

**UN INFORMAL WORKING GROUP ON THE HAZARD BASED CLASSIFICATION OF
BATTERIES
DRAFT TEXT FOR INCLUSION IN THE REGULATION**

New text appears in underlined red and deleted text is stricken through.

Proposed amendments to UN model regulation (Vol I and Vol II)

In chapter 2.9 :

2.9.2

Lithium cells and batteries

3090 and 4000 to 4007	LITHIUM METAL BATTERIES (including lithium alloy batteries)
3091 and 4016 to 4023	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT (including lithium alloy batteries) or
3091 and 4016 to 4023	LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)
3480 and 4008 to 4015	LITHIUM ION BATTERIES (including lithium ion polymer batteries)
3481 and 4024 to 4031	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT (including lithium ion polymer batteries) or
3481 and 4024 to 4031	LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)
3536	LITHIUM BATTERIES INSTALLED IN CARGO TRANSPORT UNIT

NOTE: See 2.9.4.

2.9.4. Lithium cells and batteries

2.9.4.1 Lithium batteries General requirements

Cells and batteries, containing lithium in any form shall be assigned one of the entries described in 2.9.4.2 as appropriate. They may be transported under these entries if they meet the following provisions:

- (a) Each cell or battery is of a type proven to meet the requirements of each test of the *Manual of Tests and Criteria*, Part III, sub-section 38.3 Revision 3 Amendment 1 or any later Revision; Cells and batteries manufactured according to a type meeting the requirements of subsection 38.3 of the Manual of Tests and Criteria, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, unless otherwise provided in these Regulations. Cell and battery types only meeting the requirements of the Manual of Tests and Criteria, Revision 3, are no longer valid. However, cells and batteries manufactured in conformity with such types before 1 July 2003 may continue to be transported if all other applicable requirements are fulfilled**NOTE: Batteries shall be of a type proven to meet the testing requirements of the Manual of Tests and Criteria, part III, sub-section 38.3, irrespective of whether the cells of which they are composed are of a tested type.**
- (b) Each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under conditions normally incident to transport;
- (c) Each cell and battery is equipped with an effective means of preventing external short circuits;

(d) Each battery containing cells or series of cells connected in parallel is equipped with effective means as necessary to prevent dangerous reverse current flow (e.g., diodes, fuses, etc.);
(e) Cells and batteries shall be manufactured under a quality management programme that includes:

- (i) A description of the organizational structure and responsibilities of personnel with regard to design and product quality;
- (ii) The relevant inspection and test, quality control, quality assurance, and process operation instructions that will be used;
- (iii) Process controls that should include relevant activities to prevent and detect internal short circuit failure during manufacture of cells;
- (iv) Quality records, such as inspection reports, test data, calibration data and certificates. Test data shall be kept and made available to the competent authority upon request;
- (v) Management reviews to ensure the effective operation of the quality management programme;
- (vi) A process for control of documents and their revision;
- (vii) A means for control of cells or batteries that are not conforming to the type tested as mentioned in (a) above;
- (viii) Training programmes and qualification procedures for relevant personnel; and
- (ix) Procedures to ensure that there is no damage to the final product.

NOTE: In house quality management programmes may be accepted. Third party certification is not required, but the procedures listed in (i) to (ix) above shall be properly recorded and traceable. A copy of the quality management programme shall be made available to the competent authority upon request.

(f) Lithium batteries, containing both primary lithium metal cells and rechargeable lithium ion cells, that are not designed to be externally charged (see special provision 387 of Chapter 3.3) shall meet the following conditions:

- (i) The rechargeable lithium ion cells can only be charged from the primary lithium metal cells;
- (ii) Overcharge of the rechargeable lithium ion cells is precluded by design;
- (iii) The battery has been tested as a lithium primary battery;
- (iv) Component cells of the battery shall be of a type proved to meet the respective testing requirements of the Manual of Tests and Criteria, part III, sub-section 38.3.
- (g) Except for button cells installed in equipment (including circuit boards), manufacturers and subsequent distributors of cells or batteries manufactured after 30 June 2003 shall make available the test summary as specified in the Manual of Tests and Criteria, Part III, sub-section 38.3, paragraph 38.3.57

2.9.4.2 Divisions according to hazard categories

Cells and batteries are assigned to one of the divisions according to their hazard properties as defined in the following table. Cells and batteries are assigned to the division which corresponds to the results of the tests described in the Manual of Tests and Criteria, part III, sub-section 38.3.5 and 38.3.6.

The test procedures allow assessment of cells and batteries so that an appropriate division can be assigned. The general scheme for classification of cells and batteries (flow chart) is shown in Figure 38.x of the Manual of Tests and Criteria

The assigned division is valid as long as the cell or battery remains in conformity with the type tested

Cells and batteries not tested according to 38.3.5 and 38.3.6, cells and batteries that are prototypes or low productions runs, or damaged or defective cells and batteries are assigned to classification code 9X.

division	Hazard description: cells or batteries that, when subjected to the test protocol of UN MT&C parag 38.3.5 and 38.3.6 present the following hazards:	UN Numbers for cells and batteries	UN numbers for Cells and batteries transported in or with an equipment
9A	thermal runaway propagation , , and flame	4000, 4008	4016, 4024
9B	Thermal Runaway propagation , no flame, but gas explosion hazard	4001,4009	4017, 4025
9C	Thermal run away propagation but no flame and no gas explosion hazard	4002, 4010	4018, 4026
9D	No Thermal run away propagation and flame	4003, 4011	4019, 4027
9E	No thermal runaway , no flame but gaz volume hazard, and temperature hazards,	4004, 4012,	4020, 4028
9F	No thermal Runaway propagation, no temperature hazard, but a gas volume hazard	4005, 4013	4021, 4029
9G	No thermal runaway propagation, no flame and no gaz volume hazard, but temperature hazard	4006, 4014	4022, 4030
9 H	No thermal runaway propagation, no flame, no gaz volume hazard, and no temperature hazard.	4007, 4015	4023, 4031
9X	Cells and batteries not tested according to 38.3.5 and 38.3.6	3090,3480	3091, 3481

2.9.4.3: [Transport under a specific state of charge]

Cells and batteries assigned to a category based on testing according to 2.9.4.2, conducted at a specific state of charge may be offered for transport according to the requirements of this category provided:

- The consignor demonstrates or ensures through instrumentation, physical process, documentation, inventory control or similar capability and quality management system mentioned in 2.9.4.1(e) that the cells/batteries offered for transport do not exceed the state of charge used to determine the category ;
- The transport document identifies the state of charge of the cells or batteries (see 5.4.1.5.14); and
- The test summary includes conditions related to the categorization when the cell or battery is offered at the specified state of charge.

Modify 2.9.5 as follow :

(e) Cells and batteries shall be manufactured under a quality management program as prescribed under 2.9.4.1 (e) (i) to (ix);

Commented [BA1]: To keep the doc short, the text focus only on LIBs. We wish to consider the extension to this text to Na-ion batteries in a similar way.

Commented [PC2R1]: Comments have been made about not extending the system to Sodium ion batteries based on the fact that

- 1) they are different
- 2) they don't present the same risk

We believe that these are not correct

Sodium ion batteries are liable to go into thermal runaway also. And they are already treated similarly to Li-ion in terms of testing under 38.3 and transport conditions PI etc... Except when discharged and short circuited.

Ineris has some testing results showing the way they react to the test including the new testing scheme for categorization..

This scheme is technology neutral and applies very well to Na ion batteries

Furthermore not allowing Na ion batteries to benefit from the categorization and be transported with less stringent conditions if belonging to lower hazard categories would be unfair and harm the development of this new technology

In chapter 3.2 :

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
3090	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9X			188 230 310 376 377 384 387	0	E0	P903 P908 P909 P910 P911 LP903 LP904 LP905 LP906			
3091	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9X			188 230 310 360 376 377 384 387 390	0	E0	P903 P908 P909 P910 P911 LP903 LP904 LP905 LP906			
3480	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9X			188 230 310 348 376 377 384 387	0	E0	P903 P908 P909 P910 P911 LP903 LP904 LP905 LP906			
3481	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9X			188 230 310 348 360 376 377 384 387 390	0	E0	P903 P908 P909 P910 P911 LP903 LP904 LP905 LP906			
4000	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9A			188 230 384 387 376 377			PXXX			
4001	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9B			188 230 384 387			PXXX			

Commented [PC3]: SP 188 cannot be deleted easily and replaced with LQ provision although it is an equivalent concept
 Sp188 contains more details especially a double level of LQ like in (f) of the SP
 However once the transport conditions and in particular the PI will have been defined for all divisions
 SP 188 may be deleted for some UN numbers if the transport conditions are more simple
 It may still be necessary for division 9X

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
								Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
4002	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9C			188 230 384 387			PXXY			
4003	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9D			188 230 384 387			PXXY			
4004	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9E			188 230 384 387			PXXY			
4005	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9F			188 230 384 387			PXXY			
4006	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9G			188 230 384 387			PXXX			
4007	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9H			188 230 384 387			PXXX			
4008	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9A			188 230 384 387			PXXY			
4009	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9B			188 230 384 387			PXXY			
4010	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9C			188 230 384 387 XXX			PXXY			

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
4011	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9D			188 230 384 387			PXXY			
4012	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9E			188 230 384 387			PXXY			
4013	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9F			188 230 384 387			PXXY			
4014	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9G			188 230 384 387			PXXY			
4015	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9H			188 230 384 387			PXXY			
4016	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9A			188 230 384 387 390			PXXX			
4017	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9B			188 230 384 387 390			PXXX			
4018	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9C			188 230 384 387 390			PXXY			

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
4019	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9D			188 230 384 387 390			PXXY			
4020	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9E			188 230 384 387 390			PXXY			
4021	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9F			188 230 384 387 390			PXXY			
4022	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9G			188 230 384 387 390			PXXX			
4023	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9H			188 230 384 387 390			PXXX			
4024	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9A			188 230 384 387 390			PXXY			
4025	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9B			188 230 384 387 390			PXXY			

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	(8)	(9)	(10)	(11)
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
4026	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9C			188 230 384 387 390			PXXY			
4027	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9D			188 230 384 387 390			PXXY			
4028	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9E			188 230 384 387 390			PXXY			
4029	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9F			188 230 384 387 390			PXXY			
4030	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9G			188 230 384 387 390			PXXY			
4031	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9H			188 230 384 387 390			PXXY			

Modify SP 188 :

Cells and batteries offered for transport are not subject to other provisions of these Regulations 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 or sodium ion cell, the 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 or sodium ion battery, the watt-hour rating is not more than 100 Wh. Lithium ion and sodium ion batteries subject to this provision shall be marked with the watt-hour rating on the outside case, except lithium ion batteries manufactured before 1 January 2009;
- (c) Each lithium cell or battery meets the provisions of 2.9.4.1 (a), (e), (f) if applicable and (g) or for sodium ion cells or batteries, the provisions of 2.9.5 (a), (e) and (f) shall apply;
- (d) Cells and batteries, except when installed in equipment, shall be packed in inner packagings that completely enclose the cell or battery. Cells and batteries shall be protected so as to prevent short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit. The inner packagings shall be packed in strong outer packagings which conform to the provisions of 4.1.1.1, 4.1.1.2, and 4.1.1.5;
- (e) Cells and batteries when installed in equipment shall be protected from damage and short circuit, and the equipment shall be equipped with an effective means of preventing accidental activation. This requirement does not apply to devices which are intentionally active in transport (radio frequency identification (RFID) transmitters, watches, sensors, etc.) and which are not capable of generating a dangerous evolution of heat. When batteries are installed in equipment, the equipment shall 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) Each package shall be marked with the appropriate lithium or sodium battery mark, as illustrated at 5.2.1.9;

NOTE: Packages containing lithium batteries packed in conformity with the provisions of part 4, chapter 11, packing instructions 965 or 968, section IB of the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air that bear the mark as shown in 5.2.1.9 (lithium battery mark) and the label shown in 5.2.2.2.2, Model No.9A shall be deemed to meet the provisions of this special provision.

This requirement does not apply to:

- (i) packages containing only button cell batteries installed in equipment (including circuit boards); and

(ii) packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment.

When packages are placed in an overpack, the lithium or sodium battery mark shall either be clearly visible or be reproduced on the outside of the overpack and the overpack shall be marked with the word "OVERPACK". The lettering of the "OVERPACK" mark shall be at least 12 mm high.

(g) Except when cells or batteries are installed in equipment, each package shall 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

(h) Except when cells or batteries are installed in or packed with equipment, packages shall not exceed 30 kg gross mass.

As used above and elsewhere in these Regulations, "lithium content" means the mass of lithium in the anode of a lithium metal or lithium alloy cell. As used in this special provision "equipment" means apparatus for which the cells or batteries will provide electrical power for its operation.

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.

A single cell battery as defined in part III, sub-section 38.3.2.3 of the Manual of Tests and Criteria is considered a "cell" and shall be transported according to the requirements for "cells" for the purpose of this special provision.

. [consider deleting this SP230?]

Modify SP 310 : Cells or batteries from production runs of not more than 100 cells or batteries, or pre-production prototypes of cells or batteries when these prototypes are transported for testing, shall meet the provisions of 2.9.4.1 with the exception of 2.9.4.1 (a), (e) (vii), (f) (iii) if applicable, (f) (iv) if applicable and (g).

Modify SP 328 : [...] When lithium metal, lithium ion or sodium ion batteries are contained in the fuel cell system, the consignment shall be consigned under this entry and under the appropriate entries for UN 3091 LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT, UN 3481 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT, UN numbers from 4016 to 4023 LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT (category A to H) or UN numbers from 4024 to 4031 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT (category A to H) or UN 3552 SODIUM ION BATTERIES CONTAINED IN EQUIPMENT.

Modify SP 363 : [...] (f) Engines or machinery may contain other dangerous goods than fuels (e.g. batteries, fire extinguishers, compressed gas accumulators or safety devices) required for their functioning or safe operation without being subject to any additional requirements for these other dangerous goods, unless otherwise specified in these Regulations. However, lithium batteries shall meet the provisions of 2.9.4.1, except that 2.9.4.1 (a), (e) (vii), (f) (iii) if applicable, (f) (iv) if applicable and (g) do not apply when batteries of a production run of not more than 100 cells or batteries, or pre-production

prototypes of cells or batteries when these prototypes are transported for testing, are installed in machinery or engines.

376

Lithium ion, lithium metal or sodium ion cells or batteries identified as being damaged or defective such that they do not conform to the type tested according to the applicable provisions of the *Manual of Tests and Criteria* shall comply with the requirements of this special provision.

For the purposes of this special provision, these may include, but are not limited to:

- Cells or batteries identified as being defective for safety reasons;
- Cells or batteries that have leaked or vented;
- Cells or batteries that cannot be diagnosed prior to transport; or
- Cells or batteries that have sustained physical or mechanical damage.

NOTE: In assessing a cell or battery as damaged or defective, an assessment or evaluation shall be performed based on safety criteria from the cell, battery or product manufacturer or by a technical expert with knowledge of the cell's or battery's safety features. An assessment or evaluation may include, but is not limited to, the following criteria:

- (a) *Acute hazard, such as gas, fire, or electrolyte leaking;*
- (b) *The use or misuse of the cell or battery;*
- (c) *Signs of physical damage, such as deformation to cell or battery casing, or colours on the casing;*
- (d) *External and internal short circuit protection, such as voltage or isolation measures;*
- (e) *The condition of the cell or battery safety features; or*
- (f) *Damage to any internal safety components, such as the battery management system.*

Cells and batteries shall be transported according to the provisions applicable to UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552, as appropriate, except special provision 230 and as otherwise stated in this special provision.

Cells and batteries shall be packed in accordance with packing instructions P908 of 4.1.4.1 or LP904 of 4.1.4.3, as applicable.

Cells and batteries identified as damaged or defective and liable to rapidly disassemble, dangerously react, produce a flame or a dangerous evolution of heat or a dangerous emission of toxic, corrosive or flammable gases or vapours under normal conditions of transport shall be packed and transported in accordance with packing instruction P911 of 4.1.4.1 or LP906 of 4.1.4.3, as applicable. Alternative packing and/or transport conditions may be authorized by the competent authority.

Packages shall be marked "DAMAGED/DEFECTIVE" in addition to the proper shipping name, as stated in 5.2.1.

The transport document shall include the following statement "Transport in accordance with special provision 376".

If applicable, a copy of the competent authority approval shall accompany the transport.

377

Lithium ion, lithium metal or sodium ion cells and batteries and equipment containing such cells and batteries transported for disposal or recycling, either packed together with or packed without non-lithium or non-sodium batteries, may be packaged in accordance with packing instruction P909 of 4.1.4.1. **In this case, these** cells and batteries are not subject to the requirements of section 2.9.4 or 2.9.5. **Cells and batteries shall be transported according to the UN numbers 3090, 3091, 3480, 3481, 3551 or 3552 as appropriate.** Additional exemptions may be provided under the conditions defined by modal transport regulations.

Packages shall be marked "LITHIUM BATTERIES FOR DISPOSAL", "SODIUM ION BATTERIES FOR DISPOSAL", "LITHIUM BATTERIES FOR RECYCLING" or "SODIUM ION BATTERIES FOR RECYCLING", as appropriate.

Identified damaged or defective batteries shall be transported in accordance with special provision 376.

In the case Cells and batteries are identified as verifying the requirements of sections 2.9.4 and 2.9.5 they may be transported according their initial defined UN number

Modify SP 377 : [...] These cells and batteries are not subject to the requirements of section 2.9.4.1 or 2.9.5. Additional exemptions may be provided under the conditions defined by modal transport regulations. [...]

Modify SP 384 **option 1** The label to be used is Model No 9A, see 5.2.2.2.2. However, for placarding of cargo transport units, the placard shall correspond to Model No 9.

option 2 The label to be used is Model No 9X or 9A to 9H as appropriate, see 5.2.2.2.2. However, for placarding of cargo transport units, the placard shall correspond to Model No 9.

Modify SP 387 : Lithium batteries in conformity with 2.9.4.1 (f) containing both primary lithium metal cells and rechargeable lithium ion cells shall be assigned to ~~UN Nos. 3090 or 3091 as appropriate.~~ **the UN number corresponding to the highest division of the component batteries. If both batteries have the same category, it shall be assigned to the UN number corresponding to the Li-metal battery.** When such batteries are transported in accordance with special provision 188, the total lithium content of all lithium metal cells contained in the battery shall not exceed 1.5 g and the total capacity of all lithium ion cells contained in the battery shall not exceed 10 Wh.

Modify SP 388 : [...] Examples of equipment are lawnmowers, cleaning machines or model boats and model aircraft. Equipment powered by lithium metal batteries or lithium ion batteries shall be assigned to one of the entries UN numbers from 4016 to 4023 LITHIUM METAL BATTERIES CONTAINED IN

Commented [PC4]: If necessary the division number could also be required on placards

EQUIPMENT (category A to H) or UN numbers from 4024 to 4031 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT (category A to H) and UN 3091 LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or UN 3091 LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT or UN 3481 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or UN 3481 LITHIUM ION BATTERIES PACKED WITH EQUIPMENT, as appropriate. Lithium ion batteries or lithium metal batteries installed in a cargo transport unit and designed only to provide power external to the cargo transport unit shall be assigned to the entry UN 3536 LITHIUM BATTERIES INSTALLED IN CARGO TRANSPORT UNIT lithium ion batteries or lithium metal batteries.

Dangerous goods, such as batteries, airbags, fire extinguishers, compressed gas accumulators, safety devices and other integral components of the vehicle that are necessary for the operation of the vehicle or for the safety of its operator or passengers, shall be securely installed in the vehicle and are not otherwise subject to these Regulations. However, lithium batteries shall meet the provisions of 2.9.4.1, except that 2.9.4.1 (a), (e) (vii), (f) (iii) if applicable, (f) (iv) if applicable and (g) do not apply when batteries of a production run of not more than 100 cells or batteries, or pre-production prototypes of cells or batteries when these prototypes are transported for testing, are installed in vehicles or equipment. [...]

Modify SP 389 : This entry only applies to lithium ion batteries or lithium metal batteries installed in a cargo transport unit and designed only to provide power external to the cargo transport unit. The lithium batteries shall meet the requirements of 2.9.4.1 (a) to (g) and contain the necessary systems to prevent overcharge and over discharge between the batteries. [...]

Modify SP390 : [need of an additional principle in a new SP?, for the case of mixing multiple categories, mentioning the need to mark according to the higher hazard division]When a package contains a combination of lithium batteries contained in equipment and lithium batteries packed with equipment, the following requirements apply for the purposes of package marking and documentation:

(a) the package shall be marked "UN 3091 Lithium metal batteries packed with equipment", or "UN 3481 Lithium ion batteries packed with equipment", or UN numbers from 4016 to 4023 LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT (category A to H) or UN numbers from 4024 to 4031 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT (category A to H) as appropriate. If a package contains both lithium ion batteries and lithium metal batteries packed with and contained in equipment, the package shall be marked as required for both battery types. However, button cell batteries installed in equipment (including circuit boards) need not be considered.

(b) the transport document shall indicate "UN 3091 Lithium metal batteries packed with equipment" or "UN 3481 Lithium ion batteries packed with equipment" or UN numbers from 4016 to 4023 LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT (category A to H) or UN numbers from 4024 to 4031 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT (category A to H), as appropriate. If a package contains both lithium metal batteries and lithium ion batteries packed with and contained in equipment, then the transport document shall indicate both "UN 3091 Lithium metal batteries packed with equipment" and "UN 3481 Lithium ion batteries packed with equipment".

In chapter 4 :

1. Introduce new packing instructions per (group of) divisions.

1.1.Division H (and F, G?)

PXXX PACKING INSTRUCTION PXXX

Dangerous goods shall be placed in suitable outer packagings. [For the purpose of this packing instruction, "equipment" means apparatus for which the cells or batteries will provide electrical power for its operation]. The packagings shall meet the provisions of 4.1.1.1, 4.1.1.2, ~~4.1.1.4~~, 4.1.1.8 and 4.1.3 and be so designed that they meet the construction requirements of 6.1.4. Outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, shall be used. Where this packing instruction is used for the transport of articles or inner packagings of combination packagings the packaging shall be designed and constructed to prevent inadvertent discharge of articles during normal conditions of transport.

In addition, for a cell or a battery employing a strong, impact resistant outer casing, pallets or other handling devices may be used. Cells or batteries shall be secured to prevent inadvertent movement, and the terminals shall not support the weight of other superimposed elements.

Special packing provisions:

PPX For UN 40YY batteries shall be protected from short circuit within the packagings.

NOTE: The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3).

PPX+1 For division 9G cells and batteries, the packaging material [in contact with the cells and batteries] shall be capable of withstanding temperatures exceeding 200°C. (link between the specified protection level and the tested battery?)

PPX+2 For dision 9F, [specific text for gaz containment TBC general principle about the quantity of gaz related to the cells and batteries size??]

1.2: Divisions A, B C D, E: specify constructions requirements of the packaging, such has to mitigate the hazards identified. Prpose in addition testing methods to qualifty these requirements;

PXXY PACKING INSTRUCTION PXXY

Dangerous goods shall be placed in suitable outer packagings. The packagings shall meet the provisions of 4.1.1.1, 4.1.1.2, 4.1.1.4, 4.1.1.8 and 4.1.3 and be so designed that they meet the construction requirements of 6.1.4. Outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, shall be used. Where this packing instruction is used for the transport of articles or inner packagings of combination packagings the packaging shall be designed and constructed to prevent inadvertent discharge of articles during normal conditions of transport.

Special packing provisions:

"qualified gaps. Separations to be discussed, test to be tested

PP16 For UN 40YY batteries shall be protected from short circuit within the packagings.

NOTE: The packagings authorized may exceed a net mass of 400 kg (see 4.1.3.3).

In Chapter 5.2

5.2.2.2.1.3 With the exception of labels for divisions 1.4, 1.5 and 1.6 of Class 1, the upper half of the label shall contain the pictorial symbol and the lower half shall contain the class or division number 1, 2, 3, 4, 5.1, 5.2, 6, 7, 8 or 9 as appropriate. However, for label model No. 9A, the upper half of the label shall only contain the seven vertical stripes of the symbol and the lower half shall contain the group of batteries of the symbol and the division number 9X or 9A to 9H. Except for label model No. 9A, the label may include such text as the UN number, or words describing the hazard class (e.g. "flammable") in accordance with 5.2.2.2.1.5 provided that the text does not obscure or detract from the other required label elements (or using only the UN number for identification?)

The table of specimen labels needs to be modified accordingly

In Chapter 5.4

Add 5.4.1.5.14 : Transport of a battery at a specific SOC

When batteries are transported in accordance with 2.9.4.3, the transport document shall identify the maximum state of charge.

Proposed amendments to UN Manual of Test and Criteria (§38.3)

38.3 Lithium metal and lithium ion cells and batteries

38.3.1 Purpose

This section presents

- the procedures to be followed for the classification of lithium metal and lithium ion cells and batteries (~~see UN Nos. 3090, 3091, 3480 and 3481, and the applicable special provisions of Chapter 3.3 of the Model Regulations~~); as described in 38.3.2, 38.3.3 and 38.3.4; and
- The procedure to be followed for the categorization of the lithium metal and lithium ion cells and batteries according to their hazard as described in 38.3.5 and 38.3.6

The cells and batteries tested in accordance with the following procedures may be assigned one of the UN Nos. described in 2.9.4.2, depending on the test results.

38.3.2 Scope

38.3.2.1 All cell types shall be subjected to tests T.1 to T.6 and T.8. as defined in 38.3.3 and 38.3.4. All non-rechargeable battery types, including those composed of previously tested cells, shall be subjected to tests T.1 to T.5. All rechargeable battery types, including those composed of previously tested cells, shall be subjected to tests T.1 to T.5 and T.7. In addition, rechargeable single cell batteries with overcharge protection shall be subjected to test T.7. A component cell that is not transported separately from the battery it is part of needs only to be tested according to tests T.6 and T.8. A component cell that is transported separately from the battery shall be subjected to tests T.1 to T.6 and T.8. A cell or battery that is an integral part of the equipment it is intended to power that is transported only when installed in the equipment, may be tested in accordance with the applicable tests when installed in the equipment.

To allow categorization according to 2.9.4.2, cell and battery types may be subjected to the tests defined in 38.3.5 and 38.3.6.

38.3.2.2 Lithium metal and lithium ion cells and batteries shall be subjected to the tests, as required by special provisions 188 ~~and~~, (230) of Chapter 3.3 of the Model Regulations prior to the transport of a particular cell or battery type. Cells or batteries which differ from a tested type by:

- (a) For primary cells and batteries, a change of more than 0.1 g or 20 % by mass, whichever is greater, to the cathode, to the anode, or to the electrolyte;
- (b) For rechargeable cells and batteries, a change in nominal energy in Watt-hours of more than 20 % or an increase in nominal voltage of more than 20 %; or
- (c) A change that would lead to failure of any of the tests, shall be considered a new type and shall be subjected to the required tests of 38.3.4

Cells and batteries which differ from a tested type by a change in the design that would lead to a change in the result of the test defined in 38.3.5 and 38.3.6 shall be subject to a new test in order to benefit the classification.

NOTE: The type of change that might be considered to differ from a tested type, such that it might lead to failure of any of the test results, may include, but is not limited to:

- (a) A change in the material of the anode, the cathode, the separator or the electrolyte;
- (b) A change of protective devices, including hardware and software;
- (c) A change of safety design in cells or batteries, such as a venting valve;
- (d) A change in the number of component cells;
- (e) A change in connecting mode of component cells; and
- (f) For batteries which are to be tested according to T.4 with a peak acceleration less than 150 g_n, a change in the mass which could adversely impact the result of the T.4 test and lead to a failure.

In the event that a cell or battery type does not meet one or more of the test requirements, steps

shall be taken to correct the deficiency or deficiencies that caused the failure before such cell or battery type is retested.

38.3.2.3 For the purposes of classification, the following definitions apply:

...

State-of-charge (SOC) means the percentage of the rated capacity contained in a cell or a battery as measured by subjecting it to a load, temperature and voltage cut-off point specified by the manufacturer.

NOTE: see note of the "rated capacity" definition for measurement methods.

...

38.3.3 Requested tests for classification

When a cell or battery type is to be tested under this sub-section, the number and condition of cells and batteries of each type to be tested are as follows: *(existing text unchanged)*

38.3.4 Procedure for classification tests (T1 to T8)

(existing text of the procedure unchanged)

38.3.5 Required tests for categorization (T9 to T11)

In order to determine a specific categorization of the cell or battery, 3 repetitions of the tests corresponding to the categorization flowchart shall be run. If one of the tests cannot be completed and makes the hazard evaluation impossible, additional tests shall be run, until a total of 3 valid tests are completed.

primary cells and batteries shall be tested undischarged. Rechargeable Cells and batteries transported at a specific state of charge under 2.9.4.3 shall be tested at that state of charge.

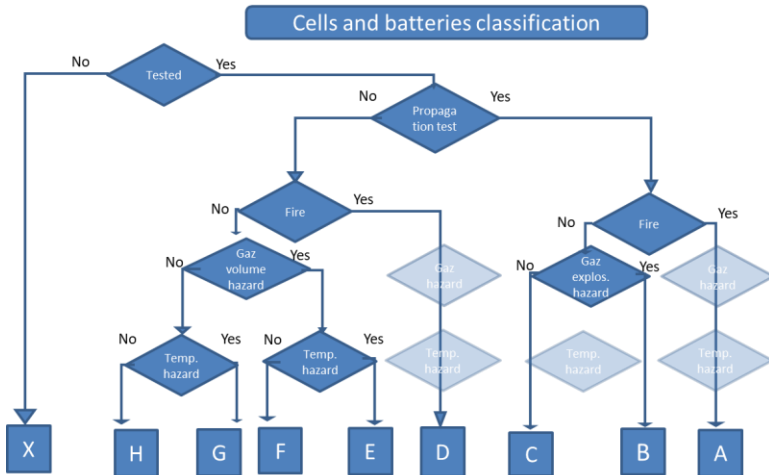
When cells or batteries that have been tested through categorization tests (T9 to T11) are electrically connected, the assembled battery can use the category of tested component cells or batteries without retesting if the assembled battery is of a type that has been verified as preventing:

- (i) ...TBD
- (ii)

38.3.6 Procedure for categorization tests (T9 to T11)

The categories are defined according to the test result performed following procedures and according to the following flowchart. Cells and batteries are assigned to one of the categories which corresponds to the results of the tests :

Commented [BA5]: To be discussed with the IWG on the basis of design requirements based on the possibility to characterize designs without electrical and/or thermal additives risks (reverse currents, extra heat conduction...) compared with the cell test.



The most severe hazard measured over the 3 valid tests shall be reported as the cell or battery test results.

The proposed tests for the hazard classification system are based on forcing the initiation cell into thermal runaway through the application of heat on the surface of a cell or a cell in a battery pack or module until the thermal runaway reaction is initiated inside the cell or the cell surface temperature has reached 350 °C.

For the cells or batteries that would not initiate a thermal runaway at a fully charged state when applying the test protocol, the working group will look at appropriate transport conditions.

• the cell or the battery may be assigned to the relevant category according to the test result (category E to H); or

• alternatively, such cells may be eligible for transport under conditions authorized by competent authorities, until the regulation is amended to address these non-reactive technologies (e.g. solid state batteries).

Commented [BA6]: Bob : Perhaps we should restrict the category reassignment or lowering when testing is based on lower SOC. The reasoning is that lower SOC is hard to check or enforcement and we likely need a factor of safety to account for this. This may apply to enhanced packaging as well.

38.3.6.1 Test T.9: Cell propagation test

38.3.6.1.1 Purpose

The purpose of the test is to create a worst-case testing condition to assess the risk of

- thermal runaway propagation and if applicable propagation rate from cell to cell,
- flame generation in the case of thermal runaway of a cell or multiple cells
- the maximum temperature of a of a cell or multiple cells in case of thermal runaway.

38.3.6.1.2 Test procedure

The propagation test is conducted by placing 4 identical cells inside a thermally insulated test fixture designed to tightly maintain the 4 cells in a row. The initiation cell shall be placed at one end of the row, with the heater on the side of the initiation cell that is not adjacent to the next cell in the row. All other cells will be placed side by side, with the larger side used as the contact surface, or the longer side for cylindrical cells. There shall not be any

material inserted between the cells. The compression force of the row shall be verified. (refer to the specified value ?)

The test fixture must have 6 sides to maximize heat containment. The test fixture shall have the required mechanical robustness to contain all mechanical ejections, including through the lid, but allow for gas and flame exhaustion. Each cell will be equipped with a thermocouple.

The initiation cell shall be heated at a rate of $15 \pm 10 \text{ }^\circ\text{C}$ per minute [ref to UN GTR/ISO 6469-1 to be checked if applicable to larger cells], based on the measure of the control thermocouple. The power of the heater shall be controlled manually or electronically to maintain the heating rate constant during the whole test duration. The heater power shall be cut off when a thermal runaway is detected (detection of a continuous increase of the temperature of the initiation cell without increase of the heater power for more than 3 minutes), or when the [initiation] cell temperature has reached $350 \text{ }^\circ\text{C}$ for at least 1 minute. The data are recorded for 6 hours after stopping power to the heater.

To detect flame the use of a video recording device is required to capture the potential appearance of flames.

The maximum temperature determination is based on the use of a thermocouple on the last cell of the row. To capture the maximum temperature during the test the thermocouple will be placed on the surface of the cell that is furthest away from the initiation cell and insulated from any test fixture contact.

38.3.6.1.3 Criteria

For propagation: The temperature of the cells in the row will be used to detect the propagation of the thermal run-away. The test will demonstrate the absence of propagation when the 4th cell in the row does not experience thermal run-away. In the case of propagation, the time difference between two successive cells experiencing thermal runaway in the row (based on the detection of the maximum temperature reached by each cell) will be measured. The propagation time will be calculated based on the average of all the time differences measured during the 3 repetitions of the test. The result is proposed to be expressed as:

- no propagation; or
- propagation (Propagation rate below 1000 mm per min); or
- rapid propagation (Propagation rate above 1000 mm per min).

For flames: the video recording of the test will be analyzed to detect the presence of flame.

The test result will be expressed as a cell property: generate fire or do not generate fire.

For temperature: the temperature recording of test will be analyzed to detect the maximum temperature for a period of 3 minutes. The test result will be expressed as a cell property: maximum temperature observed during the test:

- exceed a $150 \text{ }^\circ\text{C}$ increase above the temperature at the time the heater is stopped; or
- is below a $150 \text{ }^\circ\text{C}$ increase.

38.3.6.2 Test T.10: Cell gas volume determination

38.3.6.2.1 Purpose

The purpose of the test is to determine the quantity of gas generated in the case of thermal runaway of a cell. It is considered by default that all lithium cells generate toxic gas.

38.3.6.2.2 Test procedure

Commented [BA7]: Kevin: Compression of the cells in the row is not a requirement here, only containment and physical contact.

The test method used to determine the quantity of gas generated by a single cell in thermal runaway is based on capturing of the gas generated inside an enclosure, equipped either with a gas pressure and temperature measurement, or with a volumetric gauge.

The thermal runaway is initiated in a similar way as for the propagation test, except that it only applies to a single cell.

The chamber for gas volume measurement shall be a tight enclosure, filled with inert gas (nitrogen or argon) enabling to measure the gas volume released in absence of combustion. The chamber size will be determined based on the size of the cell, and the potential maximum volume of gas released.

The necessary time for temperature and pressure to stabilize and homogenize must be allowed before making the pressure and temperature measurements.

38.3.6.2.3 Criteria

The result of the test will be expressed as a volume of gas in liters, at ambient temperature and normal pressure.

The result could be expressed either as:

- no gas volume measured; or
- gas volume below [XX] liters; or
- gas volume above [XX] liters.

38.3.6.3 Test T.11: Battery propagation test

38.3.6.3.1 Purpose

The test purpose is to create a worst-case testing condition to assess the risk of thermal runaway propagation inside the battery, and from battery to battery.

38.3.6.3.2 Test procedure

The tests for the hazard classification are based on the initiation of the thermal runaway of the battery, with the same method as in T9, applied to one cell inside the battery.

The selected cell should be the one providing more risk of propagation. Particularly, the selected cell shall be fulfilling the following conditions, as far as applicable:

- the cell shall be on a battery side, in a position enabling the application of the heater,
- the cell shall be at the shorter distance of neighboring cells, considering the general battery design, and
- the cell shall not be closer or better connected to thermal masses or cooling systems when compared to other cells, considering the general battery design.

In the cases where the application of a heater on a cell is not technically possible, other equivalent ignition methods may be applied (overcharge of one cell, overcharge of a module, use a laser, use specially prepared cells with internal short circuit system, ...). This alternative method would only be acceptable in the case it generates a thermal run-away reaction on the initiation cell.

Similarly to the cells test, the initiation cell shall be heated at a rate of 15 ± 10 °C per minute, based on the measure of the control thermocouple. The heater power shall be cut off when a thermal runaway is detected (detection of an increase of temperature slope without increase of the heater power for more than 3 minutes), or when the cell temperature has reached 350 °C for at least 1 minute.

The battery will be equipped with external thermocouples on each surface of the battery, except the surface with the initiation cell. For placing the thermocouples, representative positions for each side of the battery should be selected, to represent the maximum measurable temperature of the surface of the battery.

To detect flame the use of a video recording device is required to capture the potential appearance of flames at any of the gas exhausts of the thermally insulated test fixture.

Commented [BA8]: For exemple in division 4.3 (Substances which in contact with water emit flammable gases) : 2.4.4.3.3 Packing group III shall be assigned to any substance which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is greater than 1 litre per kilogram of substance per hour, and which does not meet the criteria for packing groups I or II.

38.3.6.3.3 Criteria

The temperature recording of test will be analyzed to detect the maximum temperature for a period of [3 minutes].

For propagation: no surface temperature above 100 °C except momentary spike below 200 °C.

For flames: the video recording of the test will be analyzed to detect the presence of flame.

The test result will be expressed as a cell property: generate fire or do not generate fire.

For temperature:

38.3.6.3.4 Alternative Test procedure T11b.

Alternatively, a method using several batteries, similar to the cell propagation method, is applicable to verify the propagation risk between batteries in specific cases:

- in the case of batteries where the casing is hot or melting, but do not propagate the thermal runaway to a neighbor battery of the same type; and
- in the case of single cells batteries, or batteries without casing.

38.3.6.3.5 Criteria for the alternative method T11b.

The temperature recording of test will be analyzed to detect the maximum temperature for a period of [3 minutes].

For propagation: no propagation from battery to battery.

For flames: the video recording of the test will be analyzed to detect the presence of flame.

The test result will be expressed as a cell property: generate fire or do not generate fire.

For Temperature: the temperature recording of test will be analyzed to detect the maximum temperature for a period of 3 minutes. The test result will be expressed as a cell property: maximum temperature observed during the test:

- exceed a 150 °C increase above the temperature at the time the heater is stopped; or
- is below a 150 °C increase.

38.3.6.4 Test T.12: Battery gas volume determination

38.3.6.4.1 Purpose

The test purpose is to determine the quantity of gas generated in case of thermal runaway of a cell(s) inside a battery. It is considered by default that all lithium battery cells generate toxic gas.

38.3.6.4.2 Test procedure

Two protocols are proposed for the determination of gas quantities:

Commented [BA9]: Decision for the batteries without casing, where to place the thermocouples to be discussed

- the test protocol applicable is exactly the same as in T10. In this case the determination of the number of cells that have reacted inside the battery during the propagation test will be required for the criteria calculation; and
- when a single cell cannot be separated or made available from another source, then the test protocol described for the gas volume determination is applied to the complete battery, the heater being applied to a single cell in the battery.

The chamber for gas volume measurement shall be similar to the one used for the cells classification test. accept equivalent test equipment?

38.3.6.4.3 Criteria

The result of the test will be expressed as a volume of gas in liters, at ambient temperature and normal pressure.

In the case a single cell has been tested, then the measured volume of gas shall be multiplied by the number of cells that have reacted during the thermal run-away propagation test of the battery, or the total number of cells in the battery in the case the result for the propagation test is not available.

The result could be expressed as:

- no gas volume measured; or
- gas volume below [XX] liters; or
- gas volume above [XX] liters.

38.3.6.5 Test T.13: Cell gas flammability determination

38.3.6.5.1 Purpose

The flammability hazard of the gas is not applicable to all lithium batteries. Testing to determine gas flammability is optional for assignment to either category B or C. If testing is not conducted then category B is the default.

38.3.6.5.2 Test procedure

The testing method to verify gas flammability is under discussion amongst the IWG testing laboratory members based on their specific competency conducting such tests. Using standard ISO 10156 which specifies methods for determining whether or not a gas or gas mixture is flammable in air and whether a gas or gas mixture is more or less oxidizing than air under atmospheric conditions based on testing or calculation was suggested.

38.3.6.5.3 Criteria

The result of the test will be expressed as a gas property for the cell tested: flammable or non-flammable gas.

38.3.7 Lithium cell and battery test summary

The following test summary shall be made available:

Lithium cell or battery test summary in accordance with sub-section 38.3 of Manual of Tests and Criteria

The following information shall be provided in this test summary:

- Name of cell, battery, or product manufacturer, as applicable;
- Cell, battery, or product manufacturer's contact information to include address, phone number, email address and website for more information;

- (c) Name of the test laboratory to include address, phone number, email address and website for more information;
- (d) A unique test report identification number;
- (e) Date of test report;
- (f) Description of cell or battery to include at a minimum:
 - (i) Lithium ion or lithium metal cell or battery;
 - (ii) Mass of cell or battery;
 - (iii) Watt-hour rating, or lithium content;
 - (iv) Physical description of the cell/battery; and
 - (v) Cell or battery model number or, alternatively, if the test summary is established for a product containing a cell or battery, the product model number.
- (g) List of mandatory tests conducted under 38.3.4 and results (i.e., pass/fail);
- (h) If applied, List of tests conducted under 38.3.5 for categorization purpose;
- (i) If applied, SOC at which the cell or battery was tested according to 2.9.4.3
- (j) Reference to assembled battery testing requirements, if applicable (i.e. 38.3.3 (f) and 38.3.3 (g));
- (k) Reference to the revised edition of the Manual of Tests and Criteria used and to amendments thereto, if any; and
- (l) Name and title of responsible person as an indication of the validity of information provided