar) gauge pressure, using a method approved by the competent authority.

For shells equipped with venting systems and a safety device to prevent the contents spilling out if the shell overturns, the pressure for the leakproofness test shall be equal to the static pressure of the filling substance.

211 103-
211 119

*Section 2.* CONSTRUCTION

211 120 Shells shall be designed and constructed in accordance with the provisions of a technical code recognized by the competent authority, but the following minimum requirements shall be met:

(1) Shells shall be made of suitable metallic materials which, unless other temperature ranges are prescribed in the various Classes, shall be resistant to brittle fracture and to stress corrosion cracking between −20°C and +50°C.

(2) For welded shells only materials of faultless weldability and whose adequate impact strength at an ambient temperature of −20°C can be guaranteed, particularly in the welds and the zones adjacent thereto, shall be used.

(3) Welds shall be skilfully made and shall afford the fullest safety. For the execution and checking of weld beads, see also 211 127 (7). Shells whose minimum wall thicknesses have been determined in accordance with 211 127 (2) to (5) shall be checked by the methods described in the definition of the weld coefficient 0.8.

(4) The materials of shells, or of their protective linings in contact with the contents, shall not contain substances liable to react dangerously with the contents, to form dangerous compounds, or substantially to weaken the material.

(5) The protective lining shall be so designed that its leakproofness remains intact whatever the deformation liable to occur in normal conditions of carriage [211 127 (1)].

(6) If contact between the substance carried and the material used for the construction of the shell entails a progressive decrease in the thickness of the walls, this thickness shall be increased at manufacture by an appropriate amount. This additional thickness to allow for corrosion shall not be taken into consideration in calculating the thickness of the shell walls.

211 121 (1) Shells, their attachments and their service and structural equipment shall be designed to withstand without loss of contents (other than quantities of gas escaping through any degassing vents):

— Static and dynamic stresses in normal conditions of carriage;

— Prescribed minimum stresses as defined in 211 125 and 211 127.

(2) In the case of vehicles in which the shell constitutes a stressed self-supporting member, the shell shall be designed to withstand the stresses thus imposed in addition to stresses from other sources.

211 122 The pressure on which the wall thickness of the shell is based shall not be less than the calculation pressure, but the stresses referred to in 211 121 shall also be taken into account.

211 123 Unless specially prescribed otherwise in the various Classes, the following particulars shall be taken into account in the design of shells:

(1) Gravity-discharge shells intended for the carriage of substances having a vapour pressure not exceeding 110 kPa (1.1 bar) (absolute pressure) at 50°C shall be designed for a calculation pressure of twice the static pressure of the substance to be carried but not less than twice the static pressure of water.

(2) Pressure-filled or pressure-discharge shells intended for the carriage of substances having a vapour pressure not exceeding 110 kPa (1.1 bar) (absolute pressure) at 50°C shall be designed for a calculation pressure equal to 1.3 times the filling or discharge pressure.

(3) Shells intended for the carriage of substances having a vapour pressure of more than 110 kPa (1.1. bar) but not more than 175 kPa (1.75 bar) (absolute pressure) at 50°C shall, whatever their filling or discharge system,

be designed for a calculation pressure of not less than 0.15 MPa (1.5 bar) gauge pressure or 1.3 times the filling or discharge pressure, whichever is the higher.

(4) Shells intended for the carriage of substances having a vapour pressure of more than 175 kPa (1.75 bar) (absolute pressure) at 50°C shall, whatever their filling or discharge system, be designed for a calculation pressure equal to 1.3 times the filling or discharge pressure but not less than 0.4 MPa (4 bar) gauge pressure.

211 124 Tanks intended to contain certain dangerous substances shall be provided with special protection. This may take the form of additional thickness of the shell (such additional thickness being determined in the light of the dangers inherent in the substance concerned: see the relevant classes) or of a protective device.

211 125 At the test pressure, the stress $\sigma$ (sigma) at the most severely stressed point of the shell shall not exceed the material-dependent limits prescribed below. Allowance shall be made for any weakening due to the welds. In addition, in choosing the material and determining wall thickness, the maximum and minimum filling and working temperatures should be taken into account.

(1) For metals and alloys exhibiting a clearly-defined yield point or characterized by a guaranteed conventional yield stress (Re) (generally 0.2% of residual elongation and, in the case of austenitic steels, 1% of maximum elongation):

(*a*) Where the ratio Re/Rm is not more than 0.66:

(Re = apparent yield stress, or 0.2% proof stress or 1% proof stress in the case of austenitic steels;

Rm = guaranteed minimum tensile strength):

$$\sigma \leq 0.75 \text{ Re}$$

(*b*) Where the ratio Re/Rm exceeds 0.66:

$$\sigma \leq 0.5 \text{ Rm}$$

(*c*) Ratios of Re/Rm exceeding 0.85 are not allowed for steels used in the construction of welded tanks.

(2) For metals and alloys exhibiting no clearly-defined apparent yield stress and characterized by a guaranteed minimum tensile strength Rm:

$$\sigma \leq 0.43 \text{ Rm}$$

(3) For steel, the elongation at fracture in per cent shall be not less than

$$\frac{10{,}000}{\text{determined tensile strength in N/mm}^2}$$

but in any case it shall be not less than 16% for fine-grained steels and not less than 20% for other steels. For aluminium alloys the elongation at fracture shall be not less than 12%.[1]

211 126 Tanks intended for the carriage of liquids having a flash-point of or below 55°C and for the carriage of inflammable gases shall be connected to all parts of the vehicle by equipotential connexion and shall be capable of being electrically earthed. Any metal contact capable of causing electrochemical corrosion shall be avoided.

[1] 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 ($l = 5d$) shall be measured on test-pieces of circular cross-section in which the gauge length $l$ is equal to five times the diameter $d$; 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.

211 127 Shells and their fastenings shall withstand the stresses specified in (1) below, and the wall thicknesses of shells shall be at least as determined in accordance with (2) to (5).

(1) The shells and their fastenings shall be capable of absorbing, under the maximum permissible load, the forces exerted by:

— In the direction of travel: twice the total mass;

— At right angles to the direction of travel: the total mass;

— Vertically upwards: the total mass;

— Vertically downwards: twice the total mass.

Under the stresses defined above, the stress at the most severely stressed point of the shell and its fastenings shall not exceed the value defined in 211 125.

(2) The thickness of the cylindrical wall of the shell and of the ends and cover plates shall be at least equal to that obtained by the following formulae:

$$e = \frac{P_{MPa} \times D}{2 \times \sigma \times \lambda} \text{ (in mm)} \quad e = \frac{P_{bar} \times D}{20 \times \sigma \times \lambda} \text{ (in mm)}$$

where $P_{MPa}$ = calculation pressure in MPa;

$P_{bar}$ = calculation pressure in bar;

$D$ = internal diameter of shell in mm;

$\sigma$ = permissible stress, as defined in marginal 211 125 (1) and (2), in N/mm²; and

$\lambda$ = a coefficient, not exceeding 1, allowing for any weakening due to welds.

The thickness shall in no case be less than that defined in paragraphs (3) to (5) below.

(3) The walls, ends and cover plates of shells of circular cross-section not more than 1.80 m in diameter,[2] other than those referred to in paragraph (5), shall not be less than 5 mm thick if of mild steel,[3] or of equivalent thickness if of another metal. If the diameter exceeds 1.80 m,[2] this thickness shall be increased to 6 mm if the shell is of mild steel, [3] or to an equivalent thickness if the shell is of another metal. "Equivalent thickness" means the thickness obtained by the following formula:

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{Rm_1 \times A_1}}$$ [4]

[2] For shells not of circular cross-section, for example box-shaped or elliptical shells, the indicated diameters shall correspond to those calculated on the basis of a circular cross-section of the same area. For such shapes of cross-section the radius of convexity of the shell wall shall not exceed 2,000 mm at the sides or 3,000 mm at the top and bottom.

[3] "Mild steel" means a steel having a minimum breaking strength between 360 and 440 N/mm².

[4] This formula is derived from the general formula

$$e_1 = e_0 \sqrt[3]{\frac{Rm_0 \times A_0}{Rm_1 \times A_1}}$$

where $Rm_0$ = 360;

$A_0$ = 27 for the mild steel of reference;

$Rm_1$ = minimum tensile strength of the metal chosen, in N/mm²; and

$A_1$ = minimum elongation of the metal chosen on fracture under tensile stress, in per cent.

(4) Where protection of the shell against damage through lateral impact or overturning is provided, the competent authority may allow the aforesaid minimum thicknesses to be reduced in proportion to the protection provided; however, the said thicknesses shall not be less than 3 mm in the case of mild steel,[3] or than an equivalent thickness in the case of other materials, for shells not more than 1.80 m in diameter.[2] For shells with a diameter exceeding 1.80 m[2] the aforesaid minimum thickness shall be increased to 4 mm in the case of mild steel[3] and to an equivalent thickness in the case of other metal. "Equivalent thickness" means the thickness obtained by the following formula:

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{Rm_1 \times A_1}}$$ [4]

NOTE. The following measures or equivalent measures may be adopted to protect the shell against damage:

(*a*) The shell may be provided on both sides, at a height situated between its centreline and its lower half, with protection against lateral impact consisting of a rolled metal girder extending at least 25 mm beyond the extreme outer edge of the shell. This girder shall be of such cross-section that if it is of mild steel[3] or a stronger material it has a section modulus of at least 5 $cm^3$, the force being directed horizontally and at right angles to the direction of travel. If weaker materials are used, the section modulus shall be increased proportionately to the limits of elongation. Protection against overturning may take the form of strengthening rings, protective canopies, or transverse or longitudinal members so shaped that in the event of overturning no damage is caused to the fittings and accessories mounted on the upper part of the shell.

(*b*) There is also protection:

1. Where shells are made with double walls, the space between the latter being evacuated of air. The aggregate thickness of the outer metal wall and the shell wall shall correspond to the wall thickness prescribed in paragraph (3), and the thickness of the wall of the shell itself shall not be less than the minimum thickness prescribed in paragraph (4);

2. Where the shells are made with double walls with an intermediate layer of solid materials at least 50 mm thick, the outer wall having a thickness of at least 0.5 mm if it is made of mild steel[3] and at least 2 mm if it is made of a plastics material reinforced with glass fibre. Solid foam (with an impact-absorption capacity like that, for example, of polyurethane foam) may be used as the intermediate layer of solid material.

(*c*) For the rear protection of vehicles carrying fixed or demountable tanks or batteries of receptacles, see marginal 10 220.

(5) The thickness of tank shells designed in accordance with marginal 211 123 (1) which either are of not more than 5,000 litres capacity or are divided into leak-proof compartments of not more than 5,000 litres unit capacity may be adjusted to a level which, unless prescribed otherwise in the various Classes, shall however not be less than the appropriate value shown in the following table:

| *Maximum radius of curvature of shell (m)* | *Capacity of shell or shell compartment ($m^3$)* | *Minimum thickness (mm)* |
|---|---|---|
| | | *Mild steel* |
| ≤ 2 | ≤ 5.0 | 3 |
| 2-3 | ≤ 3.5 | 3 |
| | > 3.5 but ≤ 5.0 | 4 |

Where a metal other than mild steel is used, the thickness shall be determined by the equivalence formula given in paragraph (3). The thickness of the partitions and surge-plates shall in no case be less than that of the shell.

(6) Surge-plates and partitions shall be dished, with a depth of dish of not less than 10 cm, or shall be corrugated, profiled or otherwise reinforced to give equivalent strength. The area of the surge-plate shall be at least 70% of the cross-sectional area of the tank in which the surge-plate is fitted.

(7) The manufacturer's qualification for performing welding operations shall be one recognized by the competent authority. Welding shall be performed by skilled welders using a welding process whose effectiveness (including any heat treatments required) has been demonstrated by test. Non-destructive tests shall be carried out by radiography or by ultrasound and must confirm that the quality of the welding is appropriate to the stresses.

In determining the thickness of the shell walls in accordance with paragraph (2), the following values of the coefficient lambda (λ) should be adopted for the welds:

— 0.8: where the weld beads are so far as possible inspected visually on both faces and are subjected to a non-destructive spot check with particular attention to connexions;

— 0.9: where all longitudinal beads throughout their length, all connexions, 25% of circular beads, and welds for the assembly of large-diameter items of equipment are subjected to non-destructive checks. Beads shall be checked visually on both sides as far as possible;

— 1.0: where all beads are subjected to non-destructive checks and are so far as possible inspected visually on both sides. A weld test-piece shall be taken.

Where the competent authority has doubts regarding the quality of weld beads, it may require additional checks.

(8) Measures shall be taken to protect shells against the risk of deformation as a result of a negative internal pressure.

(9) The thermal insulation shall be so designed as not to hinder access to, or the operation of, filling and discharge devices and safety valves.

*Stability*

211 128 The overall width of the ground-level bearing surface (distance between the outer points of contact with the ground of the right-hand tyre and the left-hand tyre of the same axle) shall be at least equal to 90% of the height of the centre of gravity of the laden tank-vehicle. In an articulated vehicle the mass on the axles of the load-carrying unit of the laden semi-trailer shall not exceed 60% of the nominal total laden mass of the complete articulated vehicle.

211 129

*Section 3.* ITEMS OF EQUIPMENT

211 130 The items of equipment shall be so arranged as to be protected against the risk of being wrenched off or damaged during carriage or handling. They shall exhibit a suitable degree of safety comparable to that of the shells themselves, and shall in particular:

— Be compatible with the substances carried; and

— Meet the requirements of 211 121.

As many operating parts as possible shall be served by the smallest possible number of apertures in the shell wall.

The leakproofness of the service equipment shall be ensured even in the event of the overturning of the tank-vehicles, demountable tanks and batteries of receptacles.

The gaskets shall be made of material compatible with the substance carried and shall be replaced as soon as their effectiveness is impaired, for example as a result of ageing.

Gaskets ensuring the leakproofness of fittings requiring manipulation during normal use of tank-vehicles, demountable tanks and batteries of receptacles, shall be so designed and arranged that manipulation of the fittings incorporating them does not damage them.

211 131 Every bottom-discharge shell, and in the case of compartmented bottom-discharge shells every compartment, shall be equipped with two mutually independent shut-off devices, the first being an internal stop-valve[5] fixed directly to the shell and the second being a sluice-valve or other equivalent device, mounted in series, one at each end of the discharge pipe-socket. In addition, the openings of the shells shall be capable of being closed by means of screw-threaded plugs, blank flanges or other equally effective devices. The internal stop-valve shall be operable from above or from below. If possible, the setting — open or closed — of the internal stop-valve shall be capable of being verified from the ground in both cases. The controls of the internal stop-valve shall be so designed as to prevent any inadvertent opening through impact or unconsidered action. The internal shut-off device must continue to be effective in the event of damage to the external control.

The position and/or direction of closure of the sluice-valves must be clearly apparent.

In order to avoid any loss of contents in the event of damage to the external filling and discharge fittings (pipes, lateral shut-off devices), the internal stop-valve and its seating shall be protected against the danger of being wrenched off by external stresses or shall be so designed as to withstand them. The filling and discharge devices (including flanges or threaded plugs) and protective caps (if any) shall be capable of being secured against any inadvertent opening.

The shell or each of its compartments shall be provided with an opening large enough to permit inspection.

211 132 Shells intended for the carriage of substances for which all the openings are required to be above the surface level of the liquid may be equipped, in the

[5] Except in the case of shells intended for the carriage of certain crystallizable or highly viscous substances, of deeply refrigerated liquefied gases, or of powdery or granular substances.

lower part of the body, with a cleaning aperture (fist-hole). This aperture must be capable of being sealed by a flange so closed as to be leakproof and whose design must be approved by the competent authority or by a body designated by that authority.

211 133 Shells intended for the carriage of liquids having a vapour pressure of not more than 110 kPa (1.1 bar) (absolute) at 50°C shall have a venting system and a safety device to prevent the contents from spilling out if the shell overturns; otherwise they must conform to the requirements of 211 134 or 211 135.

211 134 Shells intended for the carriage of liquids having a vapour pressure of more than 110 kPa (1.1 bar) but not exceeding 175 kPa (1.75 bar) (absolute) at 50°C shall have a safety valve set at not less than 0.15 MPa (1.5 bar) gauge pressure and which must be fully open at a pressure not exceeding the test pressure; otherwise they must conform to the requirements of 211 135.

211 135 Shells intended for the carriage of liquids having a vapour pressure of more than 175 kPa (1.75 bar) but not exceeding 300 kPa (3 bar) (absolute) at 50°C shall have a safety valve set at not less than 0.3 MPa (3 bar) gauge pressure and which must be fully open at a pressure not exceeding the test pressure; otherwise they must be hermetically closed.[6]

211 136 No movable parts such as covers, closures, etc., which are liable to come into frictional or percussive contact with aluminium shells intended for the carriage of inflammable liquids having a flash-point of or below 55°C or for the carriage of inflammable gases may be made of unprotected corrodible steel.

211 137-
211 139

*Section 4.* TYPE APPROVAL

211 140 The competent authority or a body designated by that authority shall issue in respect of each new type of tank a certificate attesting that the prototype tank, including the shell fastenings which it has surveyed, is suitable for the purpose for which it is intended and meets the construction requirements of Section 2, the equipment requirements of Section 3 and the conditions peculiar to the Classes of substances carried.

The test results, the substances and/or the groups of substances for the carriage of which the tank is approved and its type approval number shall be entered in a test report. The substances of a group of substances shall be of similar kind and equally compatible with the characteristics of the shell. The substances or groups of substances permitted shall be specified in the test report, with their chemical names or the corresponding collective heading in the list of substances, and their Class and item number.

This approval shall be valid for tanks manufactured according to this prototype without modification.

211 141-
211 149

*Section 5.* TESTS

211 150 Shells and their equipment shall either together or separately undergo an initial inspection before being put into service. This inspection shall include:

— A check of conformity to the approved prototype;

[6] "Hermetically closed" shells means shells whose openings are hermetically closed and which are not equipped with safety valves, bursting discs or other similar safety devices. Shells having safety valves preceded by a bursting disc shall be deemed to be hermetically closed.

— A check of the design characteristic;[7]

— An examination of the external and internal condition;

— A hydraulic pressure test[8] at the test pressure indicated on the data plate; and

— A check of satisfactory operation of the equipment.

The hydraulic pressure test shall be carried out before the installation of such thermal insulation as may be necessary. If the shells and their equipment are tested separately, they shall be jointly subjected to a leakproofness test after assembly.

211 151 Shells and their equipment shall undergo periodic inspections at fixed intervals. The periodic inspections shall include: an external and internal examination and, as a general rule, a hydraulic pressure test.[8] Sheathing for thermal or other insulation shall be removed only to the extent required for reliable appraisal of the characteristics of the shell.

In the case of shells intended for the carriage of powdery or granular substances, and with the agreement of the expert approved by the competent authority, the periodic hydraulic pressure tests may be omitted and replaced by leakproofness tests in accordance with 211 102 (3).

The maximum intervals for inspections shall be six years.

Tank-vehicles, demountable tanks and batteries of receptacles empty, uncleaned, may be moved after expiration of the period for undergoing the test.

211 152 In addition, a leakproofness test of the shell with its equipment and a check of the satisfactory operation of all the equipment shall be carried out at least every three years.

211 153 When the safety of the shell or of its equipment may have been impaired as a result of repairs, alterations or accident, an exceptional check shall be carried out.

211 154 The tests, inspections and checks in accordance with 211 150 to 211 153 shall be carried out by the expert approved by the competent authority. Certificates shall be issued showing the results of these operations.

211 155-
211 159

*Section 6.* MARKING

211 160 Every shell shall be fitted with a corrosion-resistant metal plate permanently attached to the shell in a place readily accessible for inspection. The following particulars at least shall be marked on the plate by stamping or by any other similar method. These particulars may be engraved directly on the walls of the shell itself, if the walls are so reinforced that the strength of the shell is not impaired:

— Approval number;

— Manufacturer's name or mark;

— Manufacturer's serial number;

[7] The check of the design characteristics shall also include, for shells requiring a test pressure of 1 MPa (10 bar) or higher, the taking of weld test-pieces (work samples) in accordance with the tests prescribed in Appendix B.1 *d*.

[8] In special cases and with the agreement of the expert approved by the competent authority, the hydraulic pressure test may be replaced by a pressure test using another liquid or gas, where such an operation does not present any danger.

— Year of manufacture;

— Test pressure(*) (gauge pressure);

— Capacity(*) — in the case of multiple-element shells, the capacity of each element;

— Design temperature(*) (only if above +50°C or below −20°C);

— Date (month and year) of initial test and most recent periodic test in accordance with 211 150 and 211 151; and

— Stamp of the expert who carried out the test.

— Material of the shell and, where appropriate, the protective lining.

In addition, the maximum working pressure allowed shall be inscribed on pressure filled or pressure discharge shells.

(*) The units of measurement should be indicated after numerical values.

211 161 The following particulars shall be inscribed on the tank-vehicle itself or on a plate. These particulars shall not be required in the case of a vehicle carrying demountable tanks:

— Name of owner or operator;

— Unladen mass; and

— Maximum permissible mass.

211 162-
211 169

*Section 7.* OPERATION

211 170 The thickness of the walls of the shell shall not, throughout its use, fall below the minimum figure prescribed in 211 127.

211 171 Shells shall not be loaded with any dangerous substances other than those for whose carriage they have been approved and which, in contact with the materials of the shell, gaskets, equipment and protective linings, are not liable to react dangerously with them, to form dangerous products or appreciably to weaken the material. Foodstuffs shall not be carried in these shells unless the necessary steps have been taken to prevent any harm to public health.

211 172 (1) The following degrees of filling shall not be exceeded in shells intended for the carriage of liquids at ambient temperatures:

(*a*) For inflammable substances without additional risks (e.g. not toxic or corrosive), in shells with a venting system or with safety valves (even where preceded by a bursting disc):

$$\text{degree of filling} = \frac{100}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity;}$$

(*b*) For toxic or corrosive substances (whether inflammable or not) in shells with a venting system or with safety valves (even where preceded by a bursting disc):

$$\text{degree of filling} = \frac{98}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity;}$$

(*c*) For inflammable substances and for harmful or slightly corrosive substances, whether inflammable or not, in hermetically-closed shells without safety device:

$$\text{degree of filling} = \frac{97}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity;}$$

(*d*) For highly toxic, toxic, highly corrosive or corrosive substances (whether or not inflammable) in hermetically closed shells without safety device:

$$\text{degree of filling} = \frac{95}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity.}$$

(2) In these formulae, $\alpha$ represents the mean coefficient of cubic expansion of the liquid between 15° and 50°C, i.e. for a maximum variation in temperature of 35°C.

$$\alpha \text{ is calculated by the formula: } \alpha = \frac{d_{15} - d_{50}}{35 \times d_{50}}$$

where $d_{15}$ and $d_{50}$ are the relative density of the liquid at 15°C and 50°C respectively and $t_F$ is the mean temperature of the liquid at the time of filling.

(3) The provisions of (1) shall not apply to shells whose contents are, by means of a heating device, maintained at a temperature above 50°C during carriage. In such a case the degree of filling at the outset shall be such, and the temperature so regulated, that the shell is not full to more than 95% of its capacity at any time during carriage, and that the filling temperature is not exceeded.

(4) Where hot substances are loaded, the temperature of the outer surface of the shell or of the thermal insulation shall not exceed 70°C during carriage.

211 173 Where shells intended for the carriage of liquids[9] are not divided by partitions or surge-plates into sections of not more than 7,500 litres' capacity, they shall be filled to not less than 80% of their capacity unless they are nominally empty.

211 174 Shells shall be closed in such a way that the contents cannot run out uncontrolled. The openings of bottom-discharge shells shall be closed by means of screw-threaded plugs, blank flanges or other equally effective devices. The leakproofness of the shell closures, particularly in the upper part of the dip-tube, shall be verified by the consignor after the shell has been filled.

211 175 Where several closure systems are fitted in series, that nearest to the substance being carried shall be closed first.

211 176 No dangerous residue of the substance carried shall adhere to the outside of a shell during transport either laden or empty.

211 177 To be accepted for carriage, empty shells, uncleaned, shall be closed in the same manner and be leakproof in the same degree as though they were full.

[9] Under this provision, substances whose kinematic viscosity at 20°C is below 2,680 $mm^2/s$ shall be deemed to be liquids.

211 178 The connecting pipes between independent but interconnected shells of a transport unit shall be empty during carriage.

Flexible filling and discharge pipes which are not permanently connected to the shell shall be empty during carriage.

211 179

*Section 8.* TRANSITIONAL MEASURES

211 180 Fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles built before 1 October 1978 and not conforming to the requirements of this Appendix may, if they were built in conformity with the requirements of ADR, be used during a period of six years from 1 October 1978. Fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles intended for the carriage of gases of Class 2 may however be used for 12 years from the same date if the periodic-test requirement is complied with.

211 181 On the expiry of this period the aforesaid units may be kept in service if the equipment of the shell meets the present requirements. The thickness of the shell wall, except in the case of shells intended for the carriage of gases of Class 2, 7° and 8°, shall be appropriate to a calculation pressure of not less than 0.4 MPa (4 bar) (gauge pressure) in the case of mild steel and of not less than 0.2 MPa (2 bar) (gauge pressure) in the case of aluminium and aluminium alloys. For other than circular cross-sections of tanks, the diameter to be used as a basis for calculation shall be that of a circle whose area is equal to that of the actual cross-section of the tank.

211 182 The periodic tests for fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles kept in service under these transitional provisions shall be conducted in accordance with the provisions of Section 5 and with the pertinent special provisions for the various Classes. Unless the earlier provisions prescribed a higher test pressure, a test pressure of 0.2 MPa (2 bar) (gauge pressure) shall suffice for aluminium shells and aluminium-alloy shells.

211 183 Fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles which meet these transitional provisions may be used during a period of 15 years from 1 October 1978 for the carriage of the dangerous goods for which they have been approved. This transitional period shall not apply to fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles intended for the carriage of substances of Class 2, or to fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles whose wall thickness and items of equipment meet the requirements of this Appendix.

211 184 Fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles constructed before 1 May 1985 in accordance with the requirements of ADR in force between 1 October 1978 and 30 April 1985 but not conforming to the provisions applicable from 1 May 1985 may continue to be used after that date.

211 185 Fixed tanks (tank-vehicles), demountable tanks and batteries of receptacles, constructed between 1 May 1985 and the entry into force of the provisions applicable from 1 January 1988 which do not conform to those provisions but were constructed according to the requirements of ADR in force until that date, may still be used.

211 186-
211 199

## PART II. SPECIAL REQUIREMENTS SUPPLEMENTING OR MODIFYING THE REQUIREMENTS OF PART I

### *Class 2.* GASES, COMPRESSED, LIQUEFIED OR DISSOLVED UNDER PRESSURE

211 200-
211 209

#### *Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 210 Gases of marginal 2201 except those listed below may be carried in fixed tanks, in demountable tanks, or in batteries of receptacles:

Fluorine and silicon tetrafluoride of 1° (at); nitric oxide of 1° (ct); mixtures of hydrogen with not more than 10% hydrogen selenide or phosphine or silane or germane by volume or with not more than 15% arsine by volume; mixtures of nitrogen or rare gases (containing not more than 10% xenon by volume) with not more than 10% hydrogen selenide or phosphine or silane or germane by volume or with not more than 15% arsine by volume of 2° (bt); mixtures of hydrogen with not more than 10% diborane by volume; mixtures of nitrogen or rare gases (containing not more than 10% xenon by volume) with not more than 10% diborane by volume of 2° (ct), boron chloride, chlorine trifluoride, nitrosyl chloride, sulphuryl fluoride and tungsten hexafluoride of 3° (at); methylsilane of 3° (b); arsine, dichlorosilane, dimethylsilane, hydrogen selenide and trimethylsilane of 3° (bt); cyanogen, cyanogen chloride and ethylene oxide of 3° (ct); mixtures of methylsilanes of 4° (bt); ethylene oxide containing not more than 50% by mass methyl formate of 4° (ct); silane of 5° (b); substances of 5° (bt) and (ct); dissolved acetylene of 9° (c); gases of 12° and 13°.

211 211-
211 219

#### *Section 2.* CONSTRUCTION

211 220 Shells intended for the carriage of substances of 1° to 6° and 9° shall be made of steel. In the case of weldless shells by derogation from 211 125 (3) a minimum elongation at fracture of 14% and also a stress $\sigma$ (sigma) lower than or equal to limits hereafter given according to the material may be accepted.

(*a*) When the ratio Re/Rm of the minimum guaranteed characteristics after heat treatment is higher than 0.66 without exceeding 0.85:

$$\sigma \leq 0.75 \text{ Re.}$$

(*b*) When the ratio Re/Rm of the minimum guaranteed characteristics after heat treatment is higher than 0.85:

$$\sigma \leq 0.5 \text{ Rm.}$$

211 221 The requirements of Appendix B.1*d* shall apply to the materials and construction of welded shells.

211 222 Shells intended for the carriage of chlorine or phosgene of 3° (at) shall be designed for a calculation pressure (see 211 127 (2)) of at least 2.2 MPa (22 bar) (gauge pressure).

211 223-
211 229

*Section 3.* ITEMS OF EQUIPMENT

211 230 The discharge pipes of shells shall be capable of being closed by blank flanges or some other equally reliable device.

211 231 Shells intended for the carriage of liquefied gases may be provided with, in addition to the openings prescribed in 211 131, openings for the fitting of gauges, including pressure gauges, and thermometers and with bleed holes, as required for their operation and safety.

211 232 Safety devices shall meet the following requirements:

(1) Filling and discharge openings of shells intended for the carriage of liquefied inflammable and/or toxic gases shall be equipped with an instant-closing internal safety device which closes automatically in the event of an unintended movement of the shell or of fire. It shall also be possible to operate the closing device by remote control.

(2) All openings, other than those accommodating safety valves and than closed bleed holes, of shells intended for the carriage of liquefied inflammable and/or toxic gases shall, if their nominal diameter is more than 1.5 mm, be equipped with an internal shut-off device.

(3) By derogation from the provisions of (1) and (2), shells intended for the carriage of deeply-refrigerated inflammable and/or toxic liquefied gases may be equipped with external devices in place of internal devices if the external devices have a protection at least equivalent to that afforded by the wall of the shell.

(4) If the shells are equipped with gauges, the latter shall not be made of a transparent material in direct contact with the substance carried. If there are thermometers, they shall not project directly into the gas or liquid through the shell wall.

(5) Shells intended for the carriage of chlorine, sulphur dioxide or phosgene of 3° (at) or methyl mercaptan or hydrogen sulphide of 3° (bt) shall not have any opening below the surface level of the liquid. In addition, cleaning apertures (fist-holes) as referred to in 211 132 shall not be permitted.

(6) Filling and discharge openings situated in the upper part of shells shall be equipped with, in addition to what is prescribed in (1), a second, external, closing device. This device shall be capable of being closed by a blank flange or some other equally reliable device.

211 233 Safety valves shall meet the following requirements:

(1) Shells intended for the carriage of gases of 1° to 6° and 9° may be provided with not more than two safety valves whose aggregate clear cross-sectional area of passage at the seating or seatings shall be not less than 20 $cm^2$ per 30 $m^3$ or part thereof of the receptacle's capacity. These valves shall be capable of opening automatically at a pressure of between 0.9 and 1.0 times the test pressure of the shell to which they are fitted. They shall be of such a type as to resist dynamic stresses, including liquid surge. The use of dead-weight or counter-weight valves is prohibited.

Shells intended for the carriage of gases of 1° to 9° harmful to the respiratory organs or entailing a poison risk[10] shall not have safety valves unless the safety valves are preceded by a bursting disc. In the latter case the arrange-

[10] Gases identified by the letter "t" in the list of substances are deemed to be gases harmful to the respiratory organs or entailing a poison risk.

ment of the bursting disc and the safety valve shall be satisfactory to the competent authority.

Where tank-vehicles are intended for carriage by sea, the provisions of this paragraph shall not prohibit the fitting of safety valves conforming to the regulations governing that mode of transport.

(2) Shells intended for the carriage of gases of 7° and 8° shall be equipped with two independent safety valves, each so designed as to allow the gases formed by evaporation during normal operation to escape from the shell in such a way that the pressure does not at any time exceed by more than 10% the working pressure indicated on the shell. One of the two safety valves may be replaced by a bursting disc which shall be such as to burst at the test pressure. In the event of loss of the vacuum in a double-walled shell, or of destruction of 20% of the insulation of a single-walled shell, the safety valve and the bursting disc shall permit an outflow such that the pressure in the shell cannot exceed the test pressure.

(3) The safety valves of shells intended for the carriage of gases of 7° and 8° shall be capable of opening at the working pressure indicated on the shell. They shall be so designed as to function faultlessly even at their lowest working temperature. The reliability of their operation at that temperature shall be established and checked either by testing each valve or by testing a specimen valve of each design-type.

211 234 *Thermal insulation*

(1) If shells intended for the carriage of liquefied gases of 3° and 4° are equipped with thermal insulation, such insulation shall consist of either:

— A sun shield covering not less than the upper third but not more than the upper half of the shell surface and separated from the shell by an air space at least 4 cm across; or

— A complete cladding, of adequate thickness, of insulating materials.

(2) Shells intended for the carriage of gases of 7° and 8° shall be thermally insulated. Thermal insulation shall be ensured by means of a continuous sheathing. If the space between the shell and the sheathing is exhausted of air (vacuum insulation), the protective sheathing shall be so designed as to withstand without deformation an external pressure of at least 0.1 MPa (1 bar) (gauge pressure). By derogation from 211 102 (2), external and internal reinforcing devices may be taken into account in the calculations. If the sheathing is so closed as to be gas-tight, 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 shell or of its items of equipment. The device shall prevent the infiltration of moisture into the heat-insulating sheath.

(3) Shells intended for the carriage of liquefied gases having a boiling point below −182°C at atmospheric pressure shall not include any combustible material either in the thermal insulation or in the means of attachment to the frame.

The means of attachment of shells intended for the carriage of argon, nitrogen, helium or neon of 7° (a) or hydrogen of 7° (b) may, with the consent of the competent authority, contain plastics substances between the shell and the sheathing.

211 235 (1) The following are considered to be elements of a battery-vehicle:

— Receptacles as defined in marginal 2212 (1) (*b*); or

— Tanks as defined in marginal 2212 (1) (*c*).

The provisions of this Appendix do not apply to frames of cylinders conforming to marginal 2212 (1) (*d*).

(2) The following conditions shall be complied with for battery-vehicles:

(*a*) If one of the elements of a battery-vehicle is equipped with a safety valve and shut-off devices are provided between the elements, every element shall be so equipped.

(*b*) The filling and discharge devices may be affixed to a manifold.

(*c*) Each element of a battery-vehicle intended for the carriage of compressed gases of 1° and 2° which are harmful to the respiratory organs or entail a poison risk[10] shall be capable of being isolated by a valve.

(*d*) The elements of a battery-vehicle intended for the carriage of liquefied gases of 3° to 6° shall be so designed that they can be filled separately and can be kept isolated by a valve capable of being sealed.

(3) The following requirements shall apply to demountable tanks:

(*a*) They shall not be interconnected by a manifold; and

(*b*) If the demountable tanks can be rolled, the valves shall be provided with protective caps.

211 236 By derogation from the provisions of 211 131, shells intended for the carriage of deeply-refrigerated liquefied gases need not have an inspection aperture.

211 237-
211 239

*Section 4.* TYPE APPROVAL

211 240-
211 249 (No special requirements)

*Section 5.* TESTS

211 250 The materials of every welded shell shall be tested by the method described in Appendix B.1 *d*.

211 251 The test-pressure levels shall be as follows:

(1) For shells intended for the carriage of gases of 1° and 2°: the levels indicated in marginal 2219 (1) and (3).

(2) For shells intended for the carriage of gases of 3° and 4°:

(*a*) If the shells are not more than 1.5 m in diameter, the levels indicated in marginal 2220 (2);

(*b*) If the shells are more than 1.5 m in diameter, the levels[11] indicated below:

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[11] 1. The prescribed test pressures are:

(*a*) If the shell is equipped with thermal insulation, at least equal to the vapour pressure, reduced by 0.1 MPa (1 bar), of the liquid at 60°C, and not less than 1 MPa (10 bar);

(*b*) If the shell is not equipped with thermal insulation, at least equal to the vapour pressure, reduced by 0.1 MPa (1 bar), of the liquid at 65°C, and not less than 1 MPa (10 bar).

2. In view of the high toxicity of phosgene of 3° (at), the minimum test pressure for this gas is fixed at 1.5 MPa (15 bar) if the shell is equipped with thermal insulation and at 1.7 MPa (17 bar) if it is not so equipped.

3. The maximum values in kg/litre prescribed for the degree of filling are calculated as follows: maximum mass of contents per litre of capacity = 0.95 × density of the liquid phase at 50°C.

| *Description of substance* | *Item number* | *Minimum test pressure for shells* | | *Maximum mass of contents per litre of capacity* |
|---|---|---|---|---|
| | | *With thermal insulation* | *Without thermal insulation* | |
| | | *MPa* | *MPa* | *kg* |
| Bromochlorodifluoromethane (R 12 B1) | 3° (a) | 1.0 | 1.0 | 1.61 |
| Chlorodifluoromethane (R 22) | 3° (a) | 2.4 | 2.6 | 1.03 |
| Chloropentafluoroethane (R 115) | 3° (a) | 2.0 | 2.3 | 1.08 |
| 1-Chloro-2,2,2-trifluoroethane (R 133a) | 3° (a) | 1.0 | 1.0 | 1.18 |
| Dichlorodifluoromethane (R 12) | 3° (a) | 1.5 | 1.6 | 1.15 |
| Dichlorofluoromethane (R 21) | 3° (a) | 1.0 | 1.0 | 1.23 |
| 1,2-Dichloro-1,1,2,2-tetrafluoroethane (R 114) | 3° (a) | 1.0 | 1.0 | 1.30 |
| Octafluorocyclobutane (RC 318) | 3° (a) | 1.0 | 1.0 | 1.34 |
| Ammonia | 3° (at) | 2.6 | 2.9 | 0.53 |
| Chlorine | 3° (at) | 1.7 | 1.9 | 1.25 |
| Hexafluoropropylene (R 1216) | 3° (at) | 1.7 | 1.9 | 1.11 |
| Hydrogen bromide | 3° (at) | 5.0 | 5.5 | 1.54 |
| Methyl bromide | 3° (at) | 1.0 | 1.0 | 1.51 |
| Nitrogen dioxide $NO_2$ | 3° (at) | 1.0 | 1.0 | 1.30 |
| Phosgene | 3° (at) | 1.5 | 1.7 | 1.23 |
| Sulphur dioxide | 3° (at) | 1.0 | 1.2 | 1.23 |
| Butane | 3° (b) | 1.0 | 1.0 | 0.51 |
| 1-Butene | 3° (b) | 1.0 | 1.0 | 0.53 |
| 1-Chloro-1,1-difluoroethane (R 142b) | 3° (b) | 1.0 | 1.0 | 0.99 |
| Cis-2-butene | 3° (b) | 1.0 | 1.0 | 0.55 |
| Cyclopropane | 3° (b) | 1.6 | 1.8 | 0.53 |
| 1,1-Difluoroethane (R 152a) | 3° (b) | 1.4 | 1.6 | 0.79 |
| Dimethyl ether | 3° (b) | 1.4 | 1.6 | 0.58 |
| Isobutane | 3° (b) | 1.0 | 1.0 | 0.49 |
| Isobutene | 3° (b) | 1.0 | 1.0 | 0.52 |
| Propane | 3° (b) | 2.1 | 2.3 | 0.42 |
| Propylene | 3° (b) | 2.5 | 2.7 | 0.43 |
| Trans-2-butene | 3° (b) | 1.0 | 1.0 | 0.54 |
| 1,1,1-Trifluoroethane | 3° (b) | 2.8 | 3.2 | 0.79 |
| Dimethylamine | 3° (bt) | 1.0 | 1.0 | 0.59 |
| Ethylamine | 3° (bt) | 1.0 | 1.0 | 0.61 |
| Ethyl chloride | 3° (bt) | 1.0 | 1.0 | 0.80 |
| Hydrogen sulphide | 3° (bt) | 4.5 | 5.0 | 0.67 |
| Methylamine | 3° (bt) | 1.0 | 1.1 | 0.58 |
| Methyl chloride | 3° (bt) | 1.3 | 1.5 | 0.81 |
| Methyl mercaptan | 3° (bt) | 1.0 | 1.0 | 0.78 |
| Trimethylamine | 3° (bt) | 1.0 | 1.0 | 0.56 |
| 1,2-Butadiene | 3° (c) | 1.0 | 1.0 | 0.59 |
| 1,3-Butadiene | 3° (c) | 1.0 | 1.0 | 0.55 |
| Vinyl chloride | 3° (c) | 1.0 | 1.1 | 0.81 |
| Methyl vinyl ether | 3° (ct) | 1.0 | 1.0 | 0.67 |
| Trifluorochloroethylene (R 1113) | 3° (ct) | 1.5 | 1.7 | 1.13 |
| Vinyl bromide | 3° (ct) | 1.0 | 1.0 | 1.37 |
| Mixture F 1 | 4° (a) | 1.0 | 1.1 | 1.23 |
| Mixture F 2 | 4° (a) | 1.5 | 1.6 | 1.15 |
| Mixture F 3 | 4° (a) | 2.4 | 2.7 | 1.03 |
| Mixture of gases R 500 | 4° (a) | 1.8 | 2.0 | 1.01 |
| Mixture of gases R 502 | 4° (a) | 2.5 | 2.8 | 1.05 |
| Mixtures of 19 to 21% by mass dichlorodifluoromethane (R 12) and 79 to | | | | |

| *Description of substance* | *Item number* | *Minimum test pressure for shells* | | *Maximum mass of contents per litre of capacity* |
|---|---|---|---|---|
| | | *With thermal insulation* | *Without thermal insulation* | |
| | | *MPa* | *MPa* | *kg* |
| 81% by mass bromochlorodifluoromethane (R 12 B1) | 4° (a) | 1.0 | 1.1 | 1.50 |
| Mixtures of methyl bromide and chloropicrin | 4° (at) | 1.0 | 1.0 | 1.51 |
| Mixture A (trade name: butane) | 4° (b) | 1.0 | 1.0 | 0.50 |
| Mixture A 0 (trade name: butane) | 4° (b) | 1.2 | 1.4 | 0.47 |
| Mixture A 1 | 4° (b) | 1.6 | 1.8 | 0.46 |
| Mixture B | 4° (b) | 2.0 | 2.3 | 0.43 |
| Mixture C (trade name: propane) | 4° (b) | 2.5 | 2.7 | 0.42 |
| Mixtures of hydrocarbons containing methane | 4° (b) | — | 22.5 | 0.187 |
| | | — | 30.0 | 0.244 |
| Mixtures of methyl chloride and methylene chloride | 4° (bt) | 1.3 | 1.5 | 0.81 |
| Mixtures of methyl chloride and chloropicrin | 4° (bt) | 1.3 | 1.5 | 0.81 |
| Mixtures of methyl bromide and ethylene bromide | 4° (bt) | 1.0 | 1.0 | 1.51 |
| Methylacetylene/propadiene and hydrocarbon mixtures | | | | |
| Mixture $P_1$ | 4° (c) | 2.5 | 2.8 | 0.49 |
| Mixture $P_2$ | 4° (c) | 2.2 | 2.3 | 0.47 |
| Mixtures of 1,3-butadiene and hydrocarbons of 3° (b) | 4° (c) | 1.0 | 1.0 | 0.50 |
| Ethylene oxide containing not more than 10% carbon dioxide by mass | 4° (ct) | 2.4 | 2.6 | 0.73 |
| Ethylene oxide with nitrogen up to a total pressure of 1 MPa (10 bar) at 50°C | 4° (ct) | 1.5 | 1.5 | 0.78 |
| Dichlorodifluoromethane containing 12% ethylene oxide by mass | 4° (ct) | 1.5 | 1.6 | 1.09 |

(3) For shells intended for the carriage of gases of 5° and 6°:

(*a*) If the shells are not sheathed in thermal insulation: the levels indicated in marginal 2220 (3) and (4);

(*b*) If the shells are sheathed in thermal insulation as defined in marginal 211 234 (1): the levels indicated below:

| *Description of substance* | *Item number* | *Minimum test pressure MPa* | *Maximum mass of contents per litre of capacity kg* |
|---|---|---|---|
| Bromotrifluoromethane (R 13 B 1) | 5° (a) | 12.0 | 1.50 |
| Carbon dioxide | 5° (a) | 19.0 | 0.73 |
| | | 22.5 | 0.78 |
| Chlorotrifluoromethane (R 13) | 5° (a) | 12.0 | 0.96 |
| | | 22.5 | 1.12 |
| Hexafluoroethane (R 116) | 5° (a) | 16.0 | 1.28 |
| | | 20.0 | 1.34 |
| Nitrous oxide ($N_2O$) | 5° (a) | 22.5 | 0.78 |
| Sulphur hexafluoride | 5° (a) | 12.0 | 1.34 |

| *Description of substance* | *Item number* | *Minimum test pressure MPa* | *Maximum mass of contents per litre of capacity kg* |
|---|---|---|---|
| Trifluoromethane (R 23) | 5° (a) | 19.0 | 0.92 |
| | | 25.0 | 0.99 |
| Xenon | 5° (a) | 12.0 | 1.30 |
| Hydrogen chloride | 5° (at) | 12.0 | 0.69 |
| Ethane | 5° (b) | 12.0 | 0.32 |
| Ethylene | 5° (b) | 12.0 | 0.25 |
| | | 22.5 | 0.36 |
| 1,1-Difluoroethylene | 5° (c) | 12.0 | 0.66 |
| | | 22.5 | 0.78 |
| Vinyl fluoride | 5° (c) | 12.0 | 0.58 |
| | | 22.5 | 0.65 |
| Mixture of gases R 503 | 6° (a) | 3.1 | 0.11 |
| | | 4.2 | 0.21 |
| | | 10.0 | 0.76 |
| Carbon dioxide containing not more than 35% ethylene oxide by mass | 6° (c) | 19.0 | 0.73 |
| | | 22.5 | 0.78 |
| Ethylene oxide containing more than 10% but not more than 50% carbon dioxide by mass | 6° (ct) | 19.0 | 0.66 |
| | | 25.0 | 0.75 |

Where shells sheathed in thermal insulation are used which have been subjected to a test pressure lower than that shown in the table, the maximum mass of the contents per litre of capacity shall be such that the pressure reached in the shell by the substance in question at 55°C does not exceed the test pressure stamped on the shell. In such a case the maximum load allowed shall be prescribed by the expert approved by the competent authority.

(4) For shells intended for the carriage of ammonia dissolved under pressure of 9° (at):

| *Description of substance* | *Item number* | *Minimum test pressure MPa* | *Maximum mass of contents per litre of capacity kg* |
|---|---|---|---|
| Ammonia dissolved under pressure in water | | | |
| — With more than 35% but not more than 40% ammonia by mass | 9° (at) | 1.0 | 0.80 |
| — With more than 40% but not more than 50% ammonia by mass | 9° (at) | 1.2 | 0.77 |

(5) For shells intended for the carriage of gases of 7° and 8°: not less than 1.3 times the maximum permitted working pressure, as indicated on the shell, but not less than 0.3 MPa (3 bar) (gauge pressure); for shells with vacuum insulation the test pressure shall be not less than 1.3 times the maximum permitted working pressure increased by 0.1 MPa (1 bar).

211 252 The first hydraulic pressure test shall be carried out before the thermal insulation is placed in position.

211 253 The capacity of each shell intended for the carriage of gases of 3° to 6° and 9° shall be determined, under the supervision of an expert approved by the competent authority, by weighing or volumetric measurement of the quan-

tity of water which fills the shell; any error in the measurement of shell capacity shall be of less than 1%. Determination by a calculation based on the dimensions of the shell is not permitted. The maximum filling masses allowed in accordance with marginals 2220 (4) and 211 251 (3) shall be prescribed by an approved expert.

211 254 Checking of the welds shall be carried out in accordance with the lambda-coefficient 1.0 requirements of 211 127 (7).

211 255 By derogation from the requirements of 211 151, the periodic tests shall take place:

(1) Every three years in the case of shells intended for the carriage of boron trifluoride of 1° (at), town gas of 2° (bt), hydrogen bromide, chlorine, nitrogen dioxide, sulphur dioxide or phosgene of 3° (at), hydrogen sulphide of 3° (bt), or hydrogen chloride of 5° (at);

(2) After six years' service and thereafter every twelve years in the case of shells intended for the carriage of gases of 7° or 8°. A leakproofness check shall be performed by an approved expert six years after each periodic test.

211 256 In the case of vacuum-insulated shells, the hydraulic-pressure test and the check of the internal condition may, with the consent of the approved expert, be replaced by a leakproofness test and measurement of the vacuum.

211 257 If apertures have been made, on the occasion of periodic inspections, in shells intended for the carriage of gases of 7° or 8°, the method by which they are hermetically closed before the shells are replaced in service shall be approved by the approved expert and shall ensure the integrity of the shell.

211 258 Leakproofness tests of shells intended for the carriage of gases of 1° to 6° and 9° shall be performed at a pressure of not less than 0.4 MPa (4 bar) and not more than 0.8 MPa (8 bar) gauge pressure.

211 259

*Section 6.* MARKING

211 260 The following additional particulars shall be marked by stamping or by any other similar method on the plate prescribed in 211 160, or directly on the walls of the shell itself if the walls are so reinforced that the strength of the shell is not impaired:

(1) On shells intended for the carriage of only one substance: the name of the gas in full.

This indication shall be supplemented in the case of shells intended for the carriage of compressed gases of 1° and 2° by an indication of the maximum filling pressure at 15°C allowed for the shell, and in the case of shells intended for the carriage of liquefied gases of 3° to 8° or of ammonia dissolved under pressure of 9° (at) by an indication of the maximum permissible load mass in kg and of the filling temperature if below −20°C.

(2) On multi-purpose shells: the names, in full, of the gases for whose carriage the shell is approved.

These particulars shall be supplemented by an indication of the maximum permissible load mass in kg for each gas;

(3) On shells intended for the carriage of gases of 7° or 8°: the working pressure; and

(4) On shells equipped with thermal insulation: the inscription "thermally insulated" or "thermally insulated by vacuum".

211 261 The frame of a battery-vehicle shall bear near the filling point a plate specifying:

— The test pressure of elements;(*)

— The maximum filling pressure at 15°C(*) allowed for elements intended for compressed gases;

— The number of elements;

— The aggregate capacity(*) of the elements;

— The name of the gas in full;

and, in the case of liquefied gases:

— The permissible maximum load(*) per element.

(*) The units of measurement should be indicated after numerical values.

211 262 In addition to the particulars prescribed in marginal 211 161, the following shall be inscribed either on the shell itself or on a plate:

(*a*) Either: "minimum filling temperature allowed: −20°C", or: "minimum filling temperature allowed: . . .";

(*b*) Where the shell is intended for the carriage of one substance only:

— The name of the gas in full;

— For liquefied gases of 3° to 8° and for ammonia dissolved under pressure in water of 9° (at), the maximum permissible load mass in kg;

(*c*) Where the shell is a multi-purpose shell: the names in full of all the gases to whose carriage the shell is assigned, with an indication of the maximum permissible load mass in kg for each of them;

(*d*) Where the shell is equipped with thermal insulation: the inscription "thermally insulated" or "thermally insulated by vacuum", in an official language of the country of registration and also, if that language is not English, French or German, in English, French or German, unless any international agreements concluded between the countries concerned in the transport operation provide otherwise.

211 263 These particulars shall not be required in the case of a vehicle carrying demountable tanks.

211 264-
211 269

*Section 7.* OPERATION

211 270 A shell assigned at different times to the carriage of different liquefied gases of 3° to 8° (multi-purpose shell) may not carry substances other than those listed in one, and one only, of the following groups:

— Group 1: halogenated hydrocarbons of 3° (a) and 4° (a);

— Group 2: hydrocarbons of 3° (b) and 4° (b); butadienes of 3° (c); and mixtures of 1,3-butadiene and hydrocarbons, of 4° (c);

— Group 3: ammonia of 3° (at); dimethyl ether of 3° (b); dimethylamine, ethylamine, methylamine and trimethylamine of 3° (bt); and vinyl chloride of 3° (c);

— Group 4: methyl bromide of 3° (at); ethyl chloride and methyl chloride of 3° (bt);

— Group 5: mixtures of ethylene oxide with carbon dioxide and of ethylene oxide with nitrogen of 4° (ct);

— Group 6: nitrogen, carbon dioxide, rare gases, nitrous oxide $N_2O$, and oxygen 7° (a); air, mixtures of nitrogen with rare gases, and mixtures of oxygen with nitrogen, also when they contain rare gases of 8° (a);

— Group 7: ethane, ethylene, and methane of 7° (b); and mixtures of methane with ethane, also when they contain propane or butane, of 8° (b).

211 271 Shells which have been filled with a substance of group 1 or group 2 shall be emptied of liquefied gas before being loaded with another substance belonging to the same group. Shells which have been filled with a substance of groups 3 to 7 shall be completely emptied of liquefied gas and then blown down before being loaded with another substance belonging to the same group.

211 272 The multiple use of shells for the carriage of liquefied gases of the same group shall be allowed if all the requirements prescribed for the gases to be carried in one and the same shell are observed. Such multiple use shall be subject to approval by an approved expert.

211 273 The multiple use of shells for the carriage of gases of different groups shall be allowed if permitted by the approved expert.

When shells are reassigned to gases of a different group, the shells shall be completely emptied of liquefied gases, then blown down and, lastly, degassed. The degassing of shells shall be verified and certified by the approved expert.

211 274 When loaded tanks or empty but uncleaned tanks are handed over for carriage, only the particulars specified in marginal 211 262 applicable to the gas loaded or just discharged shall be visible; all particulars concerning other gases shall be covered up.

211 275 All the elements of a battery-vehicle shall contain only one and the same gas. In the case of a battery-vehicle intended for the carriage of liquefied gases of 3° to 6°, the elements shall be filled separately and be kept isolated by a sealed valve.

211 276 The maximum filling pressure for compressed gases of 1° and 2° other than boron trifluoride shall not exceed the values prescribed in marginal 2219 (2).

For boron trifluoride of 1° (at) the maximum filling mass per litre of capacity shall not exceed 0.86 kg.

The maximum filling mass per litre of capacity according to marginals 2220, (2), (3) and (4), and 211 251, (2), (3) and (4), shall be abided by.

211 277 The degree of filling of shells intended for the carriage of gases of 7° (b) and 8° (b) shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the valve-opening pressure, the volume of the liquid would reach 95% of the shell's capacity at that temperature. Shells intended for the carriage of gases of 7° (a) and 8° (a) may be filled to 98% at the loading temperature and the loading pressure.

211 278 On shells intended for the carriage of nitrous oxide and oxygen of 7° (a), air or mixtures containing oxygen of 8° (a), substances containing grease or oil shall not be used to ensure leakproofness of the joints or for the maintenance of the closures.

211 279 The requirement in 211 175 shall not apply to gases of 7° and 8°.

211 280-
211 299

*Class 3.* INFLAMMABLE LIQUIDS

211 300-
211 309

*Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 310 The following substances of marginal 2301 may be carried in fixed or demountable tanks:

(*a*) Substances listed by name in 12°;

(*b*) Substances classified under (a) of 11°, 14° to 23°, 25° and 26° and comparable substances to be classified under (a) of those items, with the exception of isopropyl chloroformate of 25° (a);

(*c*) Substances classified under (b) of 11°, 14° to 20°, 22° and 24° to 26° and comparable substances to be classified under (b) of those items;

(*d*) Substances of 1° to 6° and 31° to 34° and comparable substances to be classified under these items, with the exception of nitromethane of 31° (c).

211 311-
211 319

*Section 2.* CONSTRUCTION

211 320 Shells intended for the carriage of substances of 12° specified by name shall be designed for a calculation pressure (see 211 127 (2)) of not less than 1.5 MPa (15 bar) gauge pressure.

211 321 Shells intended for the carriage of the substances referred to in 211 310 (*b*) shall be designed for a calculation pressure (see 211 127 (2)) of not less than 1.0 MPa (10 bar) gauge pressure.

211 322 Shells intended for the carriage of the substances referred to in 211 310 (*c*) shall be designed for a calculation pressure (see 211 127 (2)) of not less than 0.4 MPa (4 bar) gauge pressure.

211 323 Shells intended for the carriage of the substances referred to in 211 310 (*d*) shall be designed in accordance with the requirements Part I of this Appendix.

211 324-
211 329

*Section 3.* ITEMS OF EQUIPMENT

211 330 All openings of shells intended for the carriage of the substances referred to in 211 310 (*a*) and (*b*) shall be above the surface level of the liquid. No pipes or pipe connections shall pass through the walls of the shell below the surface level of the liquid. Shells shall be capable of being hermetically closed[6] and the closures shall be capable of being protected with lockable caps.

211 331 Shells intended for the carriage of the substances referred to in 211 310 (*c*) and (*d*) may also be of the bottom-discharge type. Shells intended for the carriage of the substances referred to in 211 310 (*c*) shall be capable of being hermetically closed.[6]

211 332 If shells intended for the carriage of the substances referred to in 211 310 (*a*), (*b*) or (*c*) are fitted with safety valves, a bursting disc shall be placed before the valve. The arrangement of the bursting disc and safety valve shall be such as to satisfy the competent authority. If shells intended for the carriage of the substances referred to in 211 310 (*d*) are equipped

with safety valves or a venting system, these shall satisfy the requirements of 211 133 to 211 135. Shells intended for the carriage of the substances referred to in 211 310 (*d*) having a flash-point not exceeding 55°C and equipped with a venting system which cannot be closed shall have a flame-trap in the venting system.

211 333-
211 339

*Section 4.* TYPE APPROVAL

211 340-
211 349

(No special requirements)

*Section 5.* TESTS

211 350 Shells intended for the carriage of the substances referred to in 211 310 (*a*), (*b*) or (*c*) shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar).

211 351 Shells intended for the carriage of the substances referred to in 211 310 (*d*) shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 211 123.

211 352-
211 359

*Section 6.* MARKING

211 360-
211 369

(No special requirements)

*Section 7.* OPERATION

211 370 Shells intended for the carriage of the substances referred to in 211 310 (*a*), (*b*) and (*c*) shall be hermetically closed[6] during carriage. The closures of shells intended for the carriage of the substances referred to in 211 310 (*a*) and (*b*) shall be protected by a locked cap.

211 371 Fixed tanks (tank-vehicles) and demountable tanks approved for the carriage of substances of 6°, 11°, 12° and 14° to 20° shall not be used for the carriage of foodstuffs, articles of consumption or animal feedstuffs.

211 372 An aluminium-alloy shell shall not be used for the carriage of acetaldehyde of 1° (a) unless the shell is reserved solely for such carriage and the acetaldehyde is free from acid.

211 373 The petrol (gasoline) referred to in the Note to 3° (b) of marginal 2301 may also be carried in tanks designed according to 211 123 (1) and having equipment conforming to 211 133.

211 374-
211 399

*Class 4.1.* INFLAMMABLE SOLIDS

*Class 4.2.* SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION

*Class 4.3.* SUBSTANCES WHICH GIVE OFF INFLAMMABLE GASES ON CONTACT WITH WATER

211 400-
211 409

*Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 410 Substances of 2°, 8° and 11° of marginal 2401, substances of 1°, 3° and 8° of marginal 2431 and sodium, potassium, alloys of sodium and potassium of

1° (a), substances of 2° (e) and 4° of marginal 2471 may be carried in fixed or demountable tanks.

NOTE. For the carriage in bulk of sulphur of 2° (a), naphthalene of 11° (a) and (b), expandable polystyrenes of 12° of marginal 2401, substances of 5°, dust from blast-furnace filters (6° (a)) and substances of 10° of marginal 2431, and magnesium granules, coated, of 1° (d), calcium carbide (2° (a)) and calcium silicide in lumps (2° (d)) of marginal 2471, see 41 111, 42 111 and 43 111.

211 411-
211 419

*Section 2.* CONSTRUCTION

211 420 Shells intended for the carriage of white or yellow phosphorus of marginal 2431, 1° or substances of 2° (e) and 4° of marginal 2471 shall be designed for a calculation pressure (see 211 127 (2)) of not less than 1 MPa (10 bar) gauge pressure.

211 421 Shells intended for the carriage of substances of marginal 2431, 3°, shall be designed for a calculation pressure (see 211 127 (2)) of not less than 2.1 MPa (21 bar) gauge pressure. The requirements of Appendix B.1 *d* shall apply to the materials and construction of these shells.

211 422-
211 429

*Section 3.* ITEMS OF EQUIPMENT

211 430 Shells intended for the carriage of sulphur of 2° (b) or naphthalene of 11° (c) of marginal 2401 shall be equipped with thermal insulation made of materials which are not readily inflammable. They may be equipped with valves opening automatically inwards or outwards under the effect of a difference of pressure of 20 kPa (0.2 bar) to 30 kPa (0.3 bar).

211 431 Shells intended for the carriage of white or yellow phosphorus of marginal 2431, 1°, shall meet the following requirements:

(1) The heating device shall not penetrate into, but shall be exterior to, the body of the shell. However, a pipe used for extracting the phosphorus may be equipped with a heating jacket. The device heating the jacket shall be so regulated as to prevent the temperature of the phosphorus from exceeding the filling temperature of the shell. Other piping shall enter the shell in its upper part; openings shall be situated above the highest permissible level of the phosphorus and be capable of being completely enclosed under lockable caps. In addition, the cleaning apertures (fist-holes) referred to in 211 132 shall not be permitted.

(2) The shell shall be equipped with a gauging system for verifying the level of the phosphorus and, if water is used as the protective agent, with a fixed gauge mark showing the highest permissible level of the water.

211 432 Shells intended for the carriage of substances of marginal 2431, 3°, or marginal 2471, 2° (e) shall not have any openings or connections below the level of the liquid, even if such openings or connections are capable of being closed. In addition, the cleaning openings (fist-holes) provided for in 211 132 shall not be permitted. Openings in the upper part of the shell, including their fittings, shall be capable of being protected by a cap.

211 433 Shells intended for the carriage of substances of marginal 2471, 1° (a), shall have their openings and orifices (valves, sleeves, manholes, etc.) protected by leakproof lockable caps, and shall be equipped with thermal insulation of a not-readily inflammable material.

211 434-
211 439

*Section 4.* TYPE APPROVAL

211 440-
211 449

(No special requirements)

*Section 5.* TESTS

211 450

Shells intended for the carriage of sulphur in the molten state of 2° (b), naphthalene in the molten state of 11° (c) of marginal 2401, white or yellow phosphorus of marginal 2431, 1°, sodium, potassium or alloys of sodium or potassium of 1° (a), or substances of 2° (e), or 4° of marginal 2471 shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of at least 0.4 MPa (4 bar).

211 451

Shells intended for the carriage of substances of marginal 2431, 3°, shall be subjected to the initial and periodic tests with a liquid not reacting with the substance to be carried, at a test pressure of at least 1 MPa (10 bar) gauge pressure.

The materials of every shell intended for the carriage of substances of marginal 2431, 3°, shall be tested by the method described in Appendix B.1 *d*.

211 452

Shells intended for the carriage of sulphur (including flowers of sulphur) of 2° (a), substances of 8°, crude or pure naphthalene of 11° (a) and (b) of marginal 2401, or of freshly-quenched charcoal of marginal 2431, 8°, shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 211 123.

211 453-
211 459

*Section 6.* MARKING

211 460

Shells intended for the carriage of substances of marginal 2431, 3°, shall bear in addition to the particulars prescribed in 211 161 the words: "Do not open during carriage. Liable to spontaneous combustion".

Shells intended for the carriage of substances of marginal 2471, 2° (e), shall bear in addition to the particulars prescribed in 211 161 the words: "Do not open during carriage. Gives off inflammable gases on contact with water".

These particulars shall be in an official language of the country of approval, and also, if that language is not English, French or German, in English, French or German, unless any agreements concluded between the countries concerned in the transport operation provide otherwise.

211 461

Shells intended for the carriage of substances of marginal 2471, 4°, shall also have their maximum permissible load mass in kg marked on the plate prescribed in 211 160.

211 462-
211 469

*Section 7.* OPERATION

211 470

Shells intended for the carriage of sulphur of 2° (b) or naphthalene 11 (c) of marginal 2401 shall be filled to not more than 98% of their capacity.

211 471

White or yellow phosphorus of marginal 2431, 1°, shall, if water is used as the protective agent, be covered with a depth of not less than 12 cm of water at the time of filling; the degree of filling at a temperature of 60°C shall not exceed 98%. If nitrogen is used as the protective agent, the degree of filling at a temperature of 60°C shall not exceed 96%. The remaining space shall be

filled with nitrogen in such a way that, even after cooling, the pressure at no time falls below atmospheric pressure. The shell shall be hermetically closed[6] so that no leakage of gas occurs.

211 472 For the carriage of substances of marginal 2471, 1° (a), caps shall be locked in conformity with 211 432.

211 473 For trichlorosilane (silicochloroform) of marginal 2471, 4° (a), or for methyldichlorosilane or ethyldichlorosilane of 4° (b), the degree of filling shall not exceed 1.14 or 0.95 or 0.93 kg per litre of capacity respectively, if filling is by mass or 85% if filling is by volume.

211 474 Shells which have contained phosphorus of marginal 2431, 1°, shall when handed over for carriage either:

— Be filled with nitrogen; the sender shall certify in the transport document that the shell, after closure, is gas-tight; or

— Be filled with water to not less than 96% and not more than 98% of their capacity; between 1 October and 31 March this water shall contain one or more anti-freeze agents free from corrosive action, not liable to react with phosphorus, and in such concentration as to make it impossible for the water to freeze during carriage.

Tanks which have contained phosphorus of marginal 2431, 1°, must be considered, as far as the application of the provisions of marginal 42 500 (1) is concerned, as being "empty tanks, uncleaned".

211 475 The degree of filling for shells containing substances of marginal 2431, 3°, or marginal 2471, 2° (e), shall not exceed 90%; a space of 5% shall remain empty for safety when the liquid is at an average temperature of 50°C. During carriage, the substances shall be under a layer of inert gas, the gauge pressure of which shall not exceed 50 kPa (0.5 bar). The shells shall be hermetically closed[6] and the protective caps conforming to 211 433 shall be locked. Empty shells, uncleaned, shall when handed over for carriage be filled with an inert gas at a gauge pressure of up to 50 kPa (0.5 bar).

211 476-
211 499

## *Class 5.1.* OXIDIZING SUBSTANCES
## *Class 5.2.* ORGANIC PEROXIDES

211 500-
211 509

### *Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 510 The following substances of marginal 2501 may be carried in fixed or demountable tanks: substances of 1° to 3°, solutions of 4° (also powdery sodium chlorate in the moist or the dry state) and hot aqueous solutions of ammonium nitrate of 6° (a) in a concentration of more than 80% but not more than 93% provided that:

(*a*) The pH value, measured in a 10% aqueous solution of the substance carried, is between 5 and 7, and

(*b*) Solutions do not contain any combustible substance in a quantity greater than 0.2% or any chlorine compound in such quantity that the chlorine content exceeds 0.02%.

NOTE. For the carriage in bulk of substances of 4° to 6° and 7° (a) and (b) of marginal 2501 see marginal 51 111.

Substances of 1°, 10°, 14°, 15° and 18° of marginal 2551 may be carried in fixed or demountable tanks.

211 511-
211 519

*Section 2.* CONSTRUCTION

211 520 Shells intended for the carriage in the liquid state of the substances referred to in 211 510 shall be designed for a calculation pressure (see 211 127 (2)) of at least 0.4 MPa (4 bar) (gauge pressure).

211 521 Shells, and their items of equipment, intended for the carriage of hydrogen peroxide or of aqueous solutions of hydrogen peroxide of marginal 2501, 1°, or of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be made of aluminium not less than 99.5% pure or of suitable steel not liable to cause the hydrogen peroxide or the organic peroxides to decompose. Where shells are made of aluminium not less than 99.5% pure, the wall thickness need not be greater than 15 mm, even where calculation in accordance with 211 127 (2) gives a higher value.

211 522 Shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), shall be made of austenitic steel.

211 523-
211 529

*Section 3.* ITEMS OF EQUIPMENT

211 530 Shells intended for the carriage of hydrogen peroxide and of aqueous solutions of hydrogen peroxide containing more than 70% hydrogen peroxide, of marginal 2501, 1°, shall have their openings above the surface level of the liquid. In addition, cleaning apertures (fist-holes) as referred to in 211 132 shall not be permitted. In the case of solutions containing more than 60% but not more than 70% hydrogen peroxide, openings below the surface level of the liquid shall be permissible. In this case the shell-discharge system shall be equipped with two mutually independent shut-off devices mounted in series, the first taking the form of a quick-closing internal stop-valve of an approved type and the second that of a sluice-valve, at each end of the discharge pipe-socket. A blank flange, or another device providing the same measure of security, shall also be fitted at the outlet of each external sluice-valve. The internal stop-valve shall be such that, if the pipe is wrenched off, the stop-valve will remain integral with the shell and in the closed position. The connexions to the external pipe-sockets of shells shall be made of materials not liable to cause decomposition of hydrogen peroxide.

211 531

211 532 Shells intended for the carriage of hydrogen peroxide or of aqueous solutions of hydrogen peroxide of 1°, or of hot concentrated aqueous solutions of ammonium nitrate of 6° (a), of marginal 2501 shall be fitted in their upper part with a shut-off device preventing any build-up of excess pressure inside the receptacle, any leakage of liquid, and any entry of foreign matter into the receptacle. The shut-off devices of shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate shall be so designed as to preclude obstruction of the devices by solidified ammonium nitrate during carriage.

211 533 Where shells intended for the carriage of hot concentrated solutions of ammonium nitrate of marginal 2501, 6° (a), are sheathed in thermally-insulating material, the material shall be of an inorganic nature and entirely free from combustible matter.

211 534 Shells intended for the carriage of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be equipped with a venting device fitted with a flame-trap and followed in series by a safety valve opening at a gauge pressure of 0.18 to 0.22 MPa (1.8 to 2.2 bar).

211 535 Shells intended for the carriage of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be equipped with a thermal insulation complying with the requirements of 211 234 (1). The sun shield and any part of the shell not covered by it, or the outer sheathing of a complete lagging, shall be painted white and the paint shall be cleaned before each transport journey and renewed in case of yellowing or deterioration. The sun shields shall be free from combustible matter.

211 536-
211 539

*Section 4.* TYPE APPROVAL

211 540- (No special requirements)
211 549

*Section 5.* TESTS

211 550 Shells intended for the carriage of the substances referred to in 211 510 in the liquid state shall be subjected to the initial and periodic hydraulic pressure tests at a pressure of not less than 0.4 MPa (4 bar) gauge pressure. Shells intended for the carriage of the other substances referred to in 211 510 shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 211 123.

Shells of pure aluminium intended for the carriage of hydrogen peroxide or aqueous solutions of hydrogen peroxide of marginal 2501, 1°, or liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15°, or 18° need be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of only 0.25 MPa (2.5 bar).

211 551-
211 559

*Section 6.* MARKING

211 560- (No special requirements)
211 569

*Section 7.* OPERATION

211 570 The inside of the shell, and all parts liable to come into contact with substances referred to in 211 510, shall be kept clean. No lubricant capable of combining dangerously with the substance carried shall be used for pumps, valves or other devices.

211 571 Shells intended for the carriage of substances of marginal 2501, 1° to 3°, shall be filled to not more than 95% of their capacity at a reference temperature of 15°C.

Shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), shall be filled to not more than 97% of their capacity, and the maximum temperature after filling shall not exceed 140°C. Tanks used for the carriage of hot concentrated aqueous

solutions of ammonium nitrate of marginal 2501, 6° (a), shall not be used for the carriage of other substances.

211 572 Shells intended for the carriage of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be filled to not more than 80% of their capacity. Shells shall be free from impurities at the time of filling.

211 573-
211 599

## *Class 6.1.* TOXIC SUBSTANCES

211 600-
211 609

### *Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 610 The following substances of marginal 2601 may be carried in fixed or demountable tanks:

(*a*) The substances listed by name in 2° and 3°;

(*b*) Highly toxic substances classified under (a) of 11° to 24°, 31°, 41°, 51°, 55°, 68° and 71° to 88°, carried in the liquid state, and comparable substances or solutions to be classified under (a) of those items;

(*c*) Toxic or harmful substances classified under (b) or (c) of 11° to 24°, 51° to 55°, 57° to 68° and 71° to 88°, carried in the liquid state, and comparable substances or solutions to be classified under (b) or (c) of those items;

(*d*) Toxic or harmful powdery or granular substances classified under (b) or (c) of 12°, 14°, 17°, 19°, 21°, 23° 24°, 51° to 55°, 57° to 68° and 71° to 88°, and comparable powdery or granular substances to be classified under (b) or (c) of those items.

NOTE. For the carriage in bulk of substances of 44° (b), 60° (c) and 63° (c) and solid wastes classified under (c) of the various items see marginal 61 111.

211 611-
211 619

### *Section 2.* CONSTRUCTION

211 620 Shells intended for the carriage of substances listed by name under 2° and 3° shall be designed for a calculation pressure (see 211 127 (2)) of not less than 1.5 MPa (15 bar) gauge pressure.

211 621 Shells intended for the carriage of the substances referred to in 211 610 (*b*) shall be designed for a calculation pressure (see 211 127 (2)) of not less than 1.0 MPa (10 bar) gauge pressure.

211 622 Shells intended for the carriage of the substances referred to in 211 610 (*c*) shall be designed for a calculation pressure (see 211 127 (2)) of not less than 0.4 MPa (4 bar) gauge pressure.

211 623 Shells intended for the carriage of the powdery or granular substances referred to in 211 610 (*d*) shall be designed in accordance with the requirements of Part I of this Appendix.

211 624-
211 629

*Section 3.* ITEMS OF EQUIPMENT

211 630 All openings of shells intended for the carriage of the substances referred to in 211 610 (*a*) and (*b*) shall be above the surface level of the liquid. No pipe or pipe connections shall pass through the walls of the shell below the surface level of the liquid. Shells shall be capable of being hermetically closed[6] and the closures shall be capable of being protected with lockable caps. The cleaning openings provided for in 211 132 shall not however be permitted for shells intended for the carriage of solutions of hydrocyanic acid of 2°.

211 631 Shells intended for the carriage of the substances referred to in 211 610 (*c*) and (*d*) may also be of the bottom-discharge type. The shells shall be capable of being hermetically closed.[6]

211 632 If shells are fitted with safety valves, a bursting disc shall be placed before the valve. The arrangement of the bursting disc and safety valve shall be such as to satisfy the competent authority.

*Protection of equipment*

211 633 (1) *Fittings and accessories mounted in the upper part of the shell*

Such fittings and accessories shall be either

— Inserted in a recessed housing; or

— Equipped with an internal safety valve; or

— Shielded by a cap, or by transverse and/or longitudinal members, or by other equally effective devices, so profiled that in the event of overturning the fittings and accessories will not be damaged.

(2) *Fittings and accessories mounted in the lower part of the shell*

Pipe-sockets, lateral shut-off devices, and all discharge devices shall either be recessed by at least 200 mm from the extreme outer edge of the shell or be protected by a rail having a coefficient of inertia of not less than 20 $cm^3$ transversally to the direction of travel; their ground clearance shall be not less than 300 mm with the shell full.

(3) *Fittings and accessories mounted on the rear face of the shell*

All fittings and accessories mounted on the rear face shall be protected by the bumper prescribed in marginal 10 220. Their height above the ground shall be such that they are adequately protected by the bumper.

211 634-
211 639

*Section 4.* TYPE APPROVAL

211 640-
211 649 (No special requirements)

*Section 5.* TESTS

211 650 Shells intended for the carriage of the substances referred to in 211 610 (*a*), (*b*) and (*c*) shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar). For shells intended for the carriage of substances of 31° (a), the periodic tests shall be carried out at intervals of not more than three years and shall include the hydraulic pressure test.

211 651 Shells intended for the carriage of the substances referred to in 211 610 (*d*) shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 211 123.

211 652-
211 659

*Section 6.* MARKING

211 660-
211 669

(No special requirements)

*Section 7.* OPERATION

211 670 Shells intended for the carriage of substances of 3° shall not be filled to more than 1 kg per litre of capacity.

211 671 Shells shall be hermetically closed[6] during carriage. The closures of shells intended for the carriage of the substances referred to in 211 610 (*a*) and (*b*) shall be protected with locked caps.

211 672 Tank vehicles and demountable tanks approved for the carriage of the substances referred to in 211 610 shall not be used for the carriage of foodstuffs, articles of consumption or animal feedstuffs.

211 673-
211 699

*Class 7.* RADIOACTIVE SUBSTANCES

211 700-
211 709

*Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 710 In accordance with the applicable schedule of marginal 2703.

NOTE. Liquid or solid low-specific-activity substances, LSA (I), of marginal 2703, schedule 5, other than uranium hexafluoride and substances liable to spontaneous ignition, may be carried in fixed or demountable tanks.

211 711-
211 719

*Section 2.* CONSTRUCTION

211 720 Shells intended for the carriage of the substances referred to in marginal 2703, Schedule 5, paragraph 11, shall be designed for a pressure of at least 0.4 MPa (4 bar) (gauge pressure).

When the radioactive substances are in solution or suspension in substances of other Classes and the calculation pressures prescribed for the shells of tanks intended for the carriage of the latter substances are greater, the latter pressures shall be applied.

211 721-
211 729

*Section 3.* ITEMS OF EQUIPMENT

211 730 Shells intended for the carriage of liquid radioactive substances[9] shall have their openings above the surface level of the liquid. No piping or pipe connection shall pass through the walls of the shell below the surface level of the liquid.

211 731-
211 739

*Section 4.* TYPE APPROVAL

211 740 Tanks approved for the transport of radioactive substances shall not be approved for the transport of any other substances.

211 741-
211 749

*Section 5.* TESTS

211 750 The shells shall undergo the initial and periodical hydraulic pressure tests at a pressure of at least 0.4 MPa (4 bar) gauge pressure.

By derogation from the requirements of 211 151, the periodic internal inspection may be replaced by a check of the wall thickness by ultrasound, performed every three years.

211 751-
211 759

*Section 6.* MARKING

211 760-
211 769 (No special requirements)

*Section 7.* OPERATION

211 770 The degree of filling at the reference temperature of 15°C shall not exceed 93% of the total capacity of the shell.

211 771 Tanks which have been used for the transport of radioactive substances shall not be used for the transport of any other substances.

211 772-
211 799

## *Class 8.* CORROSIVE SUBSTANCES

211 800-
211 809

*Section 1.* GENERAL; SCOPE (USE OF TANKS); DEFINITIONS

*Use*

211 810 The following substances of marginal 2801 may be carried in fixed or demountable tanks:

(*a*) Substances listed by name in 6°, 7° and 24°, and substances comparable with those of 7°;

(*b*) Highly corrosive substances classified under (a) of 1°, 2°, 3°, 10°, 11°, 21°, 26°, 27°, 32°, 33°, 36°, 37°, 39°, 46°, 55°, 64°, 65° and 66°, carried in the liquid state, and comparable substances or solutions to be classified under (a) of those items;

(*c*) Corrosive or slightly corrosive substances classified under (b) or (c) of 1° to 5°, 8° to 11°, 21°, 26°, 27°, 31° to 39°, 42° to 46°, 51° to 55° and 61° to 66°, carried in the liquid state, and comparable substances or solutions to be classified under (b) or (c) of those items;

(*d*) Powdery or granular corrosive or slightly corrosive substances classified under (b) or (c) of 22°, 23°, 26°, 27°, 31°, 35°, 39°, 41°, 45°, 46°, 52°, 55° and 65°, and comparable powdery or granular substances to be classified under (b) or (c) of those items.

NOTE. For the carriage in bulk of lead sludge containing sulphuric acid of 1° (b), substances of 23° and solid wastes classified under (c) of the various items, see marginal 81 111.

211 811-
211 819

*Section 2.* CONSTRUCTION

211 820 Shells intended for the carriage of substances listed in 6° and 24° shall be designed for a calculation pressure (see 211 127 (2)) of not less than 2.1 MPa (21 bar) gauge pressure. Shells intended for the carriage of bromine of 24° shall be provided with a lead lining not less than 5 mm thick or an equivalent lining.

Shells intended for the carriage of substances of 7° (a) shall be 211 820 designed for a calculation pressure (see 211 127 (2)) of not less than 1.0 MPa (10 bar) and shells for the carriage of substances of 7° (b) and (c) for a calculation pressure (see 211 127 (2)) of not less than 0.4 MPa (4 bar).

The requirements of Appendix B.1 *d* shall apply to the materials and construction of welded shells intended for the carriage of anhydrous hydrofluoric acid and aqueous solutions of hydrofluoric acid of 6°.

211 821 Shells intended for the carriage of the substances referred to in 211 810 (*b*) shall be designed for a calculation pressure (see 211 127 (2)) of not less than 1.0 MPa (10 bar) gauge pressure.

Where the use of aluminium is necessary for shells intended for the carriage of nitric acid of 2° (a), such shells shall be made of aluminium not less than 99.5% pure, in which case, by derogation from the provisions of the paragraph above, the wall thickness need not exceed 15 mm.

211 822 Shells intended for the carriage of the substances referred to in 211 810 (*c*) shall be designed for a calculation pressure (see 211 127 (2)) of not less than 0.4 MPa (4 bar) gauge pressure.

Shells intended for the carriage of monochloroacetic acid of 31° (b) shall be equipped with an enamel or equivalent lining if the material of the shell is attacked by that acid.

Shells and their items of equipment intended for the carriage of aqueous solutions of hydrogen peroxide of 62° shall be made of aluminium not less than 99.5% pure or of a suitable steel not causing hydrogen peroxide to decompose.

Notwithstanding the provisions of the first paragraph, the wall thickness need not be greater than 15 mm when the shells are made of pure aluminium.

211 823 Shells intended for the carriage of the powdery or granular substances referred to in 211 810 (*d*) shall be designed in accordance with the requirements of Part I of this Appendix.

211 824-
211 829

*Section 3.* ITEMS OF EQUIPMENT

211 830 All openings of shells intended for the carriage of substances of 6°, 7° and 24° shall be above the surface level of the liquid. No pipes or pipe connections shall pass through the walls of the shell below the surface level of the liquid. Shells shall be capable of being hermetically closed[6] and the closures shall be capable of being protected by lockable caps. In addition, the cleaning openings referred to in marginal 211 132 shall not be permitted.

211 831 Shells intended for the carriage of the substances referred to in 211 810 (*b*), (*c*) and (*d*) may also be of the bottom-discharge type.

211 832 If shells intended for the carriage of the substances referred to in 211 810 (*b*) are fitted with safety valves, a bursting disc shall be placed before the valve. The arrangement of the bursting disc and safety valve shall be such as to satisfy the competent authority.

211 833 Shells intended for the carriage of sulphur trioxide of 1° (a) shall be thermally insulated and fitted with a heating device on the outside.

211 834 Shells and their service equipment intended for carriage of hypochlorite solutions of 61° and of aqueous solutions of hydrogen peroxide of 62° shall be so designed as to prevent the entry of foreign matter, leakage of liquid or any building up of dangerous excess pressure inside the shell.

211 835-
211 839

*Section 4.* TYPE APPROVAL

211 840-
211 849 (No special requirements)

*Section 5.* TESTS

211 850 Shells intended for the carriage of anhydrous hydrofluoric acid or aqueous solutions of hydrofluoric acid of 6° shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of at least 1.0 MPa (10 bar) and those intended for the carriage of substances of 7° shall be subjected to initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar).

Shells intended for the carriage of substances of 6° and 7° shall be inspected every 3 years for resistance to corrosion, by means of suitable instruments (e.g. by ultrasound).

The materials of every welded shell intended for the carriage of anhydrous hydrofluoric acid and aqueous solutions of hydrofluoric acid of 6° shall be tested by the method described in Appendix B.1 *d*.

211 851 Shells intended for the carriage of bromine of 24° or of the substances referred to in 211 810 (*b*) and (*c*) shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar). The hydraulic pressure test for shells intended for the carriage of sulphur trioxide of 1° (a) shall be repeated every three years. Shells made of pure aluminium and intended for the carriage of nitric acid of 2° (a) and of aqueous solutions of hydrogen peroxide of 62° need be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of only 0.25 MPA (2.5 bar).

The condition of the lining of shells intended for the carriage of bromine of 24° shall be inspected every year by an expert approved by the competent authority, who shall inspect the inside of the shell.

211 852 Shells intended for the carriage of the substances referred to in 211 810 (*d*) shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 211 123.

211 853-
211 859

*Section 6.* MARKING

211 860 Shells intended for the carriage of anhydrous hydrofluoric acid or aqueous solutions of hydrofluoric acid of 6°, or bromine of 24°, shall bear in addition to the particulars referred to in 211 160 an indication of the maximum

permissible load mass in kg and the date (month, year) of the most recent internal inspection of the shell.

211 861-
211 869

*Section 7.* OPERATION

211 870 Shells intended for the carriage of sulphur trioxide of 1° (a) shall not be filled to more than 88% of their capacity; those intended for the carriage of bromine of 24° shall be filled to not less than 88% and not more than 92% of their capacity or to 2.86 kg per litre of capacity.

Shells intended for the carriage of anhydrous hydrofluoric acid or aqueous solutions of hydrofluoric acid of 6° shall not be filled to more than 0.84 kg per litre of capacity.

211 871 Shells intended for the carriage of substances of 6°, 7° and 24° shall be hermetically closed[6] during carriage and the closures shall be protected with locked caps.

211 872-
211 999

## APPENDIX B.1 *b*

### PROVISIONS CONCERNING TANK-CONTAINERS

NOTE. Part I sets out the requirements applicable to tank-containers intended for the carriage of substances of all Classes. Part II contains particular requirements supplementing or modifying the requirements of Part I.

### PART I. REQUIREMENTS APPLICABLE TO ALL CLASSES

212 000-
212 099

*Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

NOTE. In accordance with the provisions of marginal 10 121 (1), the carriage of dangerous substances in tank-containers is permitted only where expressly authorized for such substances in each of the Sections 1 of Part II of this Appendix.

212 100 These requirements shall apply to tank-containers of a capacity of more than 0.45 $m^3$ which are used for the carriage of liquid, gaseous, powdery or granular substances, and to their fittings and accessories.

212 101 A tank-container comprises a shell and items of equipment, including the equipment to facilitate movement of the tank-container without significant change of attitude.

212 102 In the following requirements:

(1) (*a*) "Shell" means the tank proper (including the openings and their closures);

(*b*) "Service equipment" of the shell means filling and emptying, venting, safety, heating and heat-insulating devices and measuring instruments; and

(*c*) "Structural equipment" means the internal or external reinforcing, fastening, protective or stabilizing members of the shell.

(2) (*a*) "Calculation pressure" means a theoretical pressure at least equal to the test pressure which, according to the degree of danger exhibited by the substance being carried, may to a greater or lesser degree exceed the working pressure. It is used solely to determine the thickness of the walls of the shell, independently of any external or internal reinforcing device;

(*b*) "Test pressure" means the highest effective pressure which arises in the shell during the pressure test;

(*c*) "Filling pressure" means the maximum pressure actually built up in the shell when it is being filled under pressure;

(*d*) "Discharge pressure" means the maximum pressure actually built up in the shell when it is being discharged under pressure;

(*e*) "Maximum working pressure (gauge pressure)" means the highest of the following three pressures:

(i) The highest effective pressure allowed in the shell during filling ("maximum filling pressure allowed");

(ii) The highest effective pressure allowed in the shell during discharge ("maximum discharge pressure allowed"); and

(iii) The effective gauge pressure to which the shell is subjected by its contents (including such extraneous gases as it may contain) at the maximum working temperature.

Unless the special requirements for each Class provide otherwise, the numerical value of this working pressure (gauge pressure) shall not be lower than the vapour pressure (absolute pressure) of the filling substance at 50°C.

For shells equipped with safety valves (with or without bursting disc), the maximum working pressure (gauge pressure) shall however be equal to the prescribed opening pressure of such safety valves.

(3) "Leakproofness test" means a test which consists in subjecting the shell to an effective internal pressure equal to the maximum working pressure, but not less than 20 kPa (0.2 bar) (gauge pressure), using a method approved by the competent authority.

For shells equipped with venting systems and a safety device to prevent the contents spilling out if the shell overturns, the pressure for the leakproofness test shall be equal to the static pressure of the filling substance.

212 103-
212 119

*Section 2.* CONSTRUCTION

212 120 Shells shall be designed and constructed in accordance with the provisions of a technical code recognized by the competent authority, but the following minimum requirements shall be met:

(1) Shells shall be made of suitable metallic materials which, unless other temperature ranges are prescribed in the various Classes, shall be resistant to brittle fracture and to stress corrosion cracking between −20°C and +50°C.

(2) For welded shells only materials of faultless weldability whose adequate impact strength at an ambient temperature of −20°C can be guaranteed, particularly in the welds and the zones adjacent thereto, shall be used.

(3) Welds shall be skilfully made and shall afford the fullest safety. For the execution and checking of weld beads, see also 212 127 (6). Shells whose minimum wall thicknesses have been determined in accordance with 212 127 (3) and (4) shall be checked by the methods described in the definition of the weld coefficient of 0.8.

(4) The materials of shells or of their protective linings which are in contact with the contents shall not contain substances liable to react dangerously with the contents, to form dangerous compounds, or substantially to weaken the material.

(5) The protective lining shall be so designed that its leakproofness remains intact, whatever the deformation liable to occur in normal conditions of the carriage (212 127 (1)).

(6) If contact between the substance carried and the material used for the construction of the shell entails a progressive decrease in the thickness of the walls, this thickness shall be increased at manufacture by an appropriate amount. This additional thickness to allow for corrosion shall not be taken into consideration in calculating the thickness of the shell walls.

212 121 Shells, their attachments and their service and structural equipment shall be designed to withstand without loss of contents (other than quantities of gas escaping through any degassing vents):

— Static and dynamic stresses in normal conditions of carriage;

— Prescribed minimum stresses as defined in 212 125 and 212 127.

212 122 The pressure on which the wall thickness of the shell is based shall not be less than the calculation pressure, but the stresses referred to in marginal 212 121 shall also be taken into account.

212 123 Unless specially prescribed otherwise in the various Classes, the following particulars shall be taken into account in the design of shells:

(1) Gravity-discharge shells intended for the carriage of substances having a vapour pressure not exceeding 110 kPa (1.1 bar) (absolute pressure) at 50°C shall be designed for a calculation pressure of twice the static pressure of the substance to be carried but not less than twice the static pressure of water.

(2) Pressure-filled or pressure-discharge shells intended for the carriage of substances having a vapour pressure not exceeding 110 kPa (1.1 bar) (absolute pressure) at 50°C shall be designed for a calculation pressure equal to 1.3 times the filling or discharge pressure.

(3) Shells intended for the carriage of substances having a vapour pressure of more than 110 kPa (1.1 bar) but not more than 175 kPa (1.75 bar) (absolute pressure at 50°C shall, whatever their filling or discharge system, be designed for a calculation pressure of not less than 0.15 MPa (1.5 bar) gauge pressure or 1.3 times the filling or discharge pressure, whichever is the higher.

(4) Shells intended for the carriage of substances having a vapour pressure of more than 175 kPa (1.75 bar) (absolute pressure) at 50°C shall, whatever their filling or discharge system, be designed for a calculation pressure equal to 1.3 times the filling or discharge pressure but not less than 0.4 MPa (4 bar) gauge pressure.

212 124 Tank-containers intended to contain certain dangerous substances shall be provided with additional protection. This may take the form of additional thickness of the shell (such additional thickness being determined in the

light of the dangers inherent in the substance concerned: see the relevant classes) or of a protective device.

212 125 At the test pressure, the stress σ (sigma) at the most severely stressed point of the shell shall not exceed the material-dependent limits prescribed below. Allowance shall be made for any weakening due to the welds. In addition, in choosing the material and determining wall thickness, the maximum and minimum filling and working temperatures should be taken into account.

(1) For metals and alloys exhibiting a clearly-defined yield point or characterized by a guaranteed conventional yield stress (Re) (generally 0.2% of residual elongation and, in the case of austenitic steels, 1% of maximum elongation):

(*a*) Where the ratio Re/Rm is not more than 0.66

(Re = apparent yield stress, or 0.2% proof stress or 1% proof stress in the case of austenitic steels;

Rm = guaranteed minimum tensile strength):

$$\sigma \leq 0.75 \text{ Re}$$

(*b*) Where the ratio Re/Rm exceeds 0.66:

$$\sigma \leq 0.5 \text{ Rm}$$

(*c*) Ratios of Re/Rm exceeding 0.85 are not allowed for steels used in the construction of welded tanks.

(2) For metals and alloys exhibiting no apparent yield stress and characterized by a guaranteed minimum tensile strength Rm:

$$\sigma \leq 0.43 \text{ Rm}$$

(3) For steel, the elongation at fracture in per cent shall be not less than

$$\frac{10{,}000}{\text{determined tensile strength in N/mm}^2}$$

but in any case for fine grained steels it shall be not less than 16% and nor less than 20% for other steels. For aluminium alloys the elongation at fracture shall be not less than 12%.[1]

212 126 All parts of a tank-container intended for the carriage of liquids having a flashpoint of 55°C or below or for the carriage of inflammable gases shall be capable of being electrically earthed. Any metal contact which might encourage electrochemical corrosion shall be avoided.

212 127 Tank-containers shall be capable of withstanding the stresses specified in paragraph (1) and the wall thickness of the shells shall be at least that prescribed in paragraphs (2)-(5) below.

(1) Tank-containers and their fastenings shall, under the maximum permissible load mass, be capable of absorbing the stresses equal to those exerted by:

— In the direction of travel: twice the total mass;

[1] 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 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 $F_0$ indicates the initial cross-section area of the test-piece.

— Horizontally at right angles to the direction of travel: the total mass;

(where the direction of travel is not clearly determined, twice the total mass in each direction);

— Vertically upwards: the total mass; and

— Vertically downwards: twice the total mass.

Under each force the safety factors to be complied with shall be the following:

— For metals having a clearly-defined yield point: a safety factor of 1.5 in relation to the guaranteed apparent yield stress; or,

— For metals with no clearly-defined yield point: a safety factor of 1.5 in relation to the guaranteed 0.2% proof stress, and in the case of austenitic steels the 1% maximum elongation.

(2) The thickness of the cylindrical wall of the shell and of the ends and cover plates shall be not less than the value determined by the following formulae:

$$e = \frac{P_{MPa} \times D}{2 \times \sigma \times \lambda} \text{ (in mm)} \quad e = \frac{P_{bar} \times D}{20 \times \sigma \times \lambda} \text{ (in mm)}$$

where $P_{MPa}$ = calculation pressure in MPa;

$P_{bar}$ = calculation pressure in bar;

$D$ = internal diameter of shell in mm;

$\sigma$ = permissible stress, as defined in 212 125 (1) and (2), in $N/mm^2$;

$\lambda$ = a coefficient, not exceeding 1, allowing for any weakening due to welds.

The thickness shall in no case be less than the values prescribed in paragraphs (3) and (4) below.

(3) The walls, ends and cover-plates of shells not more than 1.80 m in diameter[2] shall be not less than 5 mm thick if of mild steel[3] (in conformity with the provisions of 212 125) or of equivalent thickness if of another metal. Where the diameter exceeds 1.80 m[2], this thickness shall be increased to 6 mm if the tank is of mild steel[3] (in conformity with the provisions of 212 125) or to an equivalent thickness if the tank is of another metal.

Whatever the metal used, the thickness of the shell wall shall in no case be less than 3 mm.

[2] For shells not of circular cross-section, for example box-shaped or elliptical shells, the indicated diameters shall correspond to those calculated on the basis of a circular cross-section of the same area. For such shapes of cross-section the radius of convexity of the shell wall shall not exceed 2,000 mm at the sides or 3,000 mm at the top and bottom.

[3] "Mild steel" means a steel having a minimum breaking strength between 360 $N/mm^2$ and 440 $N/mm^2$.

"Equivalent thickness" means the thickness obtained by the following formula:

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{Rm_1 \times A_1}}$$ [4]

(4) Where protection of the shell against damage is provided, the competent authority may allow the aforesaid minimum thicknesses to be reduced in proportion to the protection provided; however, the said thicknesses shall not be less than 3 mm in the case of mild steel,[3] or than an equivalent thickness in the case of other materials, for shells not more than 1.80 m in diameter.[2] For shells of a diameter exceeding 1.80 m[2] this minimum thickness shall be increased to 4 mm in the case of mild steel[3] and to an equivalent thickness in the case of other metals. "Equivalent thickness" means the thickness obtained by the following formula:

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{Rm_1 \times A_1}}$$ [4]

(5) The protection referred to under (4) may consist of over-all external structural protection as in "sandwich" construction where the sheathing is secured to the shell, or a structure in which the shell is supported by a complete skeleton including longitudinal and transverse structural members, or double-wall construction.

Where the shells are made with double walls, the space between being evacuated of air, the aggregate thickness of the outer metal wall and the shell wall shall correspond to the minimum wall thickness prescribed in (3), the thickness of the wall of the shell itself being not less than the minimum thickness prescribed in (4).

Where shells are made with double walls with an intermediate layer of solid materials at least 50 mm thick, the outer wall shall have a thickness of not less than 0.5 mm if it is made of mild steel[3] or at least 2 mm if it is made of a plastics material reinforced with glass fibre. Solid foam with an impact absorption capacity such as that, for example, of polyurethane foam, may be used as the intermediate layer of solid material.

(6) The manufacturer's qualification for performing welding operations shall be one recognized by the competent authority. Welding shall be performed by skilled welders using a welding process whose effectiveness (including any heat treatments required) has been demonstrated by test. Non-destructive tests shall be carried out by radiography or by ultrasound and must confirm that the quality of the welding is appropriate to the stresses.

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[4] This formula is derived from the general formula

$$e_1 = e_0 \sqrt[3]{\frac{Rm_0 \times A_0}{Rm_1 \times A_1}}$$

where $Rm_0$ = 360;
$A_0$ = 27 for the reference mild steel;
$Rm_1$ = minimum tensile strength of the metal chosen, in N/mm²; and
$A_1$ = minimum elongation of the metal chosen on fracture under tensile stress, in per cent.

In determining the thickness of the shell walls in accordance with (2), the following values of the coefficient lambda (λ) should be adopted for the welds:

— 0.8: where the weld beads are so far as possible inspected visually on both faces and are subjected to a non-destructive spot check with particular attention to connections;

— 0.9: where all longitudinal beads throughout their length, all connections, 25% of circular beads, and welds for the assembly of large-diameter items of equipment are subjected to non-destructive checks. Beads shall be checked visually on both sides as far as possible;

— 1.0: where all beads are subjected to non-destructive checks and are so far as possible inspected visually on both sides. A weld test-piece shall be taken.

Where the competent authority has doubts regarding the quality of weld beads, it may require additional checks.

(7) Measures shall be taken to protect shells against the risk of deformation as a result of a negative internal pressure.

(8) The thermal insulation shall be so designed as not to hinder access to, or the operation of, filling and discharge devices and safety valves.

212 128-
212 129

*Section 3.* ITEMS OF EQUIPMENT

212 130 The items of equipment shall be so arranged as to be protected against the risk of being wrenched off or damaged during carriage or handling. They shall exhibit a suitable degree of safety comparable to that of the shells themselves and shall in particular:

— Be compatible with the substances carried;

— Meet the requirements of 212 121.

The leakproofness of the service equipment shall be ensured even in the event of the overturning of the tank-container. The gaskets shall be made of material compatible with the substance carried and shall be replaced as soon as their effectiveness is impaired, for example as a result of ageing. Gaskets ensuring the leakproofness of fittings requiring manipulation during normal use of the tank-containers shall be so designed and arranged that manipulation of the fittings incorporating them does not damage them.

212 131 Every bottom-discharge tank-container, and in the case of compartmented bottom-discharge tank-containers every compartment, shall be equipped with two mutually independent shut-off devices, the first being an internal stop-valve[5] fixed directly to the shell and the second being a sluice-valve or other equivalent device[6], mounted in series, one at each end of the discharge pipe. In addition, the openings shall be capable of being closed by means of screw-threaded plugs, blank flanges or other equally effective devices.

The internal stop-valve shall be operable from above or from below. Its setting — open or closed — shall so far as possible in each case be capable

[5] Except in the case of shells intended for the carriage of certain crystallizable or highly viscous substances, of deeply refrigerated liquefied gases or of powdery or granular substances.

[6] In the case of tank-containers of less than 1 $m^3$ capacity, the sluice-valve or other equivalent device may be replaced by a blank flange.

of being verified from the ground. Internal stop-valve control devices shall be so designed as to prevent any unintended opening through impact or an inadvertent act.

The internal shut-off device shall continue to be effective in the event of damage to the external control device.

In order to avoid any loss of contents in the event of damage to the external discharge fittings (pipes, lateral shut-off devices), the internal stop-valve and its seating shall be protected against the danger of being wrenched off by external stresses or shall be so designed as to resist them. The filling and discharge fittings (including flanges or threaded plugs) and any protective covers shall be capable of being secured against any unintended opening.

The position and/or direction of closure of the valves shall be clearly apparent.

The shell or each of its compartments shall be provided with an opening large enough to permit inspection.

212 132 Shells intended for the carriage of substances for which all the openings are required to be above the surface level of the liquid may be equipped, in the lower part of the body, with a cleaning aperture (fist-hole). This aperture shall be capable of being sealed by a flange so closed as to be leakproof, the design of which shall be approved by the competent authority or by a body designated by that authority.

212 133 Tank-containers intended for the carriage of liquids having a vapour pressure of not more than 110 kPa (1.1 bar) (absolute pressure) at 50°C shall have a venting system and a safety device to prevent the contents from escaping from the shell if the tank-container overturns; or they shall conform to the requirements of 212 134 or 212 135 below.

212 134 Tank-containers intended for the carriage of liquids having a vapour pressure of not more than 110 kPa (1.1 bar) but not exceeding 175 kPa (1.75 bar) (absolute pressure) at 50°C shall have a safety valve set at not less than 0.15 MPa (1.5 bar) (gauge pressure) and such that it is fully open at a pressure not exceeding the test pressure; or they shall conform to the requirements of 212 135.

212 135 Tank-containers intended for the carriage of liquids having a vapour pressure of more than 175 kPa (1.75 bar) but not exceeding 300 kPa (3 bar) (absolute pressure) at 50°C shall be equipped with a safety valve set at not less than 0.3 MPa (3 bar) gauge pressure and such that it is fully open at a pressure not exceeding the test pressure; or they shall be hermetically closed.[7]

212 136 No movable parts such as covers, closures, etc., which are liable to come into frictional or percussive contact with aluminium shells intended for the carriage of inflammable liquids having a flashpoint of not more than 55°C or for the carriage of inflammable gases may be made of unprotected corrodible steel.

212 137-
212 139

*Section 4.* TYPE APPROVAL

212 140 The competent authority or a body designated by that authority shall issue in respect of each new type of tank-container a certificate attesting that the

[7] "Hermetically closed" shells means shells whose openings are hermetically closed and which are not equipped with safety valves, bursting discs or other similar safety devices. Shells having safety valves preceded by a bursting disc shall be deemed to be hermetically closed.

prototype tank-container, including fastenings, which it has inspected is suitable for the purpose for which it is intended and meets the construction requirements of Section 2, the equipment requirements of Section 3 and the special conditions for the classes of substance carried. If the tank-containers are manufactured in series without modification, this approval shall be valid for the entire series. The test results, the substances and/or groups of substances for the carriage of which the tank-container is approved and its approval number as a prototype shall be specified in a test report. The substances of a group of substances shall be of a similar kind and equally compatible with the characteristics of the shell. The substances or groups of substances permitted shall be specified in the test report, with their chemical names or the corresponding collective heading in the list of substances, and with their class and item number. The approval number shall consist of the distinguishing sign[8] of the State in whose territory the approval was granted, and a registration number.

212 141-
212 149

*Section 5.* TESTS

212 150 Shells and their equipment shall either together or separately undergo an initial inspection before being put into service. This inspection shall include:

— A check of conformity to the approved prototype;

— A check of the design characteristics;[9]

— An examination of the internal and external condition;

— A hydraulic pressure test[10] at the test pressure indicated on the data plate; and

— A check of satisfactory operation of the equipment.

The hydraulic pressure test shall be carried out before the installation of such thermal insulation as may be necessary. If the shells and their equipment are tested separately, they shall be jointly subjected after assembly to a leakproofness test in accordance with 212 102 (3).

212 151 Shells and their equipment shall undergo periodic inspections at fixed intervals. The periodic inspections shall include an external and internal examination and, as a general rule, a hydraulic pressure test.[10] Sheathing for thermal or other insulation shall be removed only to the extent required for reliable appraisal of the characteristics of the shell.

In the case of shells intended for the carriage of powdery or granular substances, and with the agreement of the expert approved by the competent authority, the periodic hydraulic pressure tests may be omitted and replaced by leakproofness tests in accordance with 212 102 (3).

The maximum intervals for inspections shall be five years.

Tank-containers, empty, uncleaned, may also be moved after expiration of this period for the purpose of undergoing the test.

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[8] Distinguishing signs for use in international traffic as provided by the 1968 (Vienna) Convention and Road Traffic.*

* United Nations, *Treaty Series*, vol. 1042, p. 17.

[9] The check of the design characteristics shall include, for shells requiring a test pressure of 1 MPa (10 bar) or higher, the taking of weld test-pieces (work samples) in accordance with the tests in Appendix B.1 *d*.

[10] In special cases, and with the agreement of the expert approved by the competent authority, the hydraulic pressure test may be replaced by a pressure test using another liquid or gas, where such an operation does not entail any danger.

212 152 In addition, a leakproofness test of the shell with its equipment in accordance with 212 102 (3) and a check of the satisfactory operation of all the equipment shall be carried out at least every two and a half years.

212 153 When the safety of the shell or of its equipment may have been impaired as a result of repairs, alterations or accident, an exceptional check shall be carried out.

212 154 The tests, inspections and checks in accordance with 212 150 to 212 153 shall be carried out by the expert approved by the competent authority. Certificates shall be issued showing the results of these operations.

212 155-
212 159

*Section 6.* MARKING

212 160 Each tank-container shall be fitted with a corrosion-resistant metal plate permanently attached to the shell in a place readily accessible for inspection. The following particulars at least shall be marked on the plate by stamping or by any other similar method. These particulars may be engraved directly on the walls of the shell itself if the walls are so reinforced that the strength of the shell is not impaired:

— Approval number;

— Manufacturer's name or mark;

— Manufacturer's serial number;

— Year of manufacture;

— Test pressure(*) (gauge pressure);

— Capacity(*) — in the case of multiple-element tank-containers: capacity of each element;

— Design temperature(*) (only if above 50°C or below −20°C);

— Date (month and year) of initial test and most recent periodic test in accordance with 212 150 and 212 151;

— Stamp of the expert who carried out the tests; and

— Material of the shell and, where appropriate, the protective lining.

In addition, the maximum permissible working pressure shall be inscribed on pressure-filled or pressure-discharge shells.

(*) The units of measurement should be indicated after numerical values.

212 161 The following particulars shall be inscribed either on the tank-container itself or on a plate:

— Names of owner and of operator;

— Capacity of the shell;(*)

— Tare;(*)

— The maximum permissible laden mass; and

— Name of substance carried.(11)

(*) The units of measurement should be indicated after numerical values.

(11) A collective description covering a group of substances of a similar nature and equally compatible with the characteristics of the shell may be given instead of the name.

212 162-
212 169

*Section 7.* OPERATION

212 170 During carriage, tank-containers shall be fixed on the carrying vehicle in such a way as to be adequately protected by the fittings of the carrying vehicle or of the tank-container itself against lateral and longitudinal impact and against overturning.[12] If the shells, including the service equipment, are so constructed as to withstand impact and overturning they need not be protected in this way. The thickness of the walls of the shell shall remain, throughout its period of use, not less than the minimum value required by 212 127 (2).

212 171 Shells shall not be loaded with any dangerous substances other than those for whose carriage they have been approved and which, in contact with the materials of the shell, gaskets, equipment and protective linings, are not liable to react dangerously with them, to form dangerous products or appreciably to weaken the material. Foodstuffs shall not be carried in these shells unless the necessary steps have been taken to prevent any harm to public health.

212 172 (1) The following degrees of filling shall not be exceeded in tank-containers intended for the carriage of liquids at ambient temperatures:

(*a*) For inflammable substances without additional risks (e.g. not toxic or corrosive), in tank-containers with a venting system or with safety valves (even where preceded by a bursting disc):

$$\text{degree of filling} = \frac{100}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity;}$$

(*b*) For toxic or corrosive substances (whether inflammable or not) in tank-containers with a venting system or with safety valves (even where preceded by a bursting disc):

$$\text{degree of filling} = \frac{98}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity;}$$

(*c*) For inflammable substances, harmful or slightly corrosive substances whether these be inflammable or not in hermetically-closed shells without safety device:

$$\text{degree of filling} = \frac{97}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity;}$$

(*d*) For highly toxic, toxic, highly corrosive or corrosive substances (whether or not inflammable) in hermetically-closed shells without safety device:

$$\text{degree of filling} = \frac{95}{1 + \alpha\,(50 - t_F)}\ \%\ \text{of capacity.}$$

[12] Examples of protection of shells:
1. Protection against lateral impact may, for example, consist of longitudinal bars protecting the shell on both sides at the level of the median line.
2. Protection against overturning may, for example, consist of reinforcing rings or bars fixed transversally in relation to the frame.
3. Protection against rear impact may, for example, consist of a bumper or frame.

(2) In these formulae, $\alpha$ is the mean coefficient of cubic expansion of the liquid between 15°C and 50°C, i.e. for a maximum variation in temperature of 35°C.

$$\alpha \text{ is calculated by the formula: } \alpha = \frac{d_{15} - d_{50}}{35 \times d_{50}}$$

where $d_{15}$ and $d_{50}$ are the density of the liquid at 15°C and 50°C respectively. $t_F$ is the mean temperature of the liquid during filling.

(3) The provisions of (1) shall not apply to shells whose contents are, by means of a heating device, maintained at a temperature above 50°C during carriage. In this case the degree of filling at the outset shall be such, and the temperature so regulated, that the shell is not full to more than 95% of its capacity and that the filling temperature is not exceeded, at any time during carriage.

(4) Where hot substances are loaded, the temperature of the outer surface of the shell or of the thermal insulation shall not exceed 70°C during carriage.

212 173 If the shells of tank-containers intended for the carriage of liquids[13] are not divided by partitions or surge plates into sections of not more than 7,500 litres capacity, they shall be filled to not less than 80% of their capacity unless they are nominally empty.

212 174 Tank-containers shall be closed so that the contents cannot spill out uncontrolled. The openings of bottom-discharge shells shall be closed by means of screw-threaded plugs, blank flanges or other equally effective devices. The leakproofness of the closures of the shells, in particular at the top of the dip-tube, shall be checked by the consignor after the shell is filled.

212 175 Where several closure systems are fitted in a series, that nearest to the substance being carried shall be closed first.

212 176 No dangerous residue of the filling substance shall adhere to the outside of a tank-container during transport either laden or empty.

212 177 To be accepted for carriage, empty tank-containers, uncleaned, shall be closed in the same manner and be leakproof in the same degree as though they were full.

212 178-
212 179

*Section 8.* TRANSITIONAL MEASURES

212 180 Tank-containers constructed before the entry into force of the provisions applicable from 1 January 1988 which do not conform to those provisions but were constructed according to the requirements of ADR in force before that date may still be used.

212 181-
212 189

[13] Substances whose kinematic viscosity at 20°C is less than 2,680 mm²/s shall be deemed to be liquids for the purposes of this provision.

*Section 9.* USE OF TANK-CONTAINERS APPROVED FOR MARITIME TRANSPORT

212 190 Tank-containers which do not fully meet the requirements of this appendix but which have been approved in accordance with the requirements concerning maritime transport[14] shall be accepted for carriage.

In addition to the particulars already prescribed, the transport document shall bear the words: "Carriage in accordance with marginal 212 190."

Only substances authorized under marginal 10 121 (1) may be carried in tank-containers.

212 191-
212 199

PART II. SPECIAL REQUIREMENTS SUPPLEMENTING OR MODIFYING THE REQUIREMENTS OF PART I

*Class 2.* GASES, COMPRESSED, LIQUEFIED OR DISSOLVED UNDER PRESSURE

212 200-
212 209

*Section 1.* GENERAL, SCOPE (USE OF TANKS-CONTAINERS), DEFINITIONS

*Use*

212 210 Gases of marginal 2201, except those listed below, may be carried in tank-containers:

Fluorine and silicon tetrafluoride of 1° (at); nitric oxide of 1° (ct); mixtures of hydrogen with not more than 10% hydrogen selenide or phosphine or silane or germane by volume or with not more than 15% arsine by volume; mixtures of nitrogen or rare gases (containing not more than 10% xenon by volume) with not more than 10% hydrogen selenide or phosphine or silane or germane by volume or with not more than 15% arsine by volume of 2° (bt); mixtures of hydrogen with not more than 10% diborane by volume; mixtures of nitrogen or rare gases (containing not more than 10% xenon by volume) with not more than 10% diborane by volume of 2° (ct), boron chloride, chlorine trifluoride, nitrosyl chloride, sulphuryl fluoride and tungsten hexafluoride of 3° (at); methylsilane of 3° (b); arsine, dichlorosilane, dimethylsilane, hydrogen selenide and trimethylsilane of 3° (bt); cyanogen, cyanogen chloride and ethylene oxide of 3° (ct); mixtures of methylsilanes of 4° (bt); ethylene oxide containing not more than 50% by mass methyl formate of 4° (ct); silane of 5° (b); substances of 5° (bt) and (ct); dissolved acetylene of 9° (c); and the gases of 12° and 13°.

212 211-
212 219

*Section 2.* CONSTRUCTION

212 220 Shells intended for the carriage of substances of 1° to 6° and 9° shall be made of steel.

In the case of weldless shells by derogation from 212 125 (3) a minimum elongation at fracture of 14° and also a stress σ (sigma) lower than or equal to limits hereafter given according to the material may be accepted.

[14] These requirements are contained in Section 13 of the General Introduction to the International Maritime Dangerous Goods (IMDG) Code published by the International Maritime Organization, London.

(*a*) When the ratio Re/Rm of the minimum guaranteed characteristics after heat treatment is higher than 0.66 without exceeding 0.85: $\sigma \leq 0.75$ Re.

(*b*) When the ratio Re/Rm of the minimum guaranteed characteristics after heat treatment is higher than 0.85: $\sigma \leq 0.5$ Rm.

212 221 The requirements of Appendix B.1*d* shall apply to the materials and construction of welded shells.

212 222 Shells intended for the carriage of chlorine or phosgene of 3° (at) shall be designed for a calculation pressure (see 212 127 (2)) of at least 2.2 MPa (22 bar) gauge pressure.

212 223-
212 229

*Section 3.* ITEMS OF EQUIPMENT

212 230 The discharge pipes of shells shall be capable of being closed by blank flanges or some other equally reliable device.

212 231 Shells intended for the carriage of liquefied gases may, in addition to the openings prescribed in 212 131 and 212 132, be provided with openings for the fitting of gauges, thermometers, manometers and with bleed holes, as required for their operation and safety.

212 232 Safety devices shall meet the following requirements:

(1) Filling and discharge openings of shells of a capacity exceeding 1 $m^3$ intended for the carriage of liquefied inflammable and/or toxic gases shall be equipped with an instant-closing internal safety device which closes automatically in the event of an unintended movement of the tank-container or of fire. It shall also be possible to operate the closing device by remote control.

(2) All openings, other than those for the accommodation of safety valves and closed bleed holes, of shells intended for the carriage of liquefied inflammable and/or toxic gases shall, if their nominal diameter is more than 1.5 mm, be equipped with an internal shut-off device.

(3) By derogation from the provisions of (1) and (2), shells intended for the carriage of deeply-refrigerated inflammable and/or toxic liquefied gases may be equipped with external devices in place of internal devices if the external devices have a protection at least equivalent to that afforded by the wall of the shell.

(4) If the shells are equipped with gauges, these shall not be of a transparent material in direct contact with the substance carried. If there are thermometers they shall not project directly into the gas or liquid through the shell wall.

(5) Shells intended for the carriage of chlorine, sulphur dioxide and phosgene of 3° (at), methyl mercaptan and hydrogen sulphide of 3° (bt) shall not have any opening below the surface level of the liquid. In addition, the cleaning apertures (fist holes) referred to in 212 132 shall not be permitted.

(6) Filling and discharge orifices situated in the upper part of shells shall be equipped with, in addition to what is prescribed in (1), a second, external, closing device. This device shall be capable of being closed by a blank flange or some other equally reliable device.

212 233 Safety valves shall meet the conditions prescribed in (1), (2) and (3) below.

(1) Shells intended for the carriage of gases of 1° to 6° and 9° may be fitted with not more than two safety valves whose aggregate clear cross-sectional

area of passage at the seating or seatings shall be not less than 20 $cm^2$ per 30 $m^3$ or part thereof of the receptacle's capacity. These safety valves shall be capable of opening automatically under a pressure of from 0.9 to 1.0 times the test pressure of the shell to which they are fitted. They shall be of such a type as to resist dynamic stresses, including liquid surge. The use of deadweight or counterweight valves is prohibited.

Shells intended for the carriage of gases of 1° to 9° harmful to the respiratory organs or entailing a poison risk[15] shall not have safety valves unless the safety valves are preceded by a bursting disc. In the latter case, the arrangement of the bursting disc and the safety valve shall be satisfactory to the competent authority.

Where tank-containers are intended for carriage by sea, the provisions of this paragraph shall not prohibit the fitting of safety valves conforming to the regulations governing that mode of transport.

(2) Shells intended for the carriage of gases of 7° and 8° shall be fitted with two independent safety valves; each valve shall be so designed as to allow the gases formed by evaporation during normal operation to escape from the shell in such a way that the pressure does not at any time exceed by more than 10% the working pressure indicated on the shell. One of the two safety valves may be replaced by a bursting disc which shall be such as to burst at the test pressure.

In the event of loss of the vacuum in a double-walled shell, or of destruction of 20% of the insulation of a single-walled shell, the safety valve and the bursting disc shall permit an outflow such that the pressure in the shell cannot exceed the test pressure.

(3) The safety valves of shells intended for the carriage of gases of 7° and 8° shall be capable of opening at the working pressure indicated on the shell. They shall be so designed as to function faultlessly even at the lowest working temperature. The reliability of their operation at that temperature shall be established and checked either by testing each valve or by testing a specimen valve of each design type.

212 234 *Thermal insulation*

(1) If shells intended for the carriage of liquefied gases of 3° and 4° are equipped with thermal insulation, such insulation shall consist of either:

— A sun shield covering not less than the upper third but not more than the upper half of the shell surface and separated from the shell by an air space at least 4 cm across; or

— A complete cladding, of adequate thickness, of insulating materials.

(2) Shells intended for the carriage of gases of 7° and 8° shall be thermally insulated. The thermal insulation shall be protected by means of continuous sheathing. If the space between the shell and the sheathing is under vacuum (vacuum insulation), the protective sheathing shall be so designed as to withstand without deformation an external pressure of at least 0.1 MPa (1 bar) (gauge pressure). Notwithstanding 212 102 (2) (*a*) external and internal reinforcing devices may be taken into account in the calculations. If the sheathing is so closed as to be gas-tight, a device shall be provided to

[15] Gases identified by the letter "t" in the list of substances are deemed to be gases harmful to the respiratory organs or entailing a poison risk.

prevent any dangerous pressure from developing in the insulating layer in the event of inadequate gas-tightness of the shell or of its items of equipment. This device shall prevent the infiltration of moisture into the heat-insulating sheath.

(3) Shells intended for the carriage of liquefied gases having a boiling point below − 182°C at atmospheric pressure shall not include any combustible material either in the thermal insulation or in the fastenings.

The fastening of shells intended for the carriage of argon, nitrogen, helium and neon of 7° (a) and hydrogen of 7° (b) may, with the consent of the competent authority, contain plastics substances between the shell and the sheathing.

212 235 (1) The following are considered to be elements of a multiple-element tank-container:

— Receptacles as defined in marginal 2212 (1) (*b*); or

— Tanks as defined in marginal 2212 (1) (*c*).

The provisions of this Appendix do not apply to frames of cylinders conforming to marginal 2212 (1) (*d*).

(2) For multiple-element tank-containers, the following conditions shall be complied with;

(*a*) If one of the elements of a multiple-element tank-container is fitted with a safety valve and shut-off devices are provided between the elements, every element shall be so fitted.

(*b*) The filling and discharge devices may be fitted to a manifold.

(*c*) Each element of a multiple-element tank-container intended for the carriage of compressed gases of 1° and 2° which are harmful to the respiratory organs or entail a poison risk[15] shall be capable of being isolated by a valve.

(*d*) The elements of a multiple-element tank-container intended for the carriage of liquefied gases of 3° to 6° shall be so designed that they can be filled separately and be kept isolated by a valve capable of being sealed.

212 236 By derogation from the provisions of 212 131 shells intended for the carriage of deeply-refrigerated liquefied gases need not have an inspection aperture.

212 237-
212 239

*Section 4.* TYPE APPROVAL

212 240-
212 249 (No special requirements)

*Section 5.* TESTS

212 250 The materials of every welded shell shall be tested according to the method described in Appendix B.1 *d*.

212 251 The test pressure values shall be as follows:

(1) For shells intended for the carriage of gases of 1° and 2°: the values indicated in marginal 2219 (1) and (3).

(2) For shells intended for the carriage of gases of 3° and 4°:

(*a*) If the shells are not more than 1.5 m in diameter, the values indicated in marginal 2220 (2):

(*b*) If the shells are more than 1.5 m in diameter, the values[16] indicated below:

| *Description of substance* | *Item number* | *Minimum test pressure for shells* | | *Maximum mass of contents per litre of capacity* |
|---|---|---|---|---|
| | | *With thermal insulation* | *Without thermal insulation* | |
| | | *MPa* | *MPa* | *kg* |
| Bromochlorodifluoromethane (R 12 B1) | 3° (a) | 1.0 | 1.0 | 1.61 |
| Chlorodifluoromethane (R 22) | 3° (a) | 2.4 | 2.6 | 1.03 |
| Chloropentafluoroethane (R 115) | 3° (a) | 2.0 | 2.3 | 1.08 |
| 1-Chloro-2,2,2-trifluoroethane (R 133a) | 3° (a) | 1.0 | 1.0 | 1.18 |
| Dichlorodifluoromethane (R 12) | 3° (a) | 1.5 | 1.6 | 1.15 |
| Dichlorofluoromethane (R 21) | 3° (a) | 1.0 | 1.0 | 1.23 |
| 1,2-Dichloro-1,1,2,2-tetrafluoroethane (R 114) | 3° (a) | 1.0 | 1.0 | 1.30 |
| Octafluorocyclobutane (RC 318) | 3° (a) | 1.0 | 1.0 | 1.34 |
| Ammonia | 3° (at) | 2.6 | 2.9 | 0.53 |
| Chlorine | 3° (at) | 1.7 | 1.9 | 1.25 |
| Hexafluoropropylene (R 1216) | 3° (at) | 1.7 | 1.9 | 1.11 |
| Hydrogen bromide | 3° (at) | 5.0 | 5.5 | 1.54 |
| Methyl bromide | 3° (at) | 1.0 | 1.0 | 1.51 |
| Nitrogen dioxide $NO_2$ | 3° (at) | 1.0 | 1.0 | 1.30 |
| Phosgene | 3° (at) | 1.5 | 1.7 | 1.23 |
| Sulphur dioxide | 3° (at) | 1.0 | 1.2 | 1.23 |
| Butane | 3° (b) | 1.0 | 1.0 | 0.51 |
| 1-Butene | 3° (b) | 1.0 | 1.0 | 0.53 |
| 1-Chloro-1,1-difluoroethane (R 142b) | 3° (b) | 1.0 | 1.0 | 0.99 |
| Cis-2-butene | 3° (b) | 1.0 | 1.0 | 0.55 |
| Cyclopropane | 3° (b) | 1.6 | 1.8 | 0.53 |
| 1,1-Difluoroethane (R 152a) | 3° (b) | 1.4 | 1.6 | 0.79 |
| Dimethyl ether | 3° (b) | 1.4 | 1.6 | 0.58 |
| Isobutane | 3° (b) | 1.0 | 1.0 | 0.49 |
| Isobutene | 3° (b) | 1.0 | 1.0 | 0.52 |
| Propane | 3° (b) | 2.1 | 2.3 | 0.42 |
| Propylene | 3° (b) | 2.5 | 2.7 | 0.43 |
| Trans-2-butene | 3° (b) | 1.0 | 1.0 | 0.54 |
| 1,1,1-Trifluoroethane | 3° (b) | 2.8 | 3.2 | 0.79 |
| Dimethylamine | 3° (bt) | 1.0 | 1.0 | 0.59 |
| Ethylamine | 3° (bt) | 1.0 | 1.0 | 0.61 |
| Ethyl chloride | 3° (bt) | 1.0 | 1.0 | 0.80 |
| Hydrogen sulphide | 3° (bt) | 4.5 | 5.0 | 0.67 |
| Methylamine | 3° (bt) | 1.0 | 1.1 | 0.58 |
| Methyl chloride | 3° (bt) | 1.3 | 1.5 | 0.81 |
| Methyl mercaptan | 3° (bt) | 1.0 | 1.0 | 0.78 |

[16] (i) The prescribed test pressures are:

(*a*) If the shell is equipped with thermal insulation, at least equal to the vapour pressure, reduced by 0.1 MPa (1 bar) of the liquid at 60°C, and not less than 1 MPa (10 bar);

(*b*) If the shell is not equipped with thermal insulation, at least equal to the vapour pressure, reduced by 0.1 MPa (1 bar), of the liquid at 65°C, and not less than 1 MPa (10 bar);

(ii) In view of the high toxicity of phosgene of (3° (at)), the minimum test pressure for this gas shall be 1.5 MPa (15 bar) if the shell is equipped with thermal insulation and 1.7 MPa (17 bar) if it is not so equipped;

(iii) The maximum values in kg/litre prescribed for the degree of filling are calculated as follows: maximum mass of contents per litre of capacity = 0.95 × density of the liquid phase at 50°C.

| *Description of substance* | *Item number* | *Minimum test pressure for shells* | | *Maximum mass of contents per litre of capacity* |
|---|---|---|---|---|
| | | *With thermal insulation* | *Without thermal insulation* | |
| | | *MPa* | *MPa* | *kg* |
| Trimethylamine | 3° (bt) | 1.0 | 1.0 | 0.56 |
| 1,2-Butadiene | 3° (c) | 1.0 | 1.0 | 0.59 |
| 1,3-Butadiene | 3° (c) | 1.0 | 1.0 | 0.55 |
| Vinyl chloride | 3° (c) | 1.0 | 1.1 | 0.81 |
| Methyl vinyl ether | 3° (ct) | 1.0 | 1.0 | 0.67 |
| Trifluorochloroethylene (R 1113) | 3° (ct) | 1.5 | 1.7 | 1.13 |
| Vinyl bromide | 3° (ct) | 1.0 | 1.0 | 1.37 |
| Mixture F 1 | 4° (a) | 1.0 | 1.1 | 1.23 |
| Mixture F 2 | 4° (a) | 1.5 | 1.6 | 1.15 |
| Mixture F 3 | 4° (a) | 2.4 | 2.7 | 1.03 |
| Mixture of gases R 500 | 4° (a) | 1.8 | 2.0 | 1.01 |
| Mixture of gases R 502 | 4° (a) | 2.5 | 2.8 | 1.05 |
| Mixtures of 19 to 21% by mass dichlorodifluoromethane (R 12) and 79 to 81% by mass bromochlorodifluoromethane (R 12 B1) | 4° (a) | 1.0 | 1.1 | 1.50 |
| Mixtures of methyl bromide and chloropicrin | 4° (at) | 1.0 | 1.0 | 1.51 |
| Mixture A (trade name: butane) | 4° (b) | 1.0 | 1.0 | 0.50 |
| Mixture A 0 (trade name: butane) | 4° (b) | 1.2 | 1.4 | 0.47 |
| Mixture A 1 | 4° (b) | 1.6 | 1.8 | 0.46 |
| Mixture B | 4° (b) | 2.0 | 2.3 | 0.43 |
| Mixture C (trade name: propane) | 4° (b) | 2.5 | 2.7 | 0.42 |
| Mixtures of hydrocarbons containing methane | 4° (b) | — | 22.5 | 0.187 |
| | | — | 30.0 | 0.244 |
| Mixtures of methyl chloride and methylene chloride | 4° (bt) | 1.3 | 1.5 | 0.81 |
| Mixtures of methyl chloride and chloropicrin | 4° (bt) | 1.3 | 1.5 | 0.81 |
| Mixtures of methyl bromide and ethylene bromide | 4° (bt) | 1.0 | 1.0 | 1.51 |
| Methylacetylene/propadiene and hydrocarbon mixtures | | | | |
| Mixture $P_1$ | 4° (c) | 2.5 | 2.8 | 0.49 |
| Mixture $P_2$ | 4° (c) | 2.2 | 2.3 | 0.47 |
| Mixtures of 1,3-butadiene and hydrocarbons of 3° (b) | 4° (c) | 1.0 | 1.0 | 0.50 |
| Ethylene oxide containing not more than 10% carbon dioxide by mass | 4° (ct) | 2.4 | 2.6 | 0.73 |
| Ethylene oxide with nitrogen up to a total pressure of 1 MPa (10 bar) at 50°C | 4° (ct) | 1.5 | 1.5 | 0.78 |
| Dichlorodifluoromethane containing 12% ethylene oxide by mass | 4° (ct) | 1.5 | 1.6 | 1.09 |

(3) For shells intended for the carriage of gases of 5° and 6°:

(*a*) If the shells are not sheathed in thermal insulation: the values indicated in marginal 2220 (3) and (4);

(*b*) If the shells are sheathed in thermal insulation: the values indicated below:

| *Description of substance* | *Item number* | *Minimum test pressure MPa* | *Maximum mass of contents per litre of capacity kg* |
|---|---|---|---|
| Bromotrifluoromethane (R 13 B1) | 5° (a) | 12.0 | 1.50 |
| Carbon dioxide | 5° (a) | 19.0 | 0.73 |
| | | 22.5 | 0.78 |
| Chlorotrifluoromethane (R 13) | 5° (a) | 12.0 | 0.96 |
| | | 22.5 | 1.12 |
| Hexafluoroethane (R 116) | 5° (a) | 16.0 | 1.28 |
| | | 20.0 | 1.34 |
| Nitrous oxide ($N_2O$) | 5° (a) | 22.5 | 0.78 |
| Sulphur hexafluoride | 5° (a) | 12.0 | 1.34 |
| Trifluoromethane (R 23) | 5° (a) | 19.0 | 0.92 |
| | | 25.0 | 0.99 |
| Xenon | 5° (a) | 12.0 | 1.30 |
| Hydrogen chloride | 5° (at) | 12.0 | 0.69 |
| Ethane | 5° (b) | 12.0 | 0.32 |
| Ethylene | 5° (b) | 12.0 | 0.25 |
| | | 22.5 | 0.36 |
| 1,1-Difluoroethylene | 5° (c) | 12.0 | 0.66 |
| | | 22.5 | 0.78 |
| Vinyl fluoride | 5° (c) | 12.0 | 0.58 |
| | | 22.5 | 0.65 |
| Mixture of gases R 503 | 6° (a) | 3.1 | 0.11 |
| | | 4.2 | 0.21 |
| | | 10.0 | 0.76 |
| Carbon dioxide containing not more than 35% ethylene oxide by mass | 6° (c) | 19.0 | 0.73 |
| | | 22.5 | 0.78 |
| Ethylene oxide containing more than 10% but not more than 50 per cent carbon dioxide by mass | 6° (ct) | 19.0 | 0.66 |
| | | 25.0 | 0.75 |

Where shells sheathed in thermal insulation are used which have been subjected to a test pressure lower than that shown in the table, the maximum mass of the contents per litre of capacity shall be such that the pressure reached in the shell by the substance in question at 55°C does not exceed the test pressure stamped on the shell. In such a case the maximum load allowed shall be prescribed by the expert approved by the competent authority.

(4) For shells intended for the carriage of ammonia dissolved under pressure of 9° (at), the values indicated below:

| *Description of substance* | *Item number* | *Minimum test pressure MPa* | *Maximum mass of contents per litre of capacity kg* |
|---|---|---|---|
| Ammonia dissolved under pressure in water | | | |
| — With more than 35% but not more than 40% ammonia by mass | 9° (at) | 1.0 | 0.80 |
| — With more than 40% but not more than 50% ammonia by mass | 9° (at) | 1.0 | 0.77 |

(5) For shells intended for the carriage of gases of 7° and 8°: not less than 1.3 times the maximum permitted working pressure indicated on the shell, but not less than 0.3 MPa (3 bar) (gauge pressure); for shells with vacuum insulation the test pressure shall be not less than 1.3 times the maximum permitted working pressure increased by 0.1 MPa (1 bar).

212 252 The first hydraulic pressure test shall be carried out before the thermal insulation is placed in position.

212 253 The capacity of each shell intended for the carriage of gases of 3° to 6° and 9° shall be determined, under the supervision of an expert approved by the competent authority, by weighing or volumetric measurement of the quantity of water which fills the shell; any error in the measurement of shell capacity shall be of less than 1%. Determination by a calculation based on the dimensions of the shell is not permitted. The maximum filling masses allowed in accordance with marginals 2220 (4) and 212 251 (3) shall be prescribed by an approved expert.

212 254 Checking of the welds shall be carried out in accordance with the lambda-coefficient 1.0 requirements of 212 127 (6).

212 255 Notwithstanding the requirements of section 5 of Part I of this Appendix, the periodic tests shall take place:

(1) Every two and a half years in the case of tank-containers intended for the carriage of boron trifluoride of 1° (at), town gas of 2° (bt), chlorine, hydrogen bromide, nitrogen dioxide, phosgene or sulphur dioxide of 3° (at), hydrogen sulphide of 3° (bt), or hydrogen chloride of 5° (at);

(2) After eight years' service and thereafter every 12 years in the case of tank-containers intended for the carriage of gases of 7° and 8°. A leak-proofness check may be performed, at the request of the competent authority, between any two successive tests.

212 256 In the case of vacuum-insulated shells the hydraulic-pressure test and the check of the internal condition may, with the consent of the approved expert, be replaced by a leakproofness test and measurement of the vacuum.

212 257 If apertures have been made, on the occasion of periodic inspections, in shells intended for the carriage of gases of 7° or 8°, the method by which they are hermetically closed before the shells are replaced in service shall be approved by the approved expert and shall ensure the integrity of the shell.

212 258 The leakproofness test of shells intended for the carriage of gases of 1° to 6° and 9° shall be carried out at a pressure of not less than 0.4 MPa (4 bar) and not more than 0.8 MPa (8 bar) gauge pressure.

212 259

*Section 6.* MARKING

212 260 The following additional particulars shall be marked by stamping or by any other similar method on the plate prescribed in 212 160, or directly on the walls of the shell itself if the walls are so reinforced that the strength of the shell is not impaired:

(1) On shells intended for the carriage of only one substance: the name of the gas in full.

This indication shall be supplemented in the case of shells intended for the carriage of compressed gases of 1° and 2° by an indication of the maximum filling pressure at 15°C allowed for the shell, and in the case of shells intended for the carriage of liquefied gases of 3° to 8° or of ammonia

dissolved under pressure of 9° (at) by an indication of the maximum permissible load mass in kg and of the filling temperature if below −20°C;

(2) On multi-purpose shells: the names, in full, of the gases for whose carriage the shell is approved.

These particulars shall be supplemented by an indication of the maximum permissible load mass in kg for each gas.

(3) On shells intended for the carriage of gases of 7° or 8°: the working pressure; and

(4) On shells equipped with thermal insulation: the inscription "thermally insulated" or "thermally insulated by vacuum".

212 261 The frame of a multiple-element tank-container shall bear near the filling point a plate specifying:

— The test pressure of the elements;(*)

— The maximum permissible loading pressure at 15°C(*) for the elements intended for compressed gases;

— The number of elements;

— The total capacity(*) of the elements;

— The name of the gas in full;

and, in addition, in the case of liquefied gases:

— The maximum permissible load mass(*) per element.

(*) The units of measurement should be indicated after numerical values.

212 262 In addition to the particulars prescribed in 212 161, the following shall be inscribed either on the tank-container itself or on a plate:

(*a*) Either: "minimum filling temperature allowed: −20°C", or: "minimum filling temperature allowed: . . .";

(*b*) Where the shell is intended for the carriage of one substance only:

— The name of the gas in full;

— For liquefied gases of 3° to 8° and for ammonia dissolved under pressure in water of 9° (at), the maximum permissible load mass in kg;

(*c*) Where the shell is a multi-purpose shell: the names in full of all the gases to whose carriage the shell is assigned, with an indication of the maximum permissible load mass in kg for each of them;

(*d*) Where the shell is equipped with thermal insulation: the inscription "thermally insulated" or "thermally insulated by vacuum", in an official language of the country of registration, and also, if that language is not English, French or German, in English, French or German, unless any international agreements concluded between the countries concerned in the transport operation provide otherwise.

212 263-
212 269

*Section 7.* OPERATION

212 270 A shell assigned at different times to the carriage of different liquefied gases of 3° to 8° (multi-purpose shells) may not carry substances other than those listed in one, and one only, of the following groups:

— Group 1: halogenated hydrocarbons of 3° (a) and 4° (a);

— Group 2: hydrocarbons of 3° (b) and 4° (b), butadienes of 3° (c) and mixtures of 1,3-butadiene and hydrocarbons of 4° (c);

— Group 3: ammonia of 3° (at); dimethyl ether of 3° (b); dimethylamine, ethylamine, methylamine and trimethylamine of 3° (bt); and vinyl chloride of 3° (c);

— Group 4: methyl bromide of 3° (at); ethyl chloride and methyl chloride of 3° (bt);

— Group 5: mixtures of ethylene oxide with carbon dioxide and of ethylene oxide with nitrogen of 4° (ct);

— Group 6: nitrogen, carbon dioxide, rare gases, nitrous oxide $N_2O$, and oxygen of 7° (a); air, mixtures of nitrogen with rare gases, and mixtures of oxygen with nitrogen, also when they contain rare gases, of 8° (a);

— Group 7: ethane, ethylene, and methane of 7° (b); and mixtures of methane with ethane, also when they contain propane or butane of 8° (b).

212 271 Shells which have been filled with a substance of group 1 or group 2 shall be emptied of liquefied gas before being loaded with another substance belonging to the same group. Shells which have been filled with a substance of groups 3 to 7 shall be completely emptied of liquefied gas and then blown down before being loaded with another substance belonging to the same group.

212 272 The multiple use of shells for the carriage of liquefied gases of the same group shall be allowed if all the requirements prescribed for the gases to be carried in one and the same shell are observed. Such multiple use shall be subject to approval by an approved expert.

212 273 The multiple use of shells for the carriage of gases of different groups shall be allowed if permitted by the approved expert.

When shells are reassigned to gases of a different group, the shells shall be completely emptied of liquefied gases, then blown down and, lastly, degassed. The degassing of shells shall be verified and certified by the approved expert.

212 274 When loaded tanks or empty but uncleaned tanks are handed over for carriage, only the particulars specified in 212 262 applicable to the gas loaded or just discharged shall be visible; all particulars concerning other gases shall be covered up.

212 275 All the elements of a multiple-element tank-container shall contain only one and the same gas. In the case of a multiple-element tank-container intended for the carriage of liquefied gases of 3° to 6°, the elements shall be filled separately and be kept isolated by a sealed valve.

212 276 The maximum filling pressure for compressed gases of 1° and 2° other than boron trifluoride of 1° (at) shall not exceed the values prescribed in 2219 (2).

For boron trifluoride of 1° (at) the maximum filling mass per litre of capacity shall not exceed 0.86kg.

The maximum filling mass per litre of capacity according to marginal 2220 (2), (3) and (4) and 212 251 (2), (3) and (4) shall be abided by.

212 277 The degree of filling of shells intended for the carriage of gases of 7° (b) and 8° (b) shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the valve-opening pressure, the volume of the liquid would reach 95% of the capacity of the shell at that temperature. Shells intended for the carriage of gases of 7° (a)

and 8° (a) may be filled to 98% at the loading temperature and the loading pressure.

212 278 On shells intended for the carriage of nitrous oxide and oxygen of 7° (a), air or mixtures containing oxygen of 8° (a), substances containing grease or oil shall not be used to ensure leakproofness of the joints or for the maintenance of the closures.

212 279 The requirement in 212 175 shall not apply to gases of 7° and 8°.

212 280-
212 299

## *Class 3.* INFLAMMABLE LIQUIDS

212 300-
212 309

### *Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

*Use*

212 310 The following substances of marginal 2301 may be carried in tank-containers:

(*a*) Substances listed by name in 12°;

(*b*) Substances classified under (a) of 11°, 14° to 23°, 25° and 26° and comparable substances to be classified under (a) of those items, with the exception of isopropyl chloroformate of 25° (a);

(*c*) Substances classified under (b) of 11°, 14° to 20°, 22° and 24° to 26° and comparable substances to be classified under (b) of those items;

(*d*) Substances of 1° to 6° and 31° to 34° and comparable substances to be classified under those items, with the exception of nitromethane of 31° (c).

212 311-
212 319

### *Section 2.* CONSTRUCTION

212 320 Shells intended for the carriage of substances of 12° specified by name shall be designed for a calculation pressure (see 212 127 (2)) of not less than 1.5 MPa (15 bar) gauge pressure.

212 321 Shells intended for the carriage of the substances referred to in 212 310 (*b*) shall be designed for a calculation pressure (see marginal 212 127 (2)) of not less than 1.0 MPa (10 bar) gauge pressure.

212 322 Shells intended for the carriage of the substances referred to in 212 310 (*c*) shall be designed for a calculation pressure (see 212 127 (2)) of not less than 0.4 MPa (4 bar) gauge pressure.

212 323 Shells intended for the carriage of the substances referred to in 212 310 (*d*) shall be designed in accordance with the requirements of Part I of this Appendix.

212 324-
212 329

### *Section 3.* ITEMS OF EQUIPMENT

212 330 All openings of shells intended for the carriage of the substances referred to in 212 310 (*a*) and (*b*) shall be above the surface level of the liquid. No pipes or pipe connections shall pass through the walls of the shell below the

surface level of the liquid. Shells shall be capable of being hermetically closed[7] and the closures shall be capable of being protected with lockable caps.

212 331 Shells intended for the carriage of the substances referred to in 212 310 (*c*) and (*d*) may also be of the bottom-discharge type. Shells intended for the carriage of the substances referred to in 212 310 (*c*) shall be capable of being hermetically closed.[7]

212 332 If shells intended for the carriage of the substances referred to in 212 310 (*a*), (*b*) or (*c*) are fitted with safety valves, a bursting disc shall be placed before the valve. The arrangement of the bursting disc and safety valve shall be such as to satisfy the competent authority. If shells intended for the carriage of the substances referred to in 212 310 (*d*) are equipped with safety valves or a venting system, these shall satisfy the requirements of 212 133 to 212 135. Shells intended for the carriage of the substances referred to in 212 310 (*d*) having a flash-point not exceeding 55°C and equipped with a venting system which cannot be closed shall have a flame-trap in the venting system.

212 333-
212 339

*Section 4.* TYPE APPROVAL

212 340-
212 349 (No special requirements)

*Section 5.* TESTS

212 350 Shells intended for the carriage of the substances referred to in 212 310 (*a*), (*b*) or (*c*) shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar).

212 351 Shells intended for the carriage of the substances referred to in 212 310 (*d*) shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 212 123.

212 352-
212 359

*Section 6.* MARKING

212 360-
212 369 (No special requirements)

*Section 7.* OPERATION

212 370 Shells intended for the carriage of the substances referred to in 212 310 (*a*), (*b*) and (*c*) shall be hermetically closed[7] during carriage. The closures of shells intended for the carriage of the substances referred to in 212 310 (*a*) and (*b*) shall be protected by a locked cap.

212 371 Tank-containers approved for the carriage of substances of 6°, 11°, 12° and 14° to 20° shall not be used for the carriage of foodstuffs, articles of consumption or animal feedstuffs.

212 372 An aluminium-alloy shell shall not be used for the carriage of acetaldehyde of 1° (a) unless the shell is reserved solely for such carriage and the acetaldehyde is free from acid.

212 373 The petrol (gasoline) referred to in the Note to 3° (b) of marginal 2301 may also be carried in tanks designed according to 212 123 (1) and having equipment conforming to 212 133.

212 374-
212 399

*Class 4.1.* INFLAMMABLE SOLIDS

*Class 4.2.* SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION

*Class 4.3.* SUBSTANCES WHICH GIVE OFF INFLAMMABLE GASES ON CONTACT WITH WATER

212 400-
212 409

*Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

*Use*

212 410 Substances of 2°, 8° and 11° of marginal 2401, of 1°, 3° and 8° of marginal 2431, sodium, potassium and alloys of sodium and potassium, of 1° (a), and substances of 2° (e) and 4° of marginal 2471 may be carried in tank-containers.

NOTE. For the carriage in bulk of sulphur of 2° (a), naphthalene of 11° (a) and (b), expandable polystyrenes of 12° of marginal 2401, substances of 5°, dust from blast-furnace filters of 6° (a) and substances of 10° of marginal 2431, and magnesium granules, coated of 1° (d), calcium carbide of 2° (a) and calcium silicide in lumps of 2° (d) of marginal 2471, see marginals 41 111, 42 111 and 43 111.

212 411-
212 419

*Section 2.* CONSTRUCTION

212 420 Shells intended for the carriage of white or yellow phosphorus of marginal 2431, 1° or substances of 2° (e) and 4° of marginal 2471 shall be designed for a calculation pressure (see 212 127 (2)) of at least 1 MPa (10 bar) gauge pressure.

212 421 Shells intended for the carriage of substances of marginal 2431, 3°, shall be designed for a calculation pressure (see 212 127 (2)) of not less than 2.1 MPa (21 bar) gauge pressure. The requirements of Appendix B.1 *d* shall apply to the materials and construction of these shells.

212 422-
212 429

*Section 3.* ITEMS OF EQUIPMENT

212 430 Shells intended for the carriage of sulphur of 2° (b) and naphthalene of 11° (c) of marginal 2401 shall be equipped with thermal insulation made of materials which are not readily inflammable. They may be equipped with valves opening automatically either inwards or outwards under the effect of a difference of pressure between 20 and 30 kPa (0.2 and 0.3 bar).

212 431 Shells intended for the carriage of white or yellow phosphorus of marginal 2431, 1°, shall meet the following requirements:

(1) The heating device shall not penetrate into, but shall be exterior to, the body of the shell. However, a pipe used for extracting the phosphorus may be equipped with a heating jacket. The heating device of the jacket shall be so regulated as to prevent the temperature of the phosphorus from exceeding the filling temperature of the shell. Other piping shall enter the shell in its upper part; openings shall be above the highest permissible level of the phosphorus and be capable of being completely enclosed under lockable caps. In addition, the cleaning apertures (fist holes) referred to in 212 132 shall not be permitted.

(2) The shell shall be equipped with a gauging system for verifying the level of the phosphorus and, if water is used as the protective agent, with a fixed gauge mark showing the highest permissible level of the water.

212 432 Shells intended for the carriage of substances of marginal 2431, 3°, or marginal 2471, 2° (e), shall not have any openings or connections below the level of the liquid, even if such openings or connections are capable of being closed. In addition, the cleaning openings (fist-holes) provided for in 212 132 shall not be permitted. Openings in the upper part of the shell, including their fittings, shall be capable of being protected by caps.

212 433 Shells intended for the carriage of substances of marginal 2471, 1° (a), shall have their openings and orifices (valves, terminals, manholes, etc.) protected by leakproof lockable caps, and shall be equipped with thermal insulation of a not readily inflammable material.

212 434-
212 439

*Section 4.* TYPE APPROVAL

212 440-
212 449 (No special requirements)

*Section 5.* TESTS

212 450 Shells intended for the carriage of sulphur in the molten state of 2° (b) or naphthalene in the molten state of 11° (c) of marginal 2401, white or yellow phosphorus of marginal 2431, 1°, and sodium, potassium, alloys of sodium or potassium of 1° (a) or substances of 2° (e) or 4° of marginal 2471 shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of at least 0.4 MPa (4 bar).

212 451 Shells intended for the carriage of substances of marginal 2431, 3°, shall undergo the initial and periodic tests with a liquid which does not react with the substance to be carried and at a test pressure of at least 1 MPa (10 bar) (gauge pressure). The materials of every shell intended for the carriage of substances of marginal 2431, 3°, shall be tested by the method described in Appendix B.1 *d*.

212 452 Shells intended for the carriage of sulphur (including flowers of sulphur) of 2° (a), substances of 8°, crude or pure naphthalene of 11° (a) and (b) of marginal 2401, or of freshly-quenched charcoal of marginal 2431, 8°, shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 212 123.

212 453-
212 459

*Section 6.* MARKING

212 460 Shells intended for the carriage of substances of marginal 2431, 3°, shall bear in addition to the particulars prescribed in 212 161 the words: "Do not open during carriage. Liable to spontaneous combustion".

Shells intended for the carriage of substances of marginal 2471, 2° (e), shall bear in addition to the particulars prescribed in 212 161 the words: "Do not open during carriage. Gives off inflammable gases on contact with water".

These particulars shall be in an official language of the country of approval, and also, if that language is not English, French or German, in English, French or German, unless any agreements concluded between the countries concerned in the transport operation provide otherwise.

212 461 Shells intended for the carriage of substances of marginal 2471, 4°, shall also have their maximum permissible load mass in kg marked on the plate prescribed in 212 160.

212 462-
212 469

*Section 7.* OPERATION

212 470 Shells intended for the carriage of sulphur of 2° (b) or naphthalene of 11° (c) of marginal 2401 shall be filled to not more than 98% of their capacity.

212 471 White or yellow phosphorus of marginal 2431, 1°, shall, if water is used as the protective agent, be covered with a depth of not less than 12 cm of water at the time of filling; the degree of filling at a temperature of 60°C shall not exceed 98%. If nitrogen is used as the protective agent, the degree of filling at a temperature of 60°C shall not exceed 96%. The remaining space shall be filled with nitrogen in such a way that, even after cooling, the pressure at no time falls below atmospheric pressure. The shell shall be hermetically closed[7] so that no leakage of gas occurs.

212 472 For the carriage of substances of marginal 2471, 1° (a), caps shall be locked in conformity with 212 433.

212 473 For trichlorosilane (silicochloroform) of 4° (b) or for methyldichlorosilane or ethyldichlorosilane of 4° (b) of marginal 2471, 4°, the degree of filling shall not exceed 1.14, 0.95 or 0.93 kg per litre of capacity respectively if filling is by mass, or 85% if filling is by volume.

212 474 Shells which have contained phosphorus of marginal 2431, 1°, shall, when handed over for carriage, be filled with either:

— Nitrogen; the sender shall certify in the transport document that the shell, after closure, is gas-tight; or

— Water to not less than 96% and not more than 98% of their capacity; between 1 October and 31 March this water shall contain one or more anti-freeze agents free from corrosive action, not liable to react with phosphorus, and sufficiently concentrated to prevent the water freezing during carriage.

Tank-containers which have contained phosphorus of marginal 2431, 1°, shall, for the purpose of the application of the requirements of marginal 42 500 (1), be considered as "empty tank-containers, uncleaned".

212 475 The degree of filling for shells containing substances of marginal 2431, 3°, or marginal 2471, 2° (e), shall not exceed 90%; a space of 5% shall remain empty when the liquid is at an average temperature of 50°C. During carriage, the substances shall be under a layer of inert gas, the gauge pressure of which shall not exceed 50 kPa (0.5 bar). The shells shall be hermetically closed[7] and the protective caps conforming to 212 432 shall be locked. Empty shells, uncleaned, shall when handed over for carriage be filled with an inert gas at a gauge pressure of up to 50 kPa (0.5 bar).

212 476-
212 499

*Class 5.1.* OXIDIZING SUBSTANCES

*Class 5.2.* ORGANIC PEROXIDES

212 500-
212 509

*Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

*Use*

212 510 The following substances of marginal 2501 may be carried in tank-containers:

Substances of 1° to 3°, solutions of 4° (as well as powdery sodium chlorate in the moist or the dry state), hot aqueous solutions of ammonium nitrate of 6° (a) in a concentration of more than 80% but not exceeding 93% on condition that:

(*a*) The pH value, measured in a 10% aqueous solution of the substance carried, is between 5 and 7;

(*b*) Solutions do not contain combustible matter in excess of 0.2% nor compounds of chlorine to such a degree that the content of chlorine exceeds 0.02%.

NOTE. For the carriage in bulk of substances of marginal 2501, 4° to 6° and 7° (a) and (b), see marginal 51 111.

Substances of 1°, 10°, 14°, 15° and 18° of marginal 2551 may be carried in tank-containers.

212 511-
212 519

*Section 2.* CONSTRUCTION

212 520 Shells intended for the carriage in the liquid state of the substances referred to in 212 510 shall be designed for a calculation pressure (see 212 127 (2)) of at least 0.4 MPa (4 bar) gauge pressure.

212 521 Shells, and their items of equipment, intended for the carriage of hydrogen peroxide or aqueous solutions of hydrogen peroxide of marginal 2501, 1°, or liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be made of aluminium not less than 99.5% pure or of suitable steel not liable to cause the hydrogen peroxide or the organic peroxides to decompose.

Where shells are made of aluminium not less than 99.5% pure, the wall thickness need not be greater than 15 mm, even where calculation in accordance with 212 127 (2) gives a higher value.

212 522 Shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), shall be made of austenitic steel.

212 523-
212 529

*Section 3.* ITEMS OF EQUIPMENT

212 530 Shells intended for the carriage of hydrogen peroxide and aqueous solutions of hydrogen peroxide containing more than 70% hydrogen peroxide, of marginal 2501, 1°, shall have their openings above the surface level of the liquid. In addition, the cleaning apertures (fist holes) referred to in 212 132 shall not be permitted. For solutions containing more than 60% but not more than 70% hydrogen peroxide, openings below the surface level of the liquid shall be permissible. In this case the shell-discharge system shall be equipped with two mutually independent shut-off devices mounted in series, the first taking the form of a quick-closing internal stop-valve of an approved type and the second that of a sluice-valve, one at each end of the discharge pipe. A blank flange, or another device providing the same measure of security, shall also be fitted at the outlet of each external sluice-valve. The internal stop-valve shall be such that if the pipe is wrenched off the stop-valve will remain integral with the shell and in the closed position. The connections to the external pipe-sockets of shells shall be made of materials not liable to cause decomposition of hydrogen peroxide.

212 531

212 532 Shells intended for the carriage of hydrogen peroxide or aqueous solutions of hydrogen peroxide of 1°, or of hot concentrated aqueous solutions of ammonium nitrate of 6° (a) of marginal 2501 shall be fitted in their upper part with a shut-off device preventing any build-up of excess pressure inside the shell, any leakage of liquid, and any entry of foreign matter into the shell. The shut-off devices of shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), shall be so designed as to preclude obstruction of the devices by solidified ammonium nitrate during carriage.

212 533 Where shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), are sheathed in thermally-insulating material, the material shall be of an inorganic nature and entirely free from combustible matter.

212 534 Shells intended for the carriage of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be equipped with a venting device fitted with a flame-trap and followed in series by a safety valve opening at a gauge pressure of 0.18 to 0.22 MPa (1.8 to 2.2 bar).

212 535 Shells intended for the carriage of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be equipped with thermal insulation complying with the requirements of 212 234 (1). The sun-shield and any part of the shell not covered by it, or the outer sheathing of a complete lagging, shall be painted white and the paint shall be cleaned before each transport journey and renewed in case of yellowing or deterioration. The thermal insulation shall be free from combustible matter.

212 536-
212 539

*Section 4.* TYPE APPROVAL

212 540 Tank-containers approved for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), shall not be approved for the carriage of other substances.

212 541-
212 549

*Section 5.* TESTS

212 550 Shells intended for the carriage of the substances referred to in 212 510 in the liquid state shall be subjected to the initial and periodic hydraulic pressure tests at a pressure of not less than 0.4 MPa (4 bar) gauge pressure. Shells intended for the carriage of the other substances referred to in 212 510 shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 212 123.

Shells of pure aluminium intended for the carriage of hydrogen peroxide or aqueous solutions of hydrogen peroxide of marginal 2501, 1°, or liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° or 18° need be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of only 0.25 MPa (2.5 bar).

212 551-
212 559

*Section 6.* MARKING

212 560-
212 569 (No special requirements)

*Section 7.* OPERATION

212 570 The inside of the shell, and all parts liable to come into contact with the substances referred to in 212 510, shall be kept clean. No lubricant capable of combining dangerously with the substance carried shall be used for pumps, valves or other devices.

212 571 Shells intended for the carriage of substances of marginal 2501, 1° to 3°, shall be filled to not more than 95% of their capacity at a reference temperature of 15°C.

Shells intended for the carriage of hot concentrated aqueous solutions of ammonium nitrate of marginal 2501, 6° (a), shall be filled to not more than 97% of their capacity, and the maximum temperature after filling shall not exceed 140°C. Tank-containers approved for the carriage of hot concentrated aqueous solutions of ammonium nitrate shall not be used for the carriage of other substances.

212 572 Shells intended for the carriage of liquid organic peroxides of marginal 2551, 1°, 10°, 14°, 15° and 18°, shall be filled to not more than 80% of their capacity. Shells shall be free from impurities at the time of filling.

212 573-
212 599

*Class 6.1.* TOXIC SUBSTANCES

212 600-
212 609

*Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

*Use*

212 610 The following substances of marginal 2601 may be carried in tank-containers:

(*a*) The substances listed by name in 2° and 3°;

(*b*) The highly toxic substances classified under (a) of 11° to 24°, 31°, 41°, 51°, 55°, 68° and 71° to 88°, carried in the liquid state, and comparable substances or solutions to be classified under (a) of those items;

(*c*) The toxic or harmful substances classified under (b) or (c) of 11° to 24°, 51° to 55°, 57° to 68° and 71° to 88°, carried in the liquid state, and comparable substances or solutions to be classified under (b) or (c) of those items;

(*d*) The toxic or harmful powdery or granular substances classified under (b) or (c) of 12°, 14°, 17°, 19°, 21°, 23°, 24°, 51° to 55°, 57° to 68° and 71° to 88°, and comparable powdery or granular substances to be classified under (b) or (c) of those items.

NOTE. For the carriage in bulk of substances of 44° (b), 60° (c) and 63° (c) and solid wastes classified under (c) of the various items, see marginal 61 111.

212 611-
212 619

*Section 2.* CONSTRUCTION

212 620 Shells intended for the carriage of substances listed by name under 2° and 3° shall be designed for a calculation pressure (see 212 127 (2)) of not less than 1.5 MPa (15 bar) gauge pressure.

212 621 Shells intended for the carriage of the substances referred to in 212 610 (*b*) shall be designed for a calculation pressure (see 212 127 (2)) of not less than 1 MPa (10 bar) gauge pressure.

212 622 Shells intended for the carriage of the substances referred to in 212 610 (*c*) shall be designed for a calculation pressure (see 212 127 (2)) of not less than 0.4 MPa (4 bar) gauge pressure.

212 623 Shells intended for the carriage of the powdery or granular substances referred to in 212 610 (*d*) shall be designed in accordance with the requirements of Part I of this Appendix.

212 624-
212 629

*Section 3.* ITEMS OF EQUIPMENT

212 630 All openings of shells intended for the carriage of the substances referred to in 212 610 (*a*) and (*b*) shall be above the surface level of the liquid. No pipe or pipe connections shall pass through the walls of the shell below the surface level of the liquid. Shells shall be capable of being hermetically closed[7] and the closures shall be capable of being protected with lockable caps. The cleaning openings (fist holes) provided for in 212 132 shall not however be permitted for shells intended for the carriage of solutions of hydrocyanic acid of 2°.

212 631 Shells intended for the carriage of the substances referred to in 212 610 (*c*) and (*d*) may also be of the bottom-discharge type. The shells shall be capable of being hermetically closed[7].

212 632 If shells are fitted with safety valves, a bursting disc shall be placed before the valve. The arrangement of the bursting disc and safety valve shall be such as to satisfy the competent authority.

212 633-
212 639

*Section 4.* TYPE APPROVAL

212 640-
212 649 (No special requirements)

*Section 5.* TESTS

212 650 Shells intended for the carriage of the substances referred to in 212 610 (*a*), (*b*) and (*c*) shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar).

212 651 Shells intended for the carriage of the substances referred to in 212 610 (*d*) shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 212 123.

212 652-
212 659

*Section 6.* MARKING

212 660-
212 669 (No special requirements)

*Section 7.* OPERATION

212 670 Shells intended for the carriage of substances of 3° shall not be filled to more than 1 kg per litre of capacity.

212 671 Shells shall be hermetically closed[7] during carriage. The closures of shells intended for the carriage of the substances referred to in 212 610 (*a*) and (*b*) shall be protected with a locked cap.

212 672 Tank-containers approved for the carriage of the substances referred to in 212 610 shall not be used for the carriage of foodstuffs, articles of consumption or animal feedstuffs.

212 673-
212 699

## *Class 7.* RADIOACTIVE SUBSTANCES

212 700-
212 709

### *Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

*Use*

212 710 In accordance with the applicable schedule of marginal 2703.

NOTE. Only liquid or solid low-specific-activity substances, LSA (I), of marginal 2703, schedule 5, including, notwithstanding the provision in 212 100, natural or depleted uranium hexafluoride[17] may be carried in tank-containers.

212 711-
212 719

### *Section 2.* CONSTRUCTION

212 720 Tank-containers intended for the transport of the substances referred to in Schedule 5, with the exception of uranium hexafluoride, shall be designed for a calculation pressure of at least 0.4 MPa (4 bar). Tank-containers intended for the transport of uranium hexafluoride shall be designed for a calculation pressure of at least 1 MPa (10 bar). When the radioactive substance is in solution or suspension in hazardous substances of other Classes and when the calculation pressures required for the tank-containers intended for the transport of the latter substances are greater, these pressures shall be applied.

212 721-
212 729

### *Section 3.* ITEMS OF EQUIPMENT

212 730 The openings of tank-containers intended for the transport of liquid radioactive substances[13] shall be above the level of the liquid and no piping or pipe connection shall pass through the walls of the shell below the surface level of the liquid.

212 731-
212 739

### *Section 4.* TYPE APPROVAL

212 740 Tank-containers approved for the transport of radioactive substances shall not be approved for the transport of any other substance.

212 741-
212 749

### *Section 5.* TESTS

212 750 The shells shall undergo the initial and periodic hydraulic pressure tests at a gauge pressure of at least 0.4 MPa (4 bar). Notwithstanding 212 151, the

[17] For enriched uranium hexafluoride, see marginal 2703, Schedule 11.

periodic internal inspection may be replaced by an ultrasonic test of the wall thickness conducted every two and a half years.

212 751-
212 759

*Section 6.* MARKING

212 760-
212 769

(No special requirements)

*Section 7.* OPERATION

212 770 The degree of filling at the reference temperature of 15°C shall not exceed 93% of the total shell capacity.

212 771 Tank-containers which have been used for the transport of radioactive substances shall not be used for the transport of other substances.

212 772-
212 799

*Class 8.* CORROSIVE SUBSTANCES

212 800-
212 809

*Section 1.* GENERAL; SCOPE (USE OF TANK-CONTAINERS); DEFINITIONS

*Use*

212 810 The following substances of marginal 2801 may be carried in tank-containers:

(*a*) The substances listed by name in 6°, 7° and 24°, and substances comparable with those of 7°;

(*b*) The highly corrosive substances classified under (a) of 1°, 2°, 3°, 10°, 11°, 21°, 26°, 27°, 32°, 33°, 36°, 37°, 39° 46°, 55°, 64°, 65° and 66°, carried in the liquid state, and comparable substances or solutions to be classified under (a) of those items;

(*c*) The corrosive or slightly corrosive substances classified under (b) or (c) of 1° to 5°, 8° to 11°, 21°, 26°, 27°, 31° to 39°, 42° to 46°, 51° to 55° and 61° to 66°, carried in the liquid state, and comparable substances or solutions to be classified under (b) or (c) of those items;

(*d*) The powdery or granular corrosive or slightly corrosive substances classified under (b) or (c) of 22°, 23°, 26°, 27°, 31°, 35°, 36°, 39°, 41°, 45°, 52°, 55° and 65°, and comparable powdery or granular substances to be classified under (b) or (c) of those items.

NOTE. For the carriage in bulk of substances of 23°, lead sludge containing sulphuric acid of 1° (b) and solid wastes classified under (c) of the various items, see marginal 81 111.

212 811-
212 819

*Section 2.* CONSTRUCTION

212 820 Shells intended for the carriage of substances listed in 6° and 24° shall be designed for a calculation pressure (see 212 127 (2)) of not less than 2.1 MPa (21 bar) gauge pressure. Shells intended for the carriage of bromine of 24° shall be provided with a lead lining not less than 5 mm thick or an equivalent lining.

Shells intended for the carriage of substances of 7° (a) shall be designed for a calculation pressure (see 212 127 (2)) of not less than 1 MPa (10 bar) and shells for the carriage of substances of 7° (b) or 7° (c) for a calculation pressure (see 212 127 (2)) of not less than 0.4 MPa (4 bar).

The requirements of Appendix B.1*d* shall apply to the materials and construction of welded shells intended for the carriage of anhydrous hydrofluoric acid and aqueous solutions of hydrofluoric acid of 6°.

212 821 Shells intended for the carriage of the substances referred to in 212 810 (*b*) shall be designed for a calculation pressure (see 212 127 (2)) of not less than 1.0 MPa (10 bar) gauge pressure.

Where the use of aluminium is necessary for shells intended for the carriage of nitric acid of 2° (a), such shells shall be made of aluminium not less than 99.5% pure; even where the calculation pressure according to 212 127 (2) gives a higher value, the wall thickness need not exceed 15 mm.

212 822 Shells intended for the carriage of the substances referred to in 212 810 (*c*) shall be designed for a calculation pressure (see 212 127 (2)) of not less than 0.4 MPa (4 bar) gauge pressure.

Shells intended for the carriage of monochloroacetic acid of 31° (b) shall be equipped with an enamel or equivalent lining if the material of the shell is attacked by that acid.

Shells and their items of equipment intended for the carriage of aqueous solutions of hydrogen peroxide of 62° shall be made of aluminium not less than 99.5% pure or of a suitable steel not causing hydrogen peroxide to decompose. If the shells are made of pure aluminium, the wall thickness need not be greater than 15 mm even where the calculation pressure according to 212 127 (2) gives a higher value.

212 823 Shells intended for the carriage of the powdery or granular substances referred to in 212 810 (*d*) shall be designed in accordance with the requirements of Part I of this Appendix.

212 824-
212 829

*Section 3.* ITEMS OF EQUIPMENT

212 830 All openings of shells intended for the carriage of substances of 6°, 7° and 24° shall be above the surface level of the liquid. No piping or pipe connections shall pass through the walls of the shell below the surface level of the liquid. In addition, the cleaning openings (fist holes) referred to in 212 132 shall not be permissible. Tank-containers shall be capable of being hermetically closed[7] and the closures shall be capable of being protected by a lockable cap.

212 831 Shells intended for the carriage of the substances referred to in 212 810 (*b*), (*c*) and (*d*) may also be of the bottom-discharge type.

212 832 If shells intended for the carriage of the substances referred to in 212 810 (*b*) are fitted with safety valves, a bursting disc shall be placed before the valve. The arrangement of the bursting disc and safety valve shall be such as to satisfy the competent authority.

212 833 Shells intended for the carriage of sulphur trioxide of 1° (a) shall be thermally insulated and fitted with a heating device on the outside.

212 834 Shells and their service equipment intended for carriage of hypochlorite solutions of 61° and of aqueous solutions of hydrogen peroxide of 62° shall

be so designed as to prevent the entry of foreign matter, leakage of liquid or any building up of dangerous excess pressure inside the shell.

212 835-
212 839

*Section 4.* TYPE APPROVAL

212 840-
212 849

(No special requirements)

*Section 5.* TESTS

212 850

Shells intended for the carriage of anhydrous hydrofluoric acid or aqueous solutions of hydrofluoric acid of 6° shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of at least 1.0 MPa (10 bar) and those intended for the carriage of substances of 7° shall be subjected to initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar).

Shells intended for the carriage of substances of 6° and 7° shall be inspected every two and a half years for resistance to corrosion, by means of suitable instruments (e.g. by ultrasound).

The materials of every welded shell intended for the carriage of anhydrous hydrofluoric acid and aqueous solutions of hydrofluoric acid of 6° shall be tested by the method described in Appendix B.1 *d*.

212 851

Shells intended for the carriage of bromine of 24° or of the substances referred to in 212 810 (*b*) and (*c*) shall be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of not less than 0.4 MPa (4 bar). The hydraulic pressure test for shells intended for the carriage of sulphur trioxide of 1° (a) shall be repeated every two and a half years. Shells made of pure aluminium and intended for the carriage of nitric acid of 2° (a) and of aqueous solutions of hydrogen peroxide of 62° need be subjected to the initial and periodic hydraulic pressure tests at a gauge pressure of only 0.25 MPa (2.5 bar).

The condition of the lining of shells intended for the carriage of bromine of 24° shall be inspected every year by an expert approved by the competent authority, who shall inspect the inside of the shell.

212 852

Shells intended for the carriage of the substances referred to in 212 810 (*d*) shall be subjected to the initial and periodic hydraulic pressure tests at their calculation pressure as defined in 212 123.

212 853-
212 859

*Section 6.* MARKING

212 860

Shells intended for the carriage of anhydrous hydrofluoric acid or aqueous solutions of hydrofluoric acid of 6°, or bromine of 24°, shall bear in addition to the particulars referred to in 212 160 an indication of the maximum permissible load mass in kg and the date (month, year) of the most recent internal inspection of the shell.

212 861-
212 869

*Section 7.* OPERATION

212 870

Shells intended for the carriage of sulphur trioxide of 1° (a) shall not be filled to more than 88% of their capacity; those intended for the carriage of bromine of 24° shall be filled to not less than 88% and not more than 92% of their capacity or to 2.86 kg per litre of capacity.

Shells intended for the carriage of anhydrous hydrofluoric acid or aqueous solutions of hydrofluoric acid of 6° shall not be filled to more than 0.84 kg per litre of capacity.

212 871 Shells intended for the carriage of substances of 6°, 7° and 24° shall be hermetically closed[7] during carriage and the closures shall be protected with a locked cap.

212 872-
212 999

## APPENDIX B.1*d*

REQUIREMENTS CONCERNING THE MATERIALS AND CONSTRUCTION OF FIXED WELDED TANKS, DEMOUNTABLE WELDED TANKS, AND WELDED SHELLS OF TANK-CONTAINERS FOR WHICH A TEST PRESSURE OF NOT LESS THAN 1 MPA (10 BAR) IS REQUIRED, AND OF FIXED WELDED TANKS, DEMOUNTABLE WELDED TANKS AND WELDED SHELLS OF TANK-CONTAINERS INTENDED FOR THE CARRIAGE OF DEEPLY-REFRIGERATED LIQUEFIED GASES OF CLASS 2

214 000-
214 249

1. *Materials and shells*

214 250 (1) Shells intended for the carriage of substances of Class 2, 1° to 6° and 9°, Class 4.2, 3° or Class 8, 6°, shall be made of steel.

(2) For shells constructed of fine-grained steels for the carriage of:

— Ammonia of marginal 2201, 3° (at) and 9° (at),

— Other substances of Class 2 whose names in marginal 2201 are followed by the word "(corrosive)", and

— Hydrofluoric acid of marginal 2801, 6°,

the steel shall have a guaranteed yield strength of not more than 460 N/mm² and a maximum ultimate tensile strength of 725 N/mm². Such shells shall be heat-treated for thermal stress relief.

(3) Shells intended for the carriage of deeply-refrigerated liquefied gases of Class 2 shall be made of steel, aluminium, aluminium alloy, copper or copper alloy, e.g. brass. However, shells made of copper or copper alloy shall be allowed only for gases containing no acetylene; ethylene, however, may contain not more than 0.005% acetylene.

(4) Only materials appropriate to the lowest and highest working temperatures of the shells and of their fittings and accessories may be used.

214 251 The following materials shall be allowed for the manufacture of shells:

(*a*) Steels not subject to brittle fracture at the lowest working temperature (see 214 265), the following may be used:

1. Mild steels (except for gases of marginal 2201, 7° and 8°);
2. Fine-grained unalloyed steels, down to a temperature of −60°C;
3. Nickel steels (with a nickel content of 0.5 to 9%), down to a temperature of −196°C, depending on the nickel content;
4. Austenitic chrome-nickel steels, down to a temperature of −270°C;

(*b*) Aluminium not less than 99.5% pure, or aluminium alloys (see 214 266);

(*c*) Deoxidized copper not less than 99.9% pure, or copper alloys having a copper content of over 56% (see 214 267).

214 252 (1) Shells made of steel, aluminium or aluminium alloys shall be either seamless or welded.

(2) Shells made of austenitic steel, copper or copper alloys may be hard-soldered.

214 253 The fittings and accessories may either be screwed to the shells or be secured thereto as follows:

(*a*) Shells made of steel, aluminium or aluminium alloy: by welding;

(*b*) Shells made of austenitic steel, of copper or of copper alloy: by welding or hard-soldering.

214 254 The construction of shells and their attachment to the vehicle, to the underframe or in the container frame shall be such as to preclude with certainty any such reduction in the temperature of the load-bearing components as would be likely to render them brittle. The means of attachment of shells shall themselves be so designed that even when the shell is at its lowest working temperature they still possess the necessary mechanical properties.

214 255-
214 264

2. *Test requirements*

(a) *Steel shells*

214 265 The materials used for the manufacture of shells and the weld beads shall, at their lowest working temperature, but at least at −20°C, meet the following requirements as to impact strength.

The tests shall be carried out with test-pieces having a V-shaped notch.

The minimum impact strength (see 214 275 to 214 277) for test-pieces with their longitudinal axis at right angles to the direction of rolling and a V-shaped notch (conforming to ISO R148 perpendicular to the plate surface, shall be 34 J/cm² for mild steel (which, because of existing ISO standards, may be tested with test-pieces having the longitudinal axis in the direction of rolling); fine-grained steel; ferritic alloy steel Ni < 5%, ferritic alloy steel 5% ≤ Ni ≤ 9% or austenitic Cr-Ni steel.

In the case of austenitic steel, only the weld bead need be subjected to an impact-strength test.

For working temperatures below −196°C the impact-strength test is not performed at the lowest working temperature, but at −196°C.

(b) *Shells made of aluminium or aluminium alloy*

214 266 The seams of shells shall meet the requirements laid down by the competent authority.

(c) *Shells made of copper or copper alloy*

214 267 It is not necessary to carry out tests to determine whether the impact strength is adequate.

214 268-
214 274

3. *Test methods*

(a) *Impact-strength tests*

214 275 For sheets less than 10 mm but not less than 5 mm thick, test-pieces having a cross-section of 10 mm × e mm, where "e" represents the thickness of the sheet, shall be used. Machining to 7.5 mm or 5 mm is permitted if it is necessary. The minimum value of 34 J/cm² shall be required in every case.

NOTE. No impact-strength test shall be carried out on sheets less than 5 mm thick, or on their weld seams.

214 276 (1) For the purpose of testing sheets, the impact strength shall be determined on three test-pieces. Test-pieces shall be taken at right angles to the direction of rolling; however, for mild steel they may be taken in the direction of rolling.

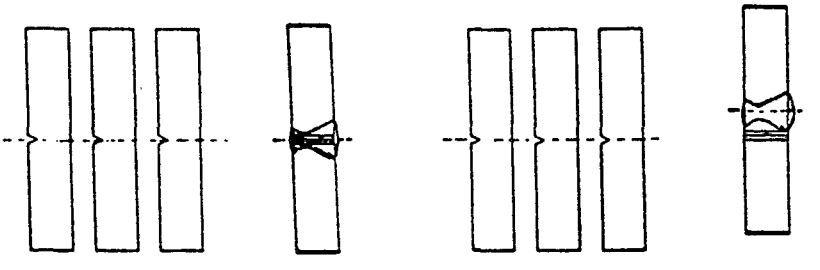
(2) For testing weld seams the test-pieces shall be taken as follows:

*When e ≤ 10 mm:*

— Three test-pieces with the notch at the centre of the weld;

— Three test-pieces with the notch in the centre of the heat affected zone;

(the V-notch to cross the fusion boundary at the centre of the specimen).



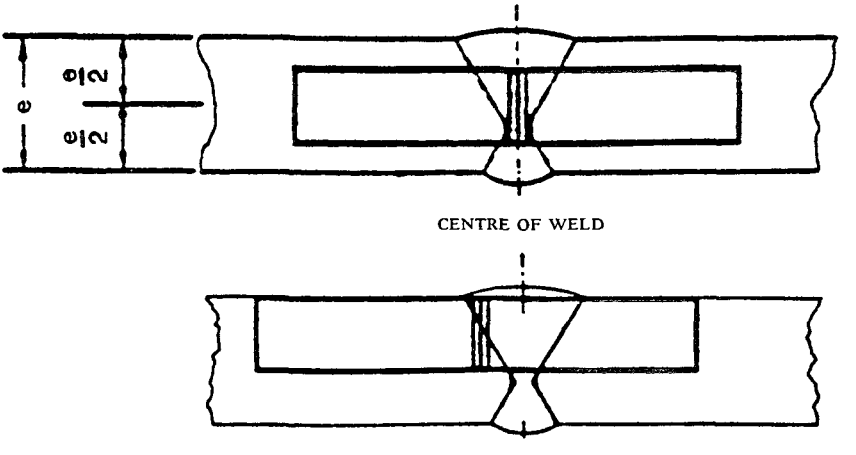
CENTRE OF WELD HEAT AFFECTED ZONE

*When 10 mm < e ≤ 20 mm:*

— Three test-pieces from the centre of the weld;

— Three test-pieces from the heat affected zone;

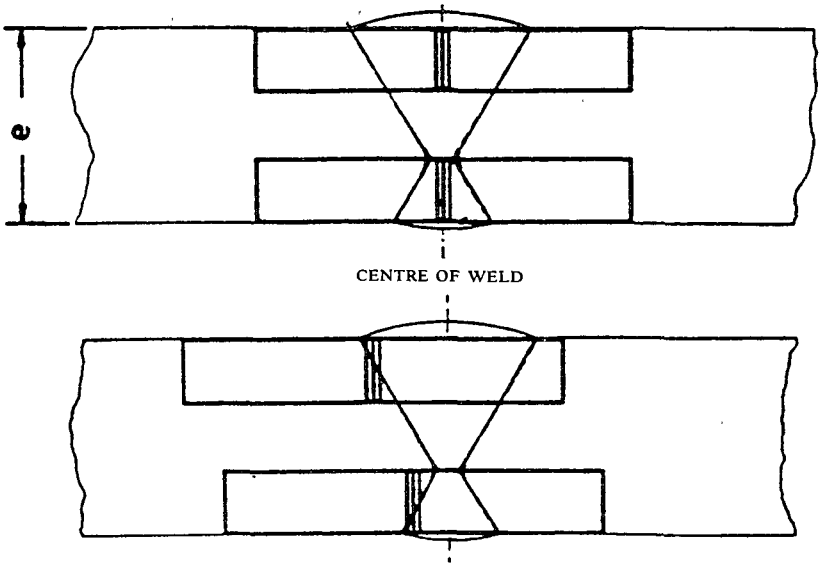
(the V-notch to cross the fusion boundary at the centre of the specimen).




CENTRE OF WELD

HEAT AFFECTED ZONE

*When e > 20 mm:* two sets of three test-pieces, one set on the upper face, one set on the lower face at each of the points indicated below (the V-notch to cross the fusion boundary at the centre of the specimen for those taken from the heat affected zone).




214 277 (1) For sheets, the average of the three tests shall meet the minimum value of 34 J/cm² indicated in 214 265; not more than one of the individual values may be below the minimum value and then not below 24 J/cm².

(2) For welds, the average value obtained from the three test-pieces taken at the centre of the weld shall not be below the minimum value of 34 J/cm²; not more than one of the individual values may be below the minimum value and then not below 24 J/cm².

(3) For the heat affected zone (the V-notch to cross the fusion boundary at the centre of the specimen) the value obtained from not more than one of the three test-pieces may be below the minimum value of 34 J/cm², though not below 24 J/cm².

214 278 If the requirements prescribed in 214 277 are not met, one retest only may be done if, (*a*) the average value of the first three tests is below the minimum value of 34 J/cm², or (*b*) more than one of the individual values is less than the minimum value of 34 J/cm² but not below 24 J/cm².

214 279 In a repeated impact test on sheets or welds, none of the individual values may be below 34 J/cm². The average value of all the results of the original test and of the retest should be equal to or more than the minimum of 34 J/cm².

In a repeated impact-strength test on the heat-affected zone, none of the individual values may be below 34 J/cm².

214 280-
[219 999][1]

[1] This reads "214 299" *in the French authentic text — Se lit « 214 299 » dans le texte authentique français.*

## TRANSPORT OF WASTES

This document is a compilation of texts of the amendments to ADR to cover the transport of wastes.

Add a paragraph (4) to marginal 2000 as follows:

"2000 (4) Wastes are substances, solutions, mixtures or articles for which no direct use is envisaged but which are transported for reprocessing, dumping, elimination by incineration or other methods of disposal."

Marginal 2002 (8), read:

"2002 (8) The following provisions shall apply to solutions and mixtures (such as preparation and wastes(*)) not mentioned by name in the lists of substances of the various Classes:

(*) See marginal 2000 (4).

NOTE 1. Solutions and mixtures comprise two or more components. These components may be either substances of ADR or substances which are not subject to the provisions of ADR.

NOTE 2. Solutions and mixtures containing one or more components of a restrictive Class are not to be accepted for carriage unless those components are listed by name in the list of substances of the restrictive Class.

(*a*) Solutions and mixtures containing only one component subject to ADR shall be regarded as substances of ADR if the concentration of the component is such that the solution or mixture continues to present a danger inherent in the component itself. They shall be classified according to the criteria of the various Classes.

(*b*) Solutions and mixtures containing two or more components subject to ADR shall be placed under an item and letter of the appropriate Class in accordance with their danger characteristics. Such classification according to the danger characteristics shall be carried out as follows:

1. Determination of the physical and chemical characteristics and physiological properties by measurement or calculation and classification according to the criteria of the various Classes.

2. If this determination is not possible without disproportionate cost or effort (as for some kinds of wastes), such solutions or mixtures shall be placed in the Class of the component presenting the predominant danger.

   The following order shall be taken into account:

   2.1. If one or more components fall within a restrictive Class and the solution or mixture presents a danger inherent in such component(s), the solution or mixture shall be placed in that Class;

   2.2. If there are components falling within two or more restrictive Classes and the solution or mixture presents a danger inherent in at least one such component, the mixture or solution shall be placed in the Class of the component presenting the predominant danger; if there is no predominant danger, classification shall be based on the following order of predominance: Classes 1a, 5.2, 2, 4.2, 4.3, 6.2;

   2.3. If there are components falling within two or more non-restrictive Classes, or when in the cases referred to in 2.1 or 2.2 the solution or mixture does not present a danger inherent in a restrictive

Class, the mixture or solution shall be placed in the Class of the component presenting the predominant danger. If there is no predominant danger, classification shall be based on the following order of precedence:

2.3.1. Classification in a Class shall take into account the various components and the order of predominance of danger indicated in the table below. For Classes 3, 6.1 and 8, account shall be taken of the degree of danger presented by the components as designated (a), (b) or (c) according to the criteria of those Classes (see marginals 2300 (3), 2600 (1) and 2800 (1)).

| Class and, where applicable, letter | 4.1 | 5.1[1] | 6.1(a)[3] | 6.1(b)[3] | 6.1(c)[3] | 8(a)[4] | 8(b)[4] | 8(c)[4] |
|---|---|---|---|---|---|---|---|---|
| 3(a)[2] | Sol. Liq. 4.1 3(a) | 3(a) | 3(a) | 3(a) | 3(a) | 3(a) | 3(a) | 3(a) |
| 3(b)[2] | Sol. Liq. 4.1 3(b) | 3(b) | 3(a) | 3(b) | 3(b) | 3(a) | 3(b) | 3(b) |
| 3(c)[2] | Sol. Liq. 4.1 3(c) | 3(c) | 6.1(a) | 6.1(b) | 3(c)[5] | 8(a) | 8(b) | 3(c) |
| 4.1 | | Sol. Liq. 4.1 5.1 | 6.1(a) | 6.1(b) | Sol. Liq. 4.1 6.1(c) | 8(a) | 8(b) | Sol. Liq. 4.1 8(c) |
| 5.1[1] | | | 6.1(a) | 6.1(b) | 5.1 | 8(a) | 8(b) | 5.1 |
| 6.1(a)[3] | | | | | | 6.1(a) | 6.1(a) | 6.1(a) |
| 6.1(b)[3] | Sol. = solid mixtures<br>Liq. = liquid mixtures and solutions | | | | | 8(a) | Sol. Liq. 6.1(b) 8(b) | 6.1(b) |
| 6.1(c)[3] | | | | | | 8(a) | 8(b) | 8(c) |

[1] These mixtures and solutions may have explosive properties, in which case they are not to be accepted for carriage unless they meet the requirements of Class 1a.

[2] Solutions or mixtures containing substances of Class 3, marginal 2301, 12° or 13° shall be placed in that Class under those items.

[3] Solutions or mixtures containing substances of Class 6.1, marginal 2601, 1° to 3° shall be placed in that Class under those items.

[4] Solutions or mixtures containing substances of Class 8, marginal 2801, 24° or 25° shall be placed in that Class under those items.

[5] Solutions or mixtures containing substances or preparations used as pesticides of Class 6.1, marginal 2601, 71° to 88°, shall be placed in that Class, under those items, if the determining percentage of the active substance of the pesticide for classification under (c) is present.

NOTE. *Example to explain the use of the table:*

Mixture consisting of an inflammable liquid classified under Class 3, letter (c), a toxic substance classified under Class 6.1, letter (b), and a corrosive substance classified under Class 8, letter (a).

*Procedure:*

The intersection of line 3(c) with column 6.1(b) gives 6.1(b).

The intersection of line 6.1(b) with column 8(a) gives 8(a).

This mixture is therefore to be classified under Class 8, letter (a).

2.3.2. Classification under an item of a specified Class in accordance with 2.3.1 shall take into account the danger characteristics of the various components of the solution

or mixture. The use of items containing a non-specific collective heading (Class 3, 20° and 26°, Class 6.1, 24°, 68° and 90°, and Class 8, 27°, 39°, 46°, 55°, 65° and 66°) in the various Classes is permissible only where classification under an item containing a specific collective heading is not possible.

NOTE. *Examples for the classification of mixtures and solutions in Classes and items:*

A solution of phenol of Class 6.1, 13° (b), in benzene of Class 3, 3° (b), is placed in Class 3, letter (b); because of the toxicity of the phenol, the solution is to be placed in Class 3 under 17° (b).

A mixture of sodium arsenate of Class 6.1, 51° (b), and sodium hydroxide of Class 8, 41° (b), is to be placed in Class 6.1 under 51° (b).

A solution of naphthalene of Class 4.1, 11° (b), in petrol of Class 3, 3° (b), is to be placed in Class 3, 3° (b)."

2002 (9) (Deleted)

*Class 1a*

2100 (1) Add:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes) containing one or more components listed in marginal 2101, see also marginal 2002 (8)."

*Class 2*

2200 (2) Add:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes) containing one or more components listed in marginal 2201, see also marginal 2002 (8)."

*Class 3*

2300 (4) Add:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes), see also marginal 2002 (8)."

2301 At the beginning of the entry for the following items, read:

— 1° "Substances and solutions and mixtures (such as preparations and wastes) having a vapour pressure. . . ."

— 2° "Substances and solutions and mixtures (such as preparations and wastes) having a vapour pressure. . . ."

— 3° "Substances and solutions and mixtures (such as preparations and wastes) having a vapour pressure. . . ."

— 20° "Highly toxic or toxic substances, solutions and mixtures (such as preparations and wastes) having. . . ."

— 26° "Highly corrosive or corrosive substances, solutions and mixtures (such as preparations and wastes) having. . . ."

— 31° "Substances, solutions and mixtures (such as preparations and wastes) having. . . ."

— 32° "Substances, solutions and mixtures (such as preparations and wastes) having. . . ."

2314 (1) Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have

been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing methanol, 3, 17° (b), ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Class 4.1*

2400 Add:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes), see also marginal 2002 (8)."

2401 1° to become 1° (a).

*Note 4:* for "1°" read "1° (a)"

Add, to follow Note 4:

"1° (b) Wastes consisting of solids containing inflammable liquids.

2414 (1) Read: "Packages containing substances of 1° (b) and 4° to 8° shall be. . ."

2416 (1) Second sentence, for "1°" read "1° (a)".

Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, earth containing toluene, 4.1, 1° (b), ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown.

*Class 4.2*

2430 Add the following Note:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes) containing one or more components listed in marginal 2431, see also marginal 2002 (8)."

2431 10°, to follow "weaving waste" add:

"wastes consisting of packing materials or cleaning rags containing residues of dyestuffs,".

2445 Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing white phosphorus, 4.2., 1°, ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Class 4.3*

2470 Add:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes) containing one or more components listed in marginal 2471, see also marginal 2002 (8)."

2481 Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have

been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing sodium, 4.3, 1° (a), ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Class 5.1*

2500 The existing Note to become Note 1.

Add the following Note 2:

"NOTE 2. For the classification of solutions and mixtures (such as preparations and wastes) see also marginal 2002 (8)."

2513 Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing chlorates, 5.1, 4° (a), ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Class 5.2*

The existing Note to become Note 1.

Add the following Note 2:

"NOTE 2. For the classification of solutions and mixtures (such as preparations and wastes) containing one or more components listed in marginal 2551, see also marginal 2002 (8)."

2565 Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing peracetic acid, 5.2, 35°, ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Class 6.1*

2600 (1) The existing Note to become Note 1.

Add the following Note 2:

"NOTE 2. For the classification of solutions and mixtures (such as preparations and wastes), see also marginal 2002 (8)."

2601 24° Read: "Organic substances and solutions and mixtures of organic substances (such as preparations and wastes) which cannot be classified under other collective headings, such as:

. . . (remainder unchanged)"

68° Read: "Inorganic substances and solutions and mixtures of inorganic substances (such as preparations and wastes) which cannot be classified under other collective headings, such as:

. . . (remainder unchanged)"

2614 (1) Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have

been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing cadmium compounds, 6.1, 61° (c), ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Class 6.2*

2650 Add:

"NOTE. For the classification of solutions and mixtures (such as preparation and wastes) containing one or more components listed in marginal 2651, see also marginal 2002 (8)."

*Class 8*

2800 (1) Add:

"NOTE. For the classification of solutions and mixtures (such as preparations and wastes), see also marginal 2002 (8)."

2801 Amend 27° and 39° as follows:

"27° Inorganic acid substances and solutions and mixtures of inorganic acid substances (such as preparations and wastes) which cannot be classified under other collective headings, such as:

. . . (remainder unchanged)

39° Organic acid substances and solutions and mixtures of organic acid substances (such as preparations and wastes) which cannot be classified under other collective headings, such as:

(*a*) . . .

(*b*) unchanged

(*c*) unchanged"

Add items 46° and 55° as follows:

"46° Inorganic basic substances and solutions and mixtures of inorganic basic substances (such as preparations and wastes) which cannot be classified under other collective headings, such as:

(*a*). . .

(*b*) . . .

(*c*) . . .

55° Organic basic substances and solutions and mixtures of organic basic substances (such as preparations and wastes) which cannot be classified under other collective headings, such as:

(*a*) . . .

(*b*) . . .

(*c*) . . ."

Amend items 65° and 66° as follows:

"65° Solid corrosive substances and mixtures (such as preparations and wastes) which cannot be classified under other collective headings, such as:

. . . (unchanged)

"66° Liquid corrosive substances, solutions and mixtures (such as preparations and wastes) which cannot be classified under other collective headings, such as:

. . . (unchanged)"

2801a Replace "45°" by "46°" and "54°" by "55°"

2814 (1) Add:

"For the carriage of wastes [see marginal 2000 (4)] the description of the goods shall be: 'Waste, containing. . .', the component(s) which has/have been used for the classification of the waste under marginal 2002 (8) to be entered under its/their chemical name(s), e.g. 'Waste, containing soda lye, 8, 42° (b), ADR'. In general, not more than the two components which most predominantly contribute to the danger or dangers of the waste need be shown."

*Amendments to ADR, Annex B*

10 014 Add a new paragraph (4) as follows:

"(4) 'Wastes' are substances, solutions, mixtures or articles for which no direct use is envisaged but which are transported for reprocessing, dumping, elimination by incineration or other methods of disposal."

41 111 Amend paragraph (3) to read:

"(3) Substances of 1° (b) and expandable polystyrenes of 12° may be carried in bulk in open but sheeted vehicles with adequate ventilation. For substances of 1° (b), appropriate measures shall be taken to ensure that no leakage of the contents, in particular liquids, can occur."

42 118 (new) Read:

"*Carriage in containers*

Small containers intended for the carriage in bulk of the substances referred to in 42 111 shall comply with the requirements of that marginal relating to vehicles."

61 111 Add new paragraph (3) to read:

"(3) Solid wastes containing substances of 44°(b), 60°(c) and 63°(c) may be carried under the same conditions as the substances themselves. Other solid wastes classified under the letter (c) of the various items may only be carried in bulk under the conditions of 61 118."

61 118 (new) Read:

"*Carriage in containers*

Containers intended for the carriage in bulk of solid wastes classified under (c) of the various items shall have complete walls and be sheeted or have a cover."

61 415 (1) After "63°(c)", add:

"and solid wastes classified under (c) of the various items."

81 111 Number existing text (1)

Add new (2) to read:

"(2) Solid wastes containing substances of 23° may be transported under the same conditions as the substances themselves. Other solid wastes classified under the letter (c) of the various items may only be carried in bulk under the conditions of 81 118."

81 118 Amend to read:

"Containers intended for the carriage in bulk of substances of 23°, lead sludge containing sulphuric acid of 1°(b) or solid wastes classified under (c) of the various items shall have complete walls and a suitable lining and be sheeted or have a cover."

*Appendix B.5*

250 000 (3) Table I, first paragraph of introduction, to read as follows:

"List of substances described under their chemical names or under collective headings which are given a specific 'substance identification number' [column (d)] [for solutions and mixtures of substances (such as preparations and wastes), see also marginal 2002 (8)]."

Amend Table II as follows:

| | *Column (b): Class and item number* |
|---|---|
| Highly toxic liquids, inflammable, having a flash-point between 21°C and 55°C..... | Add 68° |
| Toxic liquids, inflammable, having a flash-point between 21°C and 55°C..... | Add 68° |
| Harmful liquids, inflammable, having a flash-point between 21°C and 55°C ..... | Add 68° |
| Toxic solids, combustible..... | Add 68° |
| Harmful solids, combustible ..... | Add 68° |
| Toxic solids, not combustible ..... | Add 24° |
| Harmful solids, not combustible..... | Add 24° |
| Highly corrosive liquids, inflammable, having a flash-point between 21°C and 55°C..... | Add 27°, 39°, 46° and 55° |
| Corrosive or slightly corrosive liquids, inflammable, having a flash-point between 21°C and 55°C ..... | Add 27°, 46° and 55° |
| Highly corrosive liquids, not inflammable or having a flash-point above 55°C ..... | Add 39°, 46° and 55° |
| Corrosive or slightly corrosive liquids, not inflammable or having a flash-point above 55°C ..... | Add 46° and 55° |
| Corrosive or slightly corrosive solids, combustible..... | Add 27°, 46° and 55° |
| Corrosive or slightly corrosive solids, not combustible..... | Add 46° and 55° |

## MISCELLANEOUS

This document is a compilation of the miscellaneous amendments to Annexes A and B of ADR, including those to Appendix B.5

*Annex A*

2001 (4) (*b*) Read:

"(*b*) In the case of mixtures of compressed gases: the proportion of the volume indicated as a percentage of the total volume of the gaseous mixture; in the case of mixtures of liquefied gases and gases dissolved under pressure: the proportion of the mass indicated as a percentage of the total mass of the mixture."

2007 Read:

"Packages of a capacity not exceeding 450 l or 400 kg (net mass) which do not entirely meet the packing, mixed packing and labelling requirements of ADR but are in conformity with the requirements for maritime or air transport(*) shall be accepted for carriage prior to or following maritime or air carriage subject to the following conditions:

(*a*) If the packages are not labelled in accordance with ADR, they shall be labelled in accordance with the provisions for maritime or air transport(*);

(*b*) The provisions for maritime or air transport(*) shall be applicable to mixed packing within a package;

(*c*) Packages containing goods of Classes 1a, 1b, 1c, 5.1 or 5.2 which are not labelled in accordance with the provisions of ADR shall be carried only as a full load and shall not be loaded together with other goods of ADR;

(*d*) In addition to the particulars prescribed for ADR, the words 'Carriage under marginal 2007 of ADR' shall be entered in the transport document.

(*) These requirements are set out in the International Maritime Dangerous Goods (IMDG) Code published by the International Maritime Organization (IMO), London and in the Technical Instructions for the Safe Transport of Dangerous Goods by Air published by the International Civil Aviation Organization (ICA), Montreal."

*Class 2*

2210 (3) To read:

"In the case of carriage by full load, metal aerosol dispensers may also be packed as follows:

The aerosol dispensers shall be grouped together in units on trays and held in position with an appropriate plastics cover. These units shall be stacked and suitably secured on pallets."

*Classes 3, 6.1 and 8 (packing provisions for jerricans)*

2305, 2605 (1), 2805 (1) (*c*) In non-removable head steel jerricans conforming to marginal 3522 or

(*d*) In non-removable head plastics drums of a capacity not exceeding 60 litres or non-removable head plastics jerricans conforming to marginal 3526 or

2306 *Note to* (a), (b), (c) *and* (d)*:*

Removable-head drums or jerricans are only permitted for viscous substances having a viscosity above 200 mm²/s at 23°C.

2307 *Note 1 to* (a), (b), (c) *and* (d)*:*

Removable-head drums or jerricans are only permitted for viscous substances having a viscosity above 200 mm²/s at 23°C.

2605, 2805 (2) (*a*) In removable-head drums conforming to marginals 3520 for steel, 3521 for aluminium, 3523 for plywood, 3525 for fibreboard or 3526 for plastics material, or in removable-head jerricans conforming to marginals 3522 for steel or 3526 for plastics material, if necessary with one or more sift-proof inner bags; or

2606 (1) *Note to* (a), (b), (c) *and* (d):

Removable-head drums or jerricans are permitted only for viscous substances having a viscosity above 200 mm²/s at 23°C and for solids.

2806 (1) *Note 1 to* (a), (b), (c) *and* (d):

Removable-head drums or jerricans are permitted only for viscous substances having a viscosity above 200 mm²/s at 23°C and for solids.

2607 } 2807 } (1) *Note to* (a), (b), (c), (d) *and* (h):

Removable-head drums conforming to (*a*), (*b*) and (*d*), removable-head jerricans conforming to (*c*) and (*d*) and removable-head light gauge metal packagings conforming to (*h*) are permitted only for viscous substances having a viscosity above 200 mm²/s at 23°C and for solids.

*Class 3*

Also amend as follows:

2301 3° (b), add, under "halogenated substances": "2-Bromopropane".

32° (c), add, under "Halogenated substances": "1-Bromopropane".

31° (c) under alcohols sould read:

". . . aqueous solutions of ethyl alcohol in a concentration above 24% but not exceeding 70%;

NOTE. Aqueous solutions of ethyl alcohol in a concentration not exceeding 24% are not subject to the provisions of ADR."

2301*a* Insert a new paragraph (2), to read:

"Alcoholic beverages of 31° (c) in packagings containing not more than 250 litres."

Existing paragraph (2) to be renumbered (3).

*Classes 4.1, 4.2 and 4.3*

In marginals 2416 (1), 2445 and 2481 for "trade name" read "chemical name".

*Class 6.1*

Also amend marginal 2601, 71° to 88° as follows:

| | | 71° (a) | 71° (b) | 71° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 71° | Organophosphorus compounds, such as: | | | | |
| | Azinphos-ethyl | — | 100– > 25 | 25–6 | 25–2 |
| | Azinphos-methyl | — | 100– > 10 | 10–2 | 10–1 |
| | Bromophos-ethyl | — | — | 100–35 | 100–14 |
| | Carbophenothion | — | 100– > 20 | 20–5 | 20–2 |
| | Chlorfenvinphos | — | 100– > 20 | 20–5 | 20–2 |
| | Chlormephos | — | 100– > 15 | 15–3 | 15–1 |
| | Chlorpyriphos | — | — | 100–40 | 100–10 |
| | Chlorthiophos | — | 100– > 15 | 15–4 | 15–1 |
| | Crotoxyphos | — | — | 100–35 | 100–15 |
| | Crufomate | — | — | — | 100–90 |
| | Cyanophos | — | — | 100–55 | 100–55 |
| | DEF | — | — | — | 100–40 |
| | Demephion | 100– > 0 | — | — | — |
| | Demeton | 100– > 30 | 30– > 3 | 3–0.5 | 3– > 0 |
| | Demeton-O (Systox) | 100– > 34 | 34– > 3.4 | 3.4–0.85 | 3.4–0.34 |

| | 71° (a) | 71° (b) | 71° (c) | |
|---|---|---|---|---|
| | % | % | Solid % | Liquid % |
| Demeton-O-methyl | — | — | 100–90 | 100–35 |
| Demeton-S-methyl | — | 100– > 80 | 80–30 | 80–10 |
| Demeton-S-methyl-sulfone | — | 100– > 74 | 74–18.5 | 74–7.4 |
| Dialifos | — | 100– > 10 | 10–2.5 | 10–1 |
| Diazinon | — | — | 100–38 | 100–15 |
| Dichlofenthion | — | — | — | 100–54 |
| Dichlorvos | — | 100– > 35 | 35–7 | 35–7 |
| Dicrotophos | — | 100– > 25 | 25–6 | 25–2 |
| Dimefox | 100– > 20 | 20– > 2 | 2–0.5 | 2– > 0 |
| Dimethoate | — | — | 100–73 | 100–29 |
| Dioxathion | — | 100– > 40 | 40–10 | 40–4 |
| Disulfoton | 100– > 40 | 40– > 4 | 4–1 | 4– > 0 |
| Edifenphos | — | — | 100–75 | 100–30 |
| Endothion | — | 100– > 45 | 45–10 | 45–4 |
| EPN | 100– > 62 | 62– > 12.5 | 12.5–2.5 | 12.5–2.5 |
| Ethion | — | 100– > 25 | 25–5 | 25–2 |
| Ethoate-methyl | — | — | 100–60 | 100–25 |
| Ethoprophos | 100– > 65 | 65– > 13 | 13–2 | 13–2 |
| Fenaminphos | 100– > 40 | 40– > 4 | 4–1 | 4– > 0 |
| Fenitrothion | — | — | — | 100–48 |
| Fensulfothion | 100– > 40 | 40– > 4 | 4–1 | 4– > 0 |
| Fenthion | — | — | 100–95 | 100–38 |
| Fonofos | 100– > 60 | 60– > 6 | 6–1 | 6–0.5 |
| Formothion | — | — | — | 100–65 |
| Heptenophos | — | — | 100–48 | 100–19 |
| Isofenphos | — | 100– > 60 | 60–15 | 60–6 |
| Isothioate | — | — | 100–25 | 100–25 |
| Isoxathion | — | — | 100–55 | 100–20 |
| Mecarbam | — | 100– > 30 | 30–7 | 30–3 |
| Mephosfolan | 100– > 25 | 25– > 5 | 5–0.5 | 5–0.5 |
| Methamidophos | — | 100– > 15 | 15–3 | 15–1.5 |
| Methidathion | — | 100– > 40 | 40–10 | 40–4 |
| Methyltrithion | — | — | 100–49 | 100–19 |
| Mevinphos | 100– > 60 | 60– > 5 | 5–1 | 5–0.5 |
| Monocrotophos | — | 100– > 25 | 25–7 | 25–2.5 |
| Naled | — | — | — | 100–50 |
| Omethoate | — | — | 100–25 | 100–10 |
| Oxydemeton-methyl | — | 100– > 93 | 93–23 | 93–9 |
| Oxydisulfoton | 100– > 70 | 70– > 5 | 5–1.5 | 5–0.5 |
| Paraoxon | 100– > 35 | 35– > 3 | 3–0.9 | 3–0.35 |
| Parathion | 100– > 40 | 40– > 4 | 4–1 | 4–0.4 |
| Parathion-methyl | — | 100– > 12 | 12–3 | 12–1.2 |
| Phenkapton | — | — | 100–25 | 100–10 |
| Phenthoat | — | — | 100–70 | 100–70 |
| Phorate | 100– > 20 | 20– > 2 | 2–0.5 | 2– > 0 |
| Phosalone | — | — | 100–60 | 100–24 |
| Phosfolan | — | 100– > 15 | 15–4 | 15–1 |
| Phosmet (Phthalophos) | — | — | 100–45 | 100–18 |
| Phosphamidon | — | 100– > 34 | 34–8 | 34–3 |
| Pirimiphos-ethyl | — | — | 100–70 | 100–28 |
| Propaphos | — | 100– > 75 | 75–15 | 75–15 |
| Prothoate | — | 100– > 15 | 15–4 | 15–1 |
| Pyrazophos | — | — | — | 100–45 |
| Pyrazoxon | 100– > 80 | 80– > 8 | 8–2 | 8–0.5 |
| Salithion | — | — | 100–60 | 100–25 |
| Schradan | — | 100– > 18 | 18–9 | 18–3.6 |
| Sulfotep | — | 100– > 10 | 10–2 | 10–1 |

| | 71° (a) | 71° (b) | 71° (c) | |
|---|---|---|---|---|
| | % | % | Solid % | Liquid % |
| Sulprofos | — | — | 100–45 | 100–18 |
| Temephos | — | — | 100–90 | 100–90 |
| TEPP | 100– > 10 | 10– > 0 | — | — |
| Terbufos | 100– > 15 | 15– > 3 | 3–0.74 | 3–0.74 |
| Thiometon | — | 100– > 50 | 50–10 | 50–5 |
| Thionazin | 100– > 70 | 70– > 5 | 5–1 | 5–0.5 |
| Triamiphos | — | 100– > 20 | 20–5 | 20–1 |
| Triazophos | — | — | 100–33 | 100–13 |
| Trichlorfon | — | — | 100–70 | 100–23 |
| Trichloronat | — | 100– > 30 | 30–8 | 30–3 |
| Vamidothion | — | — | 100–30 | 100–10 |

| | | 72° (a) | 72° (b) | 72° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 72° | Chlorinated hydrocarbons, such as: | | | | |
| | Aldrin | — | 100– > 75 | 75–19 | 75–7 |
| | Camphechlor | — | — | 100–40 | 100–15 |
| | Chlordane | — | — | — | 100–55 |
| | Chlordimeform | — | — | — | 100–50 |
| | Chlordimeform hydrochloride | — | — | — | 100–70 |
| | DDT | — | — | 100–55 | 100–20 |
| | 1,2-dibromo-3-chloropropane | — | — | 100–85 | 100–34 |
| | Dieldrin | — | 100– > 75 | 75–19 | 75–7 |
| | Endosulfan | — | 100– > 80 | 80–20 | 80–8 |
| | Endrin | 100– > 60 | 60– > 6 | 6–1 | 6–0.5 |
| | Heptachlor | — | 100– > 80 | 80–20 | 80–8 |
| | Isodrin | — | 100– > 14 | 14–3 | 14–1 |
| | Lindane (α BHC) | — | — | 100–44 | 100–15 |
| | Pentachlorophenol | — | 100– > 54 | 54–13 | 54–5 |

| | | 73° (a) | 73° (b) | 73° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 73° | Chloro-phenoxyacetic derivatives, such as: | | | | |
| | 2,4-D | — | — | — | 100–75 |
| | 2,4-DB | — | — | — | 100–40 |
| | 2,4,5-T | — | — | — | 100–60 |
| | Triadimefon | — | — | — | 100–70 |

| | | 74° (a) | 74° (b) | 74° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 74° | Halogenated organic compounds not classified under 72° or 73°, such as: | | | | |
| | Allidochlor | — | — | 100–35 | 100–35 |
| | Bromoxynil | — | — | 100–95 | 100–38 |
| | Ioxynil | — | — | 100–20 | 100–20 |
| | Isobenzan | 100– > 10 | 10– > 2 | 2–0.4 | 2–0.4 |
| | Mirex | — | — | — | 100–60 |

| | | 75° (a) | 75° (b) | 75° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 75° | Nitrogenated organic compounds not classified under other item numbers, such as: | | | | |
| | Benquinox | — | — | 100–50 | 100–20 |
| | Binapacryl | — | — | 100–65 | 100–25 |
| | Chinomethionate | — | — | 100–50 | 100–50 |
| | Cyanazine | — | — | 100–90 | 100–35 |
| | Cycloheximide | 100– > 40 | 40– > 4 | 4–1 | 4– > 0 |
| | Dinobuton | — | — | 100–25 | 100–10 |
| | Dinoseb | — | 100– > 40 | 40–8 | 40–8 |
| | Dinoseb acetate | — | — | 100–30 | 100–10 |
| | Dinoterb | — | 100– > 50 | 50–10 | 50–5 |
| | Dinoterb acetate | — | 100– > 50 | 50–12 | 50–5 |
| | DNOC | — | 100– > 50 | 50–12 | 50–5 |
| | Drazoxolon | — | — | 100–63 | 100–25 |
| | Medinoterb | — | 100– > 80 | 80–20 | 80–8 |
| | Terbumeton | — | — | — | 100–95 |

| | | 76° (a) | 76° (b) | 76° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 76° | Carbamates and thiocarbamates, such as: | | | | |
| | Aldicarb | 100– > 15 | 15– > 1 | 1– > 0 | 1– > 0 |
| | Aminocarb | — | 100– > 60 | 60–15 | 60–6 |
| | Bendiocarb | — | 100– > 65 | 65–15 | 65–5 |
| | Butocarboxim | — | — | 100–75 | 100–30 |
| | Carbaryl | — | — | 100–30 | 100–10 |
| | Carbofuran | — | 100– > 10 | 10–2 | 10–1 |
| | Cartap HCl | — | — | 100–40 | 100–40 |
| | Di-allate | — | — | — | 100–75 |
| | Dimetan | — | — | 100–60 | 100–24 |
| | Dimetilan | — | 100– > 50 | 50–12 | 50–5 |
| | Dioxacarb | — | — | 100–30 | 100–10 |
| | Formetanate | — | 100– > 40 | 40–10 | 40–4 |
| | Isolan | — | 100– > 20 | 20–5 | 20–2 |
| | Isoprocarb | — | — | 100–85 | 100–35 |
| | Mercaptodimethur | — | 100– > 70 | 70–17 | 70–7 |
| | Metam-sodium | — | — | 100–85 | 100–35 |
| | Methomyl | — | 100– > 34 | 34–8 | 34–3 |
| | Mexacarbate | — | 100– > 28 | 28–7 | 28–2 |
| | Mobam | — | — | 100–35 | 100–14 |
| | Nabam | — | — | — | 100–75 |
| | Oxamyl | — | 100– > 10 | 10–2.5 | 10–1 |
| | Pirimicarb | — | — | 100–73 | 100–29 |
| | Promecarb | — | — | 100–35 | 100–14 |
| | Promurit (Muritan) | 100– > 5.6 | 5.6– > 0.56 | 0.56–0.14 | 0.56– > 0 |
| | Propoxur | — | — | 100–45 | 100–18 |

| | | 77° (a) | 77° (b) | 77° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 77° | Alkaloids, such as: | | | | |
| | Nicotine preparations | — | 100– > 25 | 25–5 | 25–5 |
| | Strychnine | 100– > 20 | 20– > 0 | — | — |

| | | 78° (a) | 78° (b) | 78° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 78° | Organic compounds of mercury, such as: | | | | |
| | Phenylmercuric acetate (PMA)..... | — | 100– > 60 | 60–15 | 60–6 |
| | Chloro-methoxyethyl mercury ..... | — | 100– > 40 | 40–10 | 40–4 |
| | Phenylmercury pyrocatechin (PMB) ..... | — | 100– > 60 | 60–15 | 60–6 |

| | | 79° (a) | 79° (b) | 79° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 79° | Organic compounds of tin, such as: | | | | |
| | Fentin acetate ..... | — | — | 100–62 | 100–25 |
| | Cyhexatin (Tricyclohexyl-tin hydroxide)..... | — | — | 100–95 | 100–35 |
| | Fentin hydroxide..... | — | — | 100–54 | 100–20 |

| | | 80° (a) | 80° (b) | 80° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 80° | Other organo-metallic compounds which cannot be classified under 78° and 79°, such as: | | | | |
| | ... ..... | ... | ... | ... | ... |

| | | 81° (a) | 81° (b) | 81° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 81° | Rodenticides, such as: | | | | |
| | Brodifacoum..... | 100– > 5 | 5– > 0.5 | 0.5–0.13 | 0.5–0.05 |
| | Chlorophacinone ..... | 100– > 40 | 40– > 4 | 4–1 | 4–0.4 |
| | Coumachlor ..... | — | — | 100–25 | 100–10 |
| | Coumafuryl..... | — | — | — | 100–80 |
| | Coumaphos..... | — | 100– > 30 | 30–8 | 30–3 |
| | Coumatetralyl (Racumin)..... | — | 100– > 34 | 34–8.5 | 34–3.4 |
| | Crimidine ..... | 100– > 25 | 25– > 2 | 2–0.5 | 2– > 0 |
| | Dicoumarol..... | — | — | 100–25 | 100–10 |
| | Difenacoum ..... | 100– > 35 | 35– > 3.5 | 3.5–0.9 | 3.5–0.35 |
| | Diphacinone ..... | 100– > 25 | 25– > 3 | 3–0.7 | 3–0.2 |
| | Warfarin (and salts of) ..... | 100– > 60 | 60– > 6 | 6–1.5 | 6–0.6 |

| | | 82° (a) | 82° (b) | 82° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 82° | Derivatives of bipyridyl, such as: | | | | |
| | Diquat ..... | — | — | — | 100–45 |
| | Paraquat ..... | — | 100– > 40 | 40–8 | 40–8 |

| | | 83° (a) | 83° (b) | 83° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 83° | Organic compounds not classified under a collective heading of 71° to 81°, such as: | | | | |
| | ANTU ..... | 100– > 40 | 40– > 4 | 4–1 | 4–0.8 |
| | Blasticidin-S-3 ..... | — | — | 100–25 | 100–10 |
| | Dazomet ..... | — | — | — | 100–60 |
| | Difenzoquat ..... | — | — | — | 100–90 |
| | Dimexano ..... | — | — | — | 100–48 |

| | 83° (a) | 83° (b) | 83° (c) | |
|---|---|---|---|---|
| | % | % | Solid % | Liquid % |
| Endothal-sodium | — | 100– > 75 | 75–19 | 75–7 |
| Fenaminosulph | — | 100– > 50 | 50–10 | 50–10 |
| Fenpropathrin | — | — | 100–30 | 100–10 |
| Fluoracetamide | — | 100– > 25 | 25–6.7 | 25–2.5 |
| Imazalil | — | — | — | 100–64 |
| Kelevan | — | — | — | 100–48 |
| Norbormide | 100– > 88 | 88– > 8.8 | 8.8–2.2 | 8.8–0.8 |
| Pindone (and salts of) | — | — | — | 100–55 |
| Rotenone | — | — | 100–65 | 100–25 |
| Tricamba | — | — | — | 100–60 |

| | | 84° (a) | 84° (b) | 84° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 84° | Inorganic compounds of arsenic, such as: | | | | |
| | Arsenic trioxide | — | 100– > 40 | 40–10 | 40–4 |
| | Calcium arsenate | — | 100– > 40 | 40–10 | 40–4 |
| | Sodium arsenite | — | 100– > 20 | 20–5 | 20–2 |

| | | 85° (a) | 85° (b) | 85° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 85° | Inorganic compounds of fluorine, such as: | | | | |
| | Barium silicofluoride | — | — | 100–88 | 100–35 |
| | Sodium silicofluoride | — | — | 100–62 | 100–25 |

| | | 86° (a) | 86° (b) | 86° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 86° | Inorganic compounds of mercury, such as: | | | | |
| | Mercuric chloride | — | 100– > 70 | 70–17 | 70–7 |
| | Mercury oxide | — | 100– > 35 | 35–8 | 35–3 |

| | | 87° (a) | 87° (b) | 87° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 87° | Inorganic compounds of copper, such as: | | | | |
| | Copper sulphate | — | — | 100–50 | 100–20 |

| | | 88° (a) | 88° (b) | 88° (c) | |
|---|---|---|---|---|---|
| | | % | % | Solid % | Liquid % |
| 88° | Inorganic compounds of thallium, such as: | | | | |
| | Thallium sulphate | — | 100– > 30 | 30–8 | 30–3 |

*Class 7*

2700 (2) Under "Radiation level", amend the first sentence to read:

" 'Radiation level' means the corresponding radiation dose equivalent rate expressed in microsieverts per hour (millirem per hour, where 10 μSv = 1 mrem)."

*Appendix A.2*

3250 (1) Amend the last sentence to read:

"However, receptacles made of copper or copper alloy shall be accepted only for gases containing no acetylene."

3254 Amend the last sentence to read:

"The fastenings of the receptacles shall themselves be so designed that even when the receptacle is at its lowest working temperature they still possess the necessary mechanical properties."

3267 Amend the heading which precedes this marginal to read:

"(c) *Receptacles made of copper or copper alloy*"

*Appendix A.6*

3656 (3) Amend sub-paragraph (*b*) and Note to read:

"(*b*) Next to the word 'activity' shall be written the activity in becquerels (curies) with the appropriate multiple or sub-multiple prefix."

3680 Amend sub-paragraph (*e*) to read:

"(*e*) The activity of the radioactive substances in appropriate becquerel (curie) units;"

*Appendix A.9*

Should be amended as follows:

3902 2. *Explanation of symbols*

No. 3 (black or white flame on red ground):
. . . (remainder unchanged);

No. 4.3 (black or white flame on blue ground):
. . . (remainder unchanged);

No. 7A (stylized trefoil, inscription "RADIOACTIVE" in the lower half, followed by a vertical stripe, with the following text:

Contents. . .
Activity. . .
Black symbol and inscriptions on white ground, red vertical stripe)
. . . (remainder unchanged);

No. 7B (like the foregoing but with two vertical stripes and the following text:

Contents. . .
Activity. . .
Transport index. . .
(in the rectangular black-bordered box)
Black symbol and inscriptions;
upper half of ground: yellow;
lower half of ground: white;
red vertical stripes):
. . . (remainder unchanged);

No. 7C (like the foregoing but with three vertical stripes):
. . . (remainder unchanged);

| | | |
|---|---|---|
| No. 10 | (black open umbrella and six black drops of water, on white or suitable contrasting ground); | |
| No. 11 | (two black arrows on white or suitable contrasting ground): | This side up: label to be affixed, arrows pointing upwards, near the top left-hand corner, on the four vertical faces of package; |
| No. 12 | (black wine glass on white or suitable contrasting ground): | Fragile, or: handle with care; label to be affixed on the package as for the preceding label. |

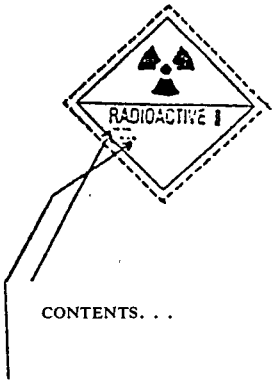
3903 *Transitional provisions*

The danger labels which until 31 December 1987 conformed to models Nos. 7A, 7B, 7C, 10, 11 and 12 may be used until stocks are exhausted.

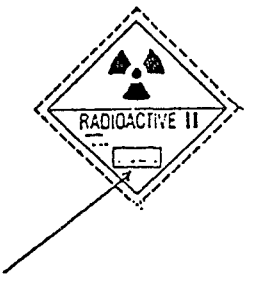
3904-
3999

*Danger labels*

N° 7A



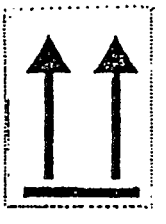

N° 7B



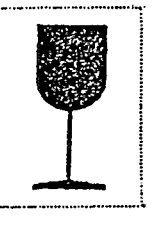

N° 7C


N° 10

N° 11



N° 12



*Annex B*

10 011 After the introductory sentence, delete the next ten sub-paragraphs and substitute the following:

"— Special requirements to be fulfilled by the means of transport and its equipment (all sections 2 of Parts I and II), subject, however, to compliance with the provisions of marginal 21 212;

— Vehicle crews (marginals XX311 of Parts I and II);

— Special training of drivers (marginal 10 315);

— Supervision of vehicles (marginals XX321 of Parts I and II);

— Carriage of passengers (marginal 10 325);

— Instructions in writing (marginals XX385 of Parts I and II);

— Places of loading and unloading (marginals XX407 of Part II), and

— Special provisions concerning the operation of vehicles (all sections 5 of Parts I and II)."

In the first Table, against Class 3, fourth line, amend "32° (a)" to read "32° (c)".

10 014 (1) Amend the twelfth definition, for "battery of receptacles", to read as follows:

"The term 'battery of receptacles' or 'battery of tanks' means an assembly of several receptacles, as defined in marginal 2212 (1) (*b*), or of tanks as defined in marginal 2212 (1) (*c*), interconnected by a manifold and permanently mounted in a frame;".

Amend the last definition, for 'battery vehicle', to read as follows:

"The term 'battery vehicle' means a vehicle with a battery of receptacles or a battery of tanks which is covered by the term 'tank vehicle'."

10 015 (1) Amend sub-paragraph (*b*) to read as follows:

"(*b*) In the case of mixtures of compressed gases: the proportion of the volume indicated as a percentage of the total volume of the gaseous mixture; in the case of mixtures of liquefied gases and gases dissolved under pressure: the proportion of the mass indicated as a percentage of the total mass of the mixture."

10 220 Amend the heading that precedes this marginal, to read as follows: "Vehicles used for the carriage of dangerous goods in fixed or demountable tanks, batteries of receptacles or tank-containers of a capacity greater than 3,000 *l*

(1) Insert a new Note to read:

"NOTE 1. This provision does not apply to vehicles used for the carriage of dangerous goods in tank-containers."

The existing Note becomes "Note 2".

10 220 (2) Amend the first sentence to read:

"Vehicles transporting liquids having a flash-point of 55°C or below or inflammable substances of Class 2 as defined in marginal 2200 (3) shall, in addition, comply with the following requirements:"

10 251 Amend sub-paragraph (*a*) to read:

". . . or inflammable substances of Class 2 as defined in marginal 2200 (3);"

10 353 Number the existing text as paragraph (1). Add a new paragraph (2) as follows:

"(2) Closed vehicles carrying liquids having a flash-point of 55°C or below or inflammable substances or articles of Class 2, as defined in marginal 2200 (3), shall not be entered by persons carrying lighting apparatus other than portable lamps so designed and constructed that they cannot ignite any inflammable vapours or gases which may have penetrated into the interior of the vehicle."

10 381 Amend the existing text, to read as follows:

"(1) In addition to the documents required under other regulations, the transport document prescribed in Annex A, marginal 2002 (3) and (4), covering all the dangerous substances carried, shall be carried on the transport unit.

(2) Where the provisions of this Annex require the following documents to be drawn up, they shall likewise be carried on the transport unit:

(*a*) The special certificate of approval referred to in marginal 10 282 or 10 283 for each transport unit or element thereof;

(*b*) The driver's training certificate prescribed in marginal 10 315 and reproduced in Appendix B.6;

(*c*) The instructions prescribed in marginal 10 385, relating to all the dangerous substances carried, and

(*d*) The permit authorizing the transport operation."

10 385 (1) Amend sub-paragraph (*e*) as follows:

"(*e*) In the case of tank vehicles or transport units with a tank or tanks of an individual capacity exceeding 3,000 *l* carrying one or more of the substances listed in Appendix B.5, the name of the substance(s), the Class, item number and letter, and the substance identification and hazard identification numbers in accordance with Appendix B.5."

10 500 (2) Amend to read as follows:

"Tank vehicles or transport units with a tank or tanks of an individual capacity exceeding 3,000 *l* carrying substances listed in Appendix B.5 shall, in addition, display on the sides of each tank or tank compartment, clearly visible and parallel to the longitudinal axis of the vehicle, orange-coloured plates identical with those prescribed in (1). These orange-coloured plates shall bear the identification numbers prescribed in Appendix B.5 for each of the substances carried in the tank or in a compartment of the tank."

21 240 Amend to read as follows:

"The provisions of marginal 10 240 (1) (*b*) and (3) shall not apply to carriage other than that of inflammable substances or articles of Class 2, as defined in marginal 2200 (3), or of empty packagings of 14° which have contained such substances."

21 353 Delete this marginal with its heading, and adjust the numbering of blank marginals to read:

"21 322-
21 377"

31 353 — Delete this marginal with its heading, and adjust the numbering of blank marginals to read:

"31 322-
31 399"

41 500, 42 500, 51 500 — In each of these marginals, delete paragraph (1), and remove "(2)" from the remaining paragraph.

51 220 — Amend the heading that precedes this marginal, to read as follows:

"Vehicles used for the carriage of dangerous goods in fixed or demountable tanks, or tank-containers of a capacity greater than 3,000 *l*"

61 353, 61 374 — Delete these marginals with their headings, and adjust the numbering of blank marginals to read:

"61 322-
61 384"

Re-arrange section 4 for Class 6.1 as follows:

"61 400-
61 402

61 403 (Existing text)

61 404-
61 406

61 407 (Heading and text of existing marginal 61 412)

61 408-
61 409

61 410 (Existing text)

61 411-
61 414

61 415 (Existing text)

61 416-
61 499"

62 010 — Amend the mention of "10 381 (1) (*a*)" to read: "10 381 (1)".

71 374 — Delete this marginal with its heading, and adjust the numbering of blank marginals to read:

"71 322-
71 399"

81 353, 81 374 — Delete these marginals with their headings, and adjust the numbering of blank marginals to read:

"81 322-
81 399"

*Appendix B.1* c

213 010 — Under (*e*), amend "hydrochloric acid of 5° (b) and" to read:

"hydrochloric acid of 5° (b), phosphoric acid of 11° (c) and"

*Appendix B.2*

220 002 — Delete this marginal, and adjust the numbering of blank marginals to read:

"220 001-
229 999"

*Appendix B.5*

250 000 (1) Amend the penultimate paragraph to read:

"The following combinations of figures, however, have a special meaning: 22, 323, 333, 423, 44 and 539; see (2) below."

(2) Insert the following additional hazard identification numbers in numerical order as indicated:

After "30" add:

"X323, inflammable liquid which reacts dangerously with water, emitting inflammable gases"

After "638" add:

"639, toxic or harmful substance, inflammable (flash-point between 21°C and 55°C), which can spontaneously lead to violent reaction"

After "83" add:

"X83, corrosive or slightly corrosive substance, inflammable (flash-point between 21°C and 55°C), which reacts dangerously with water"

After "839" add:

"X839, corrosive or slightly corrosive substance, inflammable (flash-point between 21°C and 55°C), which can spontaneously lead to violent reaction and which reacts dangerously with water"

*Table I*

1. Amend existing entries as follows:

"Bromopropanes" to read: "2-Bromopropane".

"Butane" to read: "Butane, technically pure".

"Ethanol (Ethyl alcohol) . . . from 24% up to and including 70%" to read: ". . . above 24% but not exceeding 70%".

"Propane" to read: "Propane, technically pure".

"Selenates" to read: "Selenates, solutions of".

"Selenic acid" to read: "Selenic acid, solutions of".

"Selenites" to read: "Selenites, solutions of".

"Hydrocarbons, liquid, pure or in mixtures, not otherwise specified in this appendix, having a flash-point below 21°C".

Column (*b*) should read: "3, 1° to 3°".

Prefix the letter "X" to the hazard identification number in column (*c*) of the following substances:

Allyltrichlorosilane
Amyltrichlorosilane
Butyltrichlorosilane
Chlorophenyltrichlorosilane
Chlorosilanes which do not give off inflammable gases on contact with water, not otherwise specified in this appendix:
— Having a flash-point between 21°C and 55°C
— Having a flash-point above 55°C
Cyclohexenyltrichlorosilane
Cyclohexyltrichlorosilane
Dibenzyldichlorosilane
Dichlorophenyltrichlorosilane

Diethyldichlorosilane
Diphenyldichlorosilane
Dodecyltrichlorosilane
Hexadecyltrichlorosilane
Hexyltrichlorosilane
Methylphenyldichlorosilane
Nonyltrichlorosilane
Octadecyltrichlorosilane
Octyltrichlorosilane
Phenyltrichlorosilane
Propyltrichlorosilane.

2. Delete the following entries (or parts thereof):

| | | | | |
|---|---|---|---|---|
| Aluminium alkyl halides | 4.2, 3° | X333 | 2221 | 4.2 + 4.3 |
| Aluminium alkyl halides, solutions of | 4.2, 3° | X333 | 2220 | 4.2 + 4.3 |
| Aluminium alkyls: | | | | |
| Aluminium triethyl | 4.2, 3° | X333 | 1102 | 4.2 + 4.3 |
| Aluminium triisobutyl | 4.2, 3° | X333 | 1930 | 4.2 + 4.3 |
| Aluminium trimethyl | 4.2, 3° | X333 | 1103 | 4.2 + 4.3 |

Under *Pesticides:* Delete the entries:

| | | | | |
|---|---|---|---|---|
| Organo phosphorus compounds — Solid | 71° (a) | 66 | 2783 | 6.1 |
| Chlorinated hydrocarbons: — Solid | 72° (a) | 66 | 2761 | 6.1 |
| Chloro-phenoxyacetic derivates — Solid | 73° (a) | 66 | 2765 | 6.1 |
| Carbamates — Solid | 76° (a) | 66 | 2757 | 6.1 |
| Thiocarbamates — Solid | 76° (a) | 66 | 2771 | 6.1 |
| Organotin compounds — Solid | 79° (a) | 66 | 2786 | 6.1 |
| Derivatives of bipyridyl — Solid | 82° (a) | 66 | 2781 | 6.1 |
| Inorganic compounds of arsenic — Solid | 84° (a) | 66 | 2759 | 6.1 |
| Inorganic compounds of mercury — Solid | 86° (a) | 66 | 2777 | 6.1 |
| Inorganic compounds of copper — Solid | 87° (a) | 66 | 2775 | 6.1 |

3. Insert the following new entries:

| | | | | |
|---|---|---|---|---|
| Aluminium alkyls, liable to spontaneous combustion | 4.2, 3° | X333 | 3051 | 4.2 + 4.3 |
| Aluminium alkyls, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| Aluminium alkyl halides, liable to spontaneous combustion | 4.2, 3° | X333 | 3052 | 4.2 + 4.3 |
| Aluminium alkyl halides, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| Aluminium alkyl hydrides, liable to spontaneous combustion | 4.2, 3° | X333 | 3050 | 4.2 + 4.3 |

| | | | | |
|---|---|---|---|---|
| Aluminium alkyl hydrides, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| 2-(2-Aminoethoxy) ethanol | 8, 54° (c) | 80 | 3055 | 8 |
| Boron alkyls, liable to spontaneous combustion | 4.2, 3° | X333 | 2003 | 4.2 + 4.3 |
| Boron alkyls, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| Butane, mixture of gases: see Mixtures of hydrocarbons (liquefied gas) (Mixtures A, A0): | | | | |
| 1,2-Butylene oxide | 3, 3° (b) | 339 | 3022 | 3 |
| Caproic acid | 8, 32° (c) | 80 | 2829 | 8 |
| Cyclohexyl mercaptan | 3, 31° (c) | 30 | 3054 | 3 |
| Diesel oil: see Hydrocarbons, liquid | | | | |
| Diethylzinc, liable to spontaneous combustion | 4.2, 3° | X333 | 1366 | 4.2 + 4.3 |
| Dimethylzinc, liable to spontaneous combustion | 4.2, 3° | X333 | 1370 | 4.2 + 4.3 |
| Fluoroanilines | 6.1, 11° (c) | 60 | 2941 | 6.1A |
| Gallium alkyls, liable to spontaneous combustion | 4.2, 3° | X333 | 2003 | 4.2 + 4.3 |
| Gallium alkyls, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| Gas oil, for heating and for diesel engines: see Hydrocarbons, liquid | | | | |
| Heating oil: see Hydrocarbons, liquid | | | | |
| Hexanoic acid: see Caproic acid | | | | |
| Kerosene: see Hydrocarbons, liquid | | | | |
| LPG: see Mixtures of hydrocarbons (liquefied gas) (Mixtures A, A0, A1, B and C) | | | | |
| Lithium alkyls, liable to spontaneous combustion | 4.2, 3° | X333 | 2445 | 4.2 + 4.3 |
| Lithium alkyls, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| Magnesium alkyls, liable to spontaneous combustion | 4.2, 3° | X333 | 3053 | 4.2 + 4.3 |
| Magnesium alkyls, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |
| Naphtha, solvent: see Hydrocarbons, liquid | | | | |
| Natural gas, condensation products of: see Hydrocarbons, liquid | | | | |
| tert-Octylmercaptan | 6.1, 20° (b) | 63 | 3023 | 6.1 + 3 |
| Petroleum: see Hydrocarbons, liquid | | | | |
| Petroleum, crude: see Hydrocarbons, liquid | | | | |
| Petroleum ether: see Hydrocarbons, liquid | | | | |
| Petrols: see Hydrocarbons, liquid | | | | |
| Propane, mixture of gases: see Mixtures of hydrocarbons (liquefied gas) (Mixture C) | | | | |

| | | | | |
|---|---|---|---|---|
| Sodium hydrogen sulphide, aqueous solutions of | 8, 45° (c) | 80 | 2949 | 8 |
| Turpentine substitute: see Hydrocarbons, liquid | | | | |
| Vinyl pyridines | 6.1, 11° (b) | 639 | 3073 | 6.1 + 3 |
| White spirit: see Hydrocarbons, liquid | | | | |
| Zinc alkyls, liable to spontaneous combustion, not otherwise specified in this appendix | 4.2, 3° | X333 | 2003 | 4.2 + 4.3 |
| Zinc alkyls, which give off inflammable gases on contact with water | 4.3, 2° (e) | X323 | 2813 | 4.3 |

*Table II*

Delete the following entries:

| | | | | |
|---|---|---|---|---|
| Highly toxic solids, combustible | 6.1, letter (a) of 11°-24° | 66 | 2930 | 6.1 |
| Highly toxic solids, not combustible | 6.1, letter (a) of 51°, 55° and 68° | 66 | 2811 | 6.1 |
| Highly toxic solid substances or preparations used as pesticides | 6.1, letter (a) of 74°, 75°, 77°, 78°, 80°, 81°, 83°, 85° and 88° | 66 | 2588 | 6.1 |
| Highly corrosive solids, combustible | 8, letter (a) of 64° and 65° | 88 | 2921 | 8 |
| Highly corrosive solids, not combustible | 8, letter (a) of 8°, 11°, 27° and 65° | 88 | 1759 | 8 |
| | 26° (a) | 88 | 1759 | 8 + 6.1 |

*Authentic texts: English and French.*

*Registered* ex officio *on 1 January 1988.*