International Civil Aviation Organization

DGP-WG/07-WP/4
15/3/07

WORKING PAPER

DANGEROUS GOODS PANEL (DGP)
MEETING OF THE WORKING GROUP OF THE WHOLE

Memphis, 30 April to 4 May 2007

Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2009/2010 Edition
2.3: Part 3 — Dangerous Goods List and Limited Quantities Exceptions

DRAFT AMENDMENTS TO THE TECHNICAL INSTRUCTIONS TO ALIGN TO THE UN RECOMMENDATIONS — PART 3

(Presented by the Secretary)

SUMMARY

This working paper contains draft amendments to Part 3 of the Technical Instructions (Chapters 2 and 3) to reflect the decisions taken by the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals at its third session (Geneva, 15 December 2006).

The DGP-WG is invited to agree to the draft amendments in this working paper.

Part 3

DANGEROUS GOODS LIST AND LIMITED QUANTITIES EXCEPTIONS

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Chapter 2

ARRANGEMENT OF THE DANGEROUS GOODS LIST (TABLE 3-1)

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Add new entries and *modify* existing entries as follows (entries are listed in UN No. order)

Name	UN No.	Class or division	Subsidiary risk	Labels	State variations	Special provisions	UN packing group	Passenger aircraft		Cargo aircraft	
								Packing instruction	Max. net quantity per package	Packing instruction	Max. net quantity per package
1	2	3	4	5	6	7	8	9	10	11	12
Signals, distress, ship	0505	1.4G		Explosive 1.4				FORBIDDEN		135	75 kg
Signals, distress, ship	0506	1.4S		Explosive 1.4				135	25 kg	135	100 kg
Signals, smoke	0507	1.4S		Explosive 1.4				135	25 kg	135	100 kg
1-Hydroxybenzotriazole, anhydrous, dry or wetted with less than 20% water, by mass	0508	1.3C						FORBIDDEN		FORBIDDEN	
Chlorine	1017	2.3	5.1 8		AU 1 CA 7 GB 3 IR 3 NL 1 US 3	A2		FORBIDDEN		FORBIDDEN	
Ethanol	1170	3		Liquid flammable		A3 A58 ~~A148~~	II III	305 Y305 309 Y309	5 L 1 L 60 L 10 L	307 310	60 L 220 L
Ethanol solution	1170	3		Liquid flammable		A3 A58 ~~A148~~	II III	305 Y305 309 Y309	5 L 1 L 60 L 10 L	307 310	60 L 220 L
Ethyl alcohol	1170	3		Liquid flammable		A3 A58 ~~A148~~	II III	305 Y305 309 Y309	5 L 1 L 60 L 10 L	307 310	60 L 220 L
Ethyl alcohol solution	1170	3		Liquid flammable		A3 A58 ~~A148~~	II III	305 Y305 309 Y309	5 L 1 L 60 L 10 L	307 310	60 L 220 L
Methyltrichlorosilane	1250	3	8	Liquid flammable & Corrosive	AU 1 CA 7 GB 3 IR 3 NL 1 US 3	~~A1~~	~~I~~II	~~FORBIDDEN~~ 306	 1 L	304	~~2.5~~5 L
Vinyltrichlorosilane	1305	3	8	Liquid flammable & Corrosive	AU 1 CA 7 GB 3 IR 3 NL 1 US 3	~~A1~~	~~I~~II	~~FORBIDDEN~~ 306	 1 L	304	~~2.5~~5 L
Picric acid, wetted with not less than 30% water, by mass	1344	4.1		Solid flammable	BE 3	A40	I	416	1 kg	412	15 kg
TNT, wetted with not less than 30% water, by mass	1356	4.1		Solid Flammable	BE 3	A40	I	416	0.5 kg	416	0.5 kg
Magnesium nitrate	1474	5.1		Oxidizer		A155	III	516 Y516	25 kg 10 kg	518	100 kg

Name	UN No.	Class or division	Subsidiary risk	Labels	State variations	Special provisions	UN packing group	Passenger aircraft		Cargo aircraft	
								Packing instruction	Max. net quantity per package	Packing instruction	Max. net quantity per package
1	2	3	4	5	6	7	8	9	10	11	12
Alcohols, n.o.s.*	1987	3		Liquid flammable		A3 ~~A148~~	II III	305 Y305 309 Y309	5 L 1 L 60 L 10 L	307 310	60 L 220 L
Flammable liquid, n.o.s.*	1993	3		Liquid flammable		A3 ~~A148~~	I II III	302 305 Y305 309 Y309	1 L 5 L 1 L 60 L 10 L	303 307 310	30 L 60 L 220 L
Nitric acid, other than red fuming, with less than 65% nitric acid	2031	8		Corrosive			II	807 Y807	1 L 0.5 L	813	30 L
Nitric acid, other than red fuming, with at least 65% but not more than 70% nitric acid	2031	8	5.1	Corrosive & Oxidizer	AU 1 CA 7 GB 3 IR 3 NL 1 US 3	A1	II	FORBIDDEN		813	30 L
Radioactive material, excepted package — empty packaging	2908	7		None		A130		See Part ~~2;7~~1;6			
Radioactive material, excepted package — articles manufactured from natural uranium or **depleted uranium** or **natural thorium**	2909	7		None		A130		See Part ~~2;7~~1;6			
Radioactive material, excepted package — limited quantity of material	2910	7		None		A130		See Part ~~2;7~~1;6			
Radioactive material, excepted package — instruments or **articles**	2911	7		None		A130		See Part ~~2;7~~1;6			
Radioactive material, surface contaminated objects (SCO-I or SCO-II), non-fissile or **fissile excepted**	2913	7		Radioactive	CA 1	A78 A139 A159		See Part 2;7 and Part 4;9			
Radioactive material, Type B(U) package, non-fissile or fissile excepted	2916	7		Radioactive	CA 1	A78 A139 A160		See Part 2;7 and Part 4;9			
Radioactive material, Type B(M) package, non-fissile or fissile excepted	2917	7		Radioactive	CA 1	A78 A139 A160		See Part 2;7 and Part 4;9			
Environmentally hazardous substance, solid, n.o.s.*	3077	9		Miscellaneous	CA 13 DE 5 US 4	A97 A158	III	911 Y911	400 kg 30 kg G	911	400 kg
Environmentally hazardous substance, liquid, n.o.s.*	3082	9		Miscellaneous	CA 13 DE 5 US 4	A97 A158	III	914 Y914	450 L 30 kg G	914	450 L
Lithium metal batteries (including lithium alloy batteries)†	3090	9		Miscellaneous	US 2 US 3	A45 A88 A99 A154	II	903	5 kg G	903	35 kg G

Name	UN No.	Class or division	Subsidiary risk	Labels	State variations	Special provisions	UN packing group	Passenger aircraft		Cargo aircraft	
								Packing instruction	Max. net quantity per package	Packing instruction	Max. net quantity per package
1	2	3	4	5	6	7	8	9	10	11	12
Lithium metal batteries contained in equipment†	3091	9		Miscellaneous	US 2 US 3	A45 A48 A154		see 912		see 912	
Lithium metal batteries packed with equipment†	3091	9		Miscellaneous	US 2 US 3	A45 A88 A154	II	see 918		see 918	
Chemical kit	3316	9		Miscellaneous		A44 A163		915 Y915	10 kg 1 kg	915	10 kg
Radioactive material, surface contaminated objects (SCO-I or SCO-II), non-fissile or **fissile excepted**	3321	7		Radioactive	CA 1	A23 A78 A139 A159		See Part 2;7 and Part 4;9			
Radioactive material, low specific activity (LSA-III), non-fissile or fissile excepted	3322	7		Radioactive	CA 1	A23 A78 A159		See Part 2;7 and Part 4;9			
Radioactive material, low specific activity (LSA-II) fissile	3324	7		Radioactive	CA 1	A76 A78 A159		See Part 2;7 and Part 4;9			
Radioactive material, low specific activity (LSA-III) fissile	3325	7		Radioactive	CA 1	A76 A78 A159		See Part 2;7 and Part 4;9			
Radioactive material, surface contaminated objects (SCO-I or **SCO-II), fissile**	3326	7		Radioactive	CA 1	A76 A78 A159		See Part 2;7 and Part 4;9			
Radioactive material, Type B(U) package, fissile	3328	7		Radioactive	CA 1	A78 A160		See Part 2;7 and Part 4;9			
Radioactive material, Type B(M) package, fissile	3329	7		Radioactive	CA 1	A78 A160		See Part 2;7 and Part 4;9			
Pentaerythritol tetranitrate mixture desensitized, solid, n.o.s.* with more than 10% but not more than 20% PETN, by mass	3344	4.1			BE 3			FORBIDDEN		FORBIDDEN	
PETN mixture desensitized, solid, n.o.s.* with more than 10% but not more than 20% PETN, by mass	3344	4.1			BE 3			FORBIDDEN		FORBIDDEN	
Hydrogen in a metal hydride storage system contained in equipment	3468	2.1		Gas flammable		A1 A143		FORBIDDEN		214	100 kg G
Hydrogen in a metal hydride storage system packed with equipment	3468	2.1		Gas flammable		A1 A143		FORBIDDEN		214	100 kg G
Fuel cell cartridges contained in equipment	3473	3		Liquid flammable		A146		313	5 L	313	60 L
Fuel cell cartridges packed with equipment	3473	3		Liquid flammable		A146		313	5 L	313	60 L

Name	UN No.	Class or division	Subsidiary risk	Labels	State variations	Special provisions	UN packing group	Passenger aircraft		Cargo aircraft	
								Packing instruction	Max. net quantity per package	Packing instruction	Max. net quantity per package
1	2	3	4	5	6	7	8	9	10	11	12
1-Hydroxybenzotriazole, anhydrous, wetted with not less than 20% water, by mass	3474	4.1		Solid flammable		A40	I	416	0.5 kg	416	0.5 kg
Ethanol and gasoline mixture	3475	3		Liquid flammable		A156	II	305 Y305	5 L 1 L	307	60 L
Ethanol and motor spirit mixture, with more than 10% ethanol	3475	3		Liquid flammable		A156	II	305 Y305	5 L 1 L	307	60 L
Ethanol and petrol mixture, with more than 10% ethanol	3475	3		Liquid flammable		A156	II	305 Y305	5 L 1 L	307	60 L
Fuel cell cartridges, containing water-reactive substances	3476	4.3		Danger if wet		A146 A157		436	[???]	436	[???]
Fuel cell cartridges contained in equipment, containing water-reactive substances	3476	4.3		Danger if wet		A146 A157		436	[???]	436	[???]
Fuel cell cartridges packed with equipment, containing water-reactive substances	3476	4.3		Danger if wet		A146 A157		436	[???]	436	[???]
Fuel cell cartridges, containing corrosive substances	3477	8		Corrosive		A146 A157		827	[???]	827	[???]
Fuel cell cartridges contained in equipment, containing corrosive substances	3477	8		Corrosive		A146 A157		827	[???]	827	[???]
Fuel cell cartridges packed with equipment, containing corrosive substances	3477	8		Corrosive		A146 A157		827	[???]	827	[???]
Fuel cell cartridges, containing liquefied flammable gas	3478	2.1		Gas flammable		A146 A161		[???]	[???]	215	[???]
Fuel cell cartridges contained in equipment, containing liquefied flammable gas	3478	2.1		Gas flammable		A146 A161		[???]	[???]	215	[???]
Fuel cell cartridges packed with equipment, containing liquefied flammable gas	3478	2.1		Gas flammable		A146 A161		[???]	[???]	215	[???]
Fuel cell cartridges, containing hydrogen in metal hydride	3479	2.1		Gas flammable		A146 A162		215	[???]	215	[???]
Fuel cell cartridges contained in equipment, containing hydrogen in metal hydride	3479	2.1		Gas flammable		A146 A162		215	[???]	215	[???]

Name	UN No.	Class or division	Subsidiary risk	Labels	State variations	Special provisions	UN packing group	Passenger aircraft		Cargo aircraft	
								Packing instruction	Max. net quantity per package	Packing instruction	Max. net quantity per package
1	2	3	4	5	6	7	8	9	10	11	12
Fuel cell cartridges packed with equipment, containing hydrogen in metal hydride	3479	2.1		Gas flammable		A146 A162		215	[???]	215	[???]
Lithium ion batteries (including lithium ion polymer batteries)	3480	9		Miscellaneous		A45 A88	II	903	5 kg G	903	35 kg G
Lithium ion batteries contained in equipment	3481	9		Miscellaneous		A45	II	903	5 kg G	903	35 kg G
Lithium ion batteries packed with equipment	3481	9		Miscellaneous		A45	II	903	5 kg G	903	35 kg G

Editorial Note.— Decision regarding authorization of passenger or cargo limits and quantity limits for new fuel cell entries assigned UN Nos. 3476, 3477, 3478 and 3479 to be determined.

Chapter 3

SPECIAL PROVISIONS

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≠ A32 Air bag~~s~~ inflators, air bag modules or seat-belt~~s~~ pretensioners installed in conveyances or in completed conveyance components such as steering columns, door panels, seats, etc., which are not capable of inadvertent activation are not subject to these Instructions.

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A45 ~~Lithium c~~Cells and batteries offered for transport are not subject to other provisions of these Instructions if they meet the following:

a) For a lithium metal or lithium alloy cell, the lithium content is not more than 1 g, and for a lithium ion cell, the ~~lithium equivalent content is not more than 1.5 g~~ Watt-hour rating is not more than 20 Wh;

b) For a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g, and for a lithium ion battery, the ~~aggregate lithium equivalent content is not more than 8 g~~ Watt-hour rating is not more than 100 Wh. Lithium ion batteries subject to this provision must be marked with the Watt-hour rating on the outside case;

c) Each cell or battery is of the type proved to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;

~~d) Cells and batteries are separated so as to prevent short circuits and are packed in strong packagings, except when installed in equipment; and~~

~~e) Except when installed in equipment, each package containing more than 24 lithium cells or 12 lithium batteries must in addition meet the following requirements:~~

~~i) Each package must be marked indicating that it contains lithium batteries and that special procedures should be followed in the event that the package is damaged;~~

~~ii) Each shipment must be accompanied with a document indicating that packages contain lithium batteries and that special procedures should be followed in the event a package is damaged;~~

~~iii) Each package is capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery-to-battery (or cell-to-cell) contact and without release of contents; and~~

~~iv) Except in the case of lithium batteries packed with equipment, packages may not exceed 30 kg gross mass.~~

d) Cells and batteries, except when installed in equipment, must be packed in inner packagings that completely enclose the cell or battery. Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit. The inner packagings must be packed in strong outer packagings which conform to the provisions of 4;1.1.1, 4;1.1.3.1, and 4;1.1.9.

e) Cells and batteries when installed in equipment must be protected from damage and short circuit, and the equipment must be equipped with an effective means of preventing accidental activation. When lithium batteries are installed in equipment, the equipment must be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained.

f) Except for packages containing no more than four cells installed in equipment or no more than two batteries installed in equipment, each package must be marked with the following:

i) an indication that the package contains "lithium metal" or "lithium ion" cells or batteries, as appropriate;

ii) an indication that the package must be handled with care and that a flammability hazard exists if the package is damaged;

iii) an indication that special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and

iv) a telephone number for additional information.

g) Each consignment of one or more packages marked in accordance with paragraph (f) must be accompanied with a document including the following:

i) an indication that the package contains "lithium metal" or "lithium ion" cells or batteries, as appropriate;

ii) an indication that the package must be handled with care and that a flammability hazard exists if the package is damaged;

iii) an indication that special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and

iv) a telephone number for additional information.

h) Except when lithium batteries are installed in equipment, each package must be capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents; and

(i) Except when lithium batteries are installed in or packed with equipment, packages must not exceed 30 kg gross mass.

As used above and elsewhere in the Instructions, “lithium content” means the mass of lithium in the anode of a lithium metal or lithium alloy cell~~, except in the case of a lithium ion cell the “lithium equivalent content” in grams is calculated to be 0.3 times the rated capacity in ampere-hours~~.

Separate entries exist for lithium metal batteries and lithium ion batteries to facilitate the transport of these batteries for specific modes of transport and to enable the application of different emergency response actions.

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≠ A66 Polyester resin kits consist of two components: a base material (Class 3, Packing Group II or III) and an activator (Division 5.2). The organic peroxide must be type D, E or F, not requiring temperature control. ~~Only organic peroxides that are authorized for transport on passenger aircraft are permitted in the kits. Those requiring temperature control are forbidden.~~ Packing Group II or III is assigned according to the criteria for Class 3, applied to the base material. The quantity limit ~~[and the excepted quantity code]~~ shown in [1;2.4.3] apply to the base material.

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A79 This entry may only be used for uniform mixtures containing ammonium nitrate as the main ingredient within the following composition limits:

a) not less than 90 per cent ammonium nitrate with not more than 0.2 per cent total combustible/organic material calculated as carbon and with added matter, if any, which is inorganic and inert towards ammonium nitrate; or

b) less than 90 per cent but more than 70 per cent ammonium nitrate with other inorganic materials or more than 80 per cent but less than 90 per cent ammonium nitrate mixed with calcium carbonate and/or dolomite and/or mineral calcium sulphate and not more than 0.4 per cent total combustible/organic material calculated as carbon; or

c) nitrogen type ammonium nitrate based fertilizers containing mixtures of ammonium nitrate and ammonium sulphate with more than 45 per cent but less than 70 per cent ammonium nitrate and not more than 0.4 per cent total combustible/organic material calculated as carbon such that the sum of the percentage composition of ammonium nitrate and ammonium sulphate exceeds 70 per cent.

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A91 A nitrocellulose solution containing not more than 20 per cent nitrocellulose may be transported under the requirements for “Paint” or “Printing ink” as applicable; see UN 1210, 1263~~ and~~, 3066, 3469 and 3470.

A92 Lead compounds which, when mixed in a ratio of 1:1000 with 0.07 M hydrochloric acid and stirred for 1 hour at a temperature of 23°C ±2°C, exhibit a solubility of 5 per cent or less are~~ considered insoluble~~ (see ISO 3711:1990 *“Lead chromate pigments and lead chromate-molybdate pigments — Specifications and methods of test”*) are considered insoluble and are not subject to these Instructions unless they meet the criteria for inclusion in another hazard class or division.

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+ A146 This entry applies to fuel cell cartridges ~~containing flammable liquids, including methanol or methanol/water solutions.~~ including when contained in equipment or packed with equipment. Fuel cell cartridges installed in or integral to a fuel cell system are regarded as contained in equipment. Fuel cell cartridge means an ~~container~~ article that stores fuel for discharge into the fuel cell ~~powered equipment~~ through a valve(s) that controls the discharge of fuel into ~~such equipment and is free of electric charge generating components~~ the fuel cell. ~~The cartridge~~ Fuel cell cartridges, including when contained in equipment, must be designed and constructed to prevent ~~the~~ fuel ~~from~~ leak~~ing~~age ~~during~~ under normal conditions of transport.

~~This entry applies to f~~Fuel cell cartridge design types ~~shown without their packaging to~~ using liquids as fuels must pass an internal pressure test at a pressure of 100 kPa (gauge) without leakage..

Except for fuel cell cartridges containing hydrogen in metal hydride which must be in compliance with A162, each fuel cell cartridge design type must be shown to pass a 1.2 meter drop test onto an unyielding surface in the orientation most likely to result in failure of the containment system with no loss of contents.

Fuel cell cartridges containing hydrogen in a metal hydride transported under this entry must have a water capacity less than or equal to 120 mL.

A147 Where substances have a flash point of 60°C or less, the package(s) must bear a “FLAMMABLE LIQUID” subsidiary risk label in addition to the hazard label(s) required by these Instructions.

A148 ~~Alcohols containing petroleum products (e.g. gasoline) up to 5 per cent must be transported under the entry UN 1987 **Alcohols, n.o.s.**~~Not used.

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Editorial Note.— A154 below is included in the proposed Addendum No. 1 to the 2007-2008 edition.

+ A154 Lithium batteries that have the potential of producing a dangerous evolution of heat, fire or short circuit as a result of being damaged or defective are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

+ A155 Magnesium nitrate hexahydrate is not subject to these Instructions.

+ A156 Ethanol and gasoline, motor spirit or petrol mixtures for use in spark-ignition engines (e.g. in automobiles, stationary engines and other engines) must be assigned to this entry regardless of variations in volatility.

+ A157 A fuel cell cartridge may contain an activator provided it is fitted with two independent means of preventing unintended mixing with the fuel during transport.

+ A158 Mixtures of solids which are not subject to these Instructions and environmentally hazardous liquids or solids must be classified as UN 3077 and may be transported under this entry, provided there is no free liquid visible at the time the substance is loaded or at the time the packaging is closed. Sealed packets and articles containing less than 10 mL of an environmentally hazardous liquid, absorbed into a solid material but with no free liquid in the packet or article, or containing less than 10 g of an environmentally hazardous solid, are not subject to these Instructions.

+ A159 A single package of non-combustible solid LSA-II or LSA-III material must not contain an activity greater than 3000 A_2.

+ A160 Type B(U) and Type B(M) packages, must not contain activities greater than the following:

a) For low dispersible radioactive material: as authorized for the package design as specified in the certificate of approval;

b) For special form radioactive material: 3000 A_1 or 100 000 A_2, whichever is the lower; or

c) For all other radioactive material: 3000 A_2.

+ A161 Each fuel cell cartridge transported under this entry and designed to contain a liquefied flammable gas must:

a) be capable of withstanding, without leakage or bursting, a pressure of at least two times the equilibrium pressure of the contents at 55°C;

b) not contain more than 200 mL of liquefied flammable gas with a vapour pressure not exceeding 1 000 kPa at 55°C; and

c) Pass the hot water bath test prescribed in 6;5.4.1.

+ A162 Fuel cell cartridges containing hydrogen in a metal hydride transported under this entry must have a water capacity less than or equal to 120 mL.

The pressure in the fuel cell cartridge must not exceed 5 MPa at 55°C. The design type must withstand, without leaking or bursting, a pressure of two (2) times the design pressure of the cartridge at 55°C or 200 kPa more than the design pressure of the cartridge at 55°C, whichever is greater. The pressure at which this test is conducted is referred to in the drop test and the hydrogen cycling test as the "minimum shell burst pressure".

Fuel cell cartridges must be filled in accordance with procedures provided by the manufacturer. The manufacturer must provide the following information with each fuel cell cartridge:

a) inspection procedures to be carried out before initial filling and before refilling of the fuel cell cartridge;

b) safety precautions and potential hazards to be aware of;

c) method for determining when the rated capacity has been achieved;

d) minimum and maximum pressure range;

e) minimum and maximum temperature range; and

f) any other requirements to be met for initial filling and refilling including the type of equipment to be used for initial filling and refilling.

The fuel cell cartridges must be designed and constructed to prevent fuel leakage under normal conditions of transport. Each cartridge design type, including cartridges integral to a fuel cell, must be subjected to and must pass the following tests:

Drop test

A 1.8 metre drop test onto an unyielding surface in four different orientations:

a) Vertically, on the end containing the shut-off valve assembly;

b) Vertically, on the end opposite to the shut-off valve assembly;

c) Horizontally, onto a 38 mm steel apex, with the steel apex in the upward position; and

d) At a 45° angle on the end containing the shut-off valve assembly.

There must be no leakage, determined by using a soap bubble solution or other equivalent means on all possible leak locations, when the cartridge is charged to its rated charging pressure. The fuel cell cartridge must then be hydrostatically pressurized to destruction. The recorded burst pressure must exceed 85 per cent of the minimum shell burst pressure.

Fire test

A fuel cell cartridge filled to rated capacity with hydrogen will be subjected to a fire engulfment test. The cartridge design, which may include a vent feature integral to it, is deemed to have passed the fire test if:

a) The internal pressure vents to zero gauge pressure without rupture of the cartridge; or

b) The cartridge withstands the fire for a minimum of 20 minutes without rupture.

Hydrogen cycling test

This test is intended to ensure that a fuel cell cartridge design stress limits are not exceeded during use.

The fuel cell cartridge must be cycled from not more than 5 per cent rated hydrogen capacity to not less than 95 per cent rated hydrogen capacity and back to not more than 5 per cent rated hydrogen capacity. The rated charging pressure must be used for charging and temperatures must be held within the operating temperature range. The cycling must be continued for at least 100 cycles.

Following the cycling test, the fuel cell cartridge must be charged and the water volume displaced by the cartridge must be measured. The cartridge design is deemed to have passed the hydrogen cycling test if the water volume displaced by the cycled cartridge does not exceed the water volume displaced by an uncycled cartridge charged to 95 per cent rated capacity and pressurized to 75 per cent of its minimum shell burst pressure.

Production leak test

Each fuel cell cartridge must be tested for leaks at 15°C ± 5°C, while pressurized to its rated charging pressure.

There must be no leakage, determined by using a soap bubble solution or other equivalent means on all possible leak locations.

Each fuel cell cartridge must be permanently marked with the following information:

a) The rated charging pressure in megapascals (MPa);

b) The manufacturer's serial number of the fuel cell cartridges or unique identification number; and

c) The date of expiry based on the maximum service life (year in four digits; month in two digits).

\+ A163 Chemical kits and first aid kits containing dangerous goods in inner packagings which do not exceed the quantity limits for excepted quantities applicable to individual substances as specified in [1;2.4.3] may be transported in accordance with 3;5. Division 5.2 substances, although not individually authorized as excepted quantities in the Dangerous Goods List, are authorized in such kits and are [assigned Code E2 (see 3;5.2)].

Editorial Note.— Amend quantity limits for outer packagings for Division 5.2 substances in 1;2.4.3 to read 500 g or 500 ml if new Chapter 5 (see DGP-WG/07-WP/9) is not adopted.

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