Distributions Class 1 General

Technical Notice

ADR 2025 - Transport Regulations for Road and Rail Transport Overview

UN 3090 LITHIUM-METALL-BATTERIES UN 3091 LITHIUM-METALL-BATTERIES CONTAINED IN EQUIPMENT or LITHIUM-METALL-BATTERIES PACKED WITH EQUIPMENT					See ADR chapter
Class	9	Miscellaneous	x	x	2.2
Classification code	M4	Lithium Batteries	x	x	2.2.9.1.2.
Classification		Lithium cells and batteries	x	x	2.2.9.1.7
Packing group		See page 6 ff.	x	x	2.0.1.3
Hazard label	9A	Hazard label 9A for lithium batteries	x	x	5.2.2
Special provisions	188	Exceptions...	x	x	3.3
	230	Full regulations if...	x	x	
	310	Prototypes	x	x	
	360	Battery powered vehicles	x		
	376	Damaged or defective lithium batteries	x	x	
	377	Lithium batteries for disposal or recycling	x	x	
	387	Hybrid batteries special devision188	x	x	
	636	Used batteries		x	
	670	Lithium batteries in household appliances	x		
Limited quantities	LQ0	No	x	x	3.4.6
Excepted quantity	E0	No	x	x	3.5.1.2
Packing instructions	P903	Lithium batteries	x	x	4.1.4.1
	P908	Defect batteries	x	x	
	P909	Batteries for disposal	x	x	
	P910	Prototypes	x	x	
	P911	Damaged or defective battery	x	x	
	LP903	Large packaging for single battery	x	x	
	LP904	Large packaging for single damaged or defect battery	x	x	
	LP 905	Prototypes	x	x	
	LP 906	Defective/ single demanded batteries	x	x	
Transport Category	2	Exemption unter 333 kg	x	x	1.1.3.6
Tunnel code	E	Forbidden in tunnels of category E	x	x	8.6

1.6.1.29

Lithium cells and batteries manufactured according to a type meeting the requirements of sub-section 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 carried, unless otherwise provided in ADR. Lithium cells and batteries manufactured before 1 July 2003 meeting the requirements of the Manual of Tests and Criteria, Revision 3, may continue to be carried if all other applicable requirements are fulfilled.

2.2.9.1.7.1

Lithium batteries shall meet the following requirements, except when otherwise provided for in ADR (e.g. for prototype batteries and small production runs under special provision 310 or damaged batteries under special provision 376).

NOTE: *For UN 3536 LITHIUM BATTERIES INSTALLED IN CARGO TRANSPORT UNIT, see special provision 389 in Chapter 3.3.*

Cells and batteries, cells and batteries contained in equipment, or cells and batteries packed with equipment, containing lithium in any form shall be assigned to UN Nos. 3090, 3091, 3480 or 3481 as appropriate. They may be carried under these entries if they meet the following provisions:

(a) Each cell or battery is of the type proved to meet the requirements of each test of the Manual of Tests and Criteria, Part III, sub-section 38.3;

NOTE: *Batteries shall be of a type proved 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 normal conditions of carriage;

(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 instead 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 38.3.5.

Note: *The term "make it available" means that manufactures and subsequent distributors ensure that the test summary is accessible so that the consignor or other persons in the supply chain can confirm compliance*.

Lithium batteries are not subject to the provisions of ADR if they meet the requirements of special provision 188 of Chapter 3.3.

Special Provision 188

Cells and batteries offered for carriage are not subject to other provisions of ADR 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 or sodium ion, the Watt-hour rating is not more than 20 Wh;

Note: *When lithium batteries in conformity with 2.2.9.1.7 (f) are carried in accordance with this special provision, 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 (see special provision 387).*

(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 batteries subject to this provision shall be marked with the Watt-hour rating on the outside case, except those manufactured before 1 January 2009;

Note: *When lithium batteries in conformity with 2.2.9.1.7 (f) are carried in accordance with this special provision, 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 (see special provisions 387).*

(c) Each cell or battery meets the provisions of 2.2.9.1.7 (a), (e), (f) if applicable and (g) or for sodium ion cells or batteries, the provisions of 2.2.9.1.7.2 (a), € 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 carriaget (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 battery mark, as illustrated in 5.2.1.9; This requirement does not apply to:

(i) Packages containing only button cell batteries installed in equipment (including circuit boards); and Packages containing no more than four cells or two batteries installed in equipment, where there are more than two packages in the consignment.

(ii) When packages are placed in an overpack, the lithium 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.

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 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.*

(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 ADR. "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 lithium cells or batteries will provide electrical power for its operation.

Separate entries exist for lithium metal batteries and lithium ion batteries to facilitate the carriage of these batteries for specific modes of carriage 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 carried according to the requirements for "cells" for the purpose of this special provision.

Special Provision 230

Lithium cells and batteries may be carried under this entry if they meet the provisions of 2.2.9.1.7. Sodium ion cells and batteries may be carried under this entry if they meet the provisions of 2.2.9.1.7.2.

Special Provision 310

Cells and batteries from production runs of not more than 100 cells or batteries, or pre-production prototypes of cells or batteries when these prototypes are carried for testing, shall meet the provisions of 2.2.9.1.7.1 with exception of (a), (e) (vii), (f) (iii) if applicate and (g).

Note: *"Carried for testing" includes, but is not limited to, testing described in the "Manual of Tests and Criteria", part III sub-section 38.3, integration testing and product performance testing.*

These cells and batteries shall be packaged in accordance with packing instruction P910 of 4.1.4.3, as applicable, are met.

Articles (UN Nos. 3537, 3538, 3540, 3541, 3546, 3547 or 3548) may contain such cells or batteries provided that the applicable parts of packing instruction P006 of 4.1.4.1 or LP03 of 4.1.4.3, as applicable, are met.

The transport document shall include the following statement: "Transport in accordance with special provision 310".

Damaged or defective cells, batteries or cells and batteries contained in equipment shall be carried in accordance with special provision 376.

Cells, batteries or cells and batteries contained in equipment carried for disposal or recycling may be packaged in accordance with special provision 377 and packing instruction P909 of 4.1.4.1.

Special Provision 360

Vehicles only powered by lithium metal batteries, lithium ion or sodium ion batteries shall be assigned to the entries UN 3556 VEHICLE, LITHIUM ION BATTERY POWERD or UN 3557 VIHICLE; LITHIUM METALL BATTERY POWERD or UN 3558 VEHICLE; SODIUM ION BATTERY POWERD; as applicable. Lithium batteries installed in cargo transport units, designed only to provide power external to the transport unit shall be assigned to entry UN 3536 LITHIUM BATTERIES INSTALLED IN CARGO TRANSPORT UNIT lithium ion batteries or lithium metal batteries.

Special Provision 376

Lithium metal, lithium ion or sodium ion cells or batteries 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 carriage; 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 carried according to the provisions applicable to UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552 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 carriage shall be packed and carried in accordance with packing instruction P911 of 4.1.4.1 or LP906 of 4.1.4.3., as applicable. Alternative packing and/or carriage conditions may be authorized by the competent authority of any ADR Contacting Party who may also recognize an approval granted by the competent authority of a country which is not an ADR Contracting Party provided that this approval has been granted in accordance with the procedures applicable according to RID, ADR, ADN, the IMDG Code or the ICAO Technical Instructions.
Packages shall be marked "DAMAGED/DEFECTIVE LITHIUM-ION BATTERIES", "DAMADGED/ DEFEVTIVE LITHIUM METAL BATTERIES" or "DAMAGED/DEFECTIVE SODUIUM ION BATTERIES", as applicable.
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 carriage.

Special Provision 377

Lithium metal, lithium ion and sodium ion cells and batteries and equipment containing such cells and batteries carried for disposal or recycling, either packed together with or packed without non-lithium batteries, may be packaged in accordance with packing instruction P909 of 4.1.4.1.

These cells and batteries are not subject to the provisions of 2.2.9.1.7.1 (a) to (g)or 2.2.9.1.7.2 (a) to (g). Packages shall be marked "LITHIUM BATTERIES FOR DISPOSAL", "SODIUM ION BATTERIES FOR DISPOSAL", "LITHIUM BATTERIES FOR RECYCLING" or "SODIUM ION FOR RECYCLING; as appropriate.

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

Special Provision 387

Lithium batteries in conformity with 2.2.9.1.7.1 (f) containing both primary lithium metal cells and rechargeable lithium ion cells shall be assigned to UN Nos. 3090 or 3091 as appropriate. When such batteries are carried 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.

Special Provision 636

Up to the intermediate processing futility, lithium cells and batteries with a gross mass of not more than 500 g each, lithium ion cells with a Watt-hour rating of not more than 20 Wh, lithium ion batteries with a Watt-hour rating of not more than 100 Wh, lithium metal cells with a lithium content of not more than 1 g and lithium metal batteries with an aggregate lithium content of not more than 2 g, not contained in equipment, collected and handed over for carriage for sorting, disposal or recycling, together with or without other non-lithium cells or batteries, are not subject to the other provisions of ADR including special provision 376 and 2.2.9.1.7, if the following conditions are met:

(a) The cells and batteries are packed according to packing instruction P909 of 4.1.4.1 except for the additional requirements 1 and 2;
A quality assurance system is in place to ensure that the total amount of lithium cells and batteries per transport unit does not exceed 333 kg; ***NOTE:*** *The total quantity of lithium cells and batteries in the mix may be assessed by means of a statistical method included in the quality assurance system. A copy of the quality assurance records shall be made available to the competent authority upon request.*

(c) Packages are marked: "LITHIUM BATTERIES FOR DISPOSAL" or "LITHIUM BATTERIES FOR RECYCLING" as appropriate.

Special Provision 670

(a) Lithium cells and batteries and sodium ion cells and batteries installed in equipment from private households collected and handed over for carriage for depollution, dismantling, recycling or disposal are not subject to the other provisions of ADR including special provision 376, 2.2.9.1.7.1 and 2.2.9.1.7.2 when:

(i) They are not the main power source for the operation of the equipment in which they are contained;

(ii) The equipment in which they are contained does not contain any other lithium cell or battery used as the main power source; and

(iii) They are afforded protection by the equipment in which they are contained.

Examples for cells and batteries covered by this paragraph are button cells used for data integrity in household appliances (e.g. refrigerators, washing machines, dishwashers) or in other electrical or electronic equipment;

(b) Up to the intermediate processing facility lithium cells and batteries and sodium ion cells and batteries contained in equipment from private households not meeting the requirements of (a) collected and handed over for carriage for depollution, dismantling, recycling or disposal are not subject to the other provisions of ADR including special provision 376, 2.2.9.1.7.1 and 2.2.9.1.7.2, if the following conditions are met:

(i)

The equipment is packed in accordance with packing instruction P909 of 4.1.4.1 except for the additional requirements 1 and 2; or it is packed in strong outer packagings, e.g. specially designed collection receptacles, which meet the following requirements:

- The packagings shall be constructed of suitable material and be of adequate strength and design in relation to the packaging capacity and its intended use. The packagings need not meet the requirements of 4.1.1.3;
- Appropriate measures shall be taken to minimize the damage of the equipment when filling and handling the packaging, e.g. use of rubber mats; and
- The packagings shall be constructed and closed so as to prevent any loss of contents during carriage, e.g. by lids, strong inner liners, covers for transport. Openings designed for filling are acceptable if they are constructed so as to prevent loss of content;

(ii) A quality assurance system is in place to ensure that the total amount of lithium cells and batteries and sodium ion cells and batteries per transport unit does not exceed 333 kg;

NOTE: *The total quantity of lithium cells and batteries and sodium ion cells and batteries in the equipment from private households may be assessed by means of a statistical method included in the quality assurance system. A copy of the quality assurance records shall be made available to the competent authority upon request.*

(iii) Packages are marked "LITHIUM BATTERIES FOR DISPOSAL", “SODIUM ION BATTERIES FOR DISPOSAL”, "LITHIUM BATTERIES FOR RECYCLING" or “SODIUM ION FOR RECYCLING as appropriate. If equipment containing lithium cells or batteries and sodium ion cells and batteries is carried unpackaged or on pallets in accordance with packing instruction P909 (3) of 4.1.4.1, this mark may alternatively be affixed to the external surface of the vehicles or containers).

NOTE: *"Equipment from private households" means equipment which comes from private households and equipment which comes from commercial, industrial, institutional and other sources which, because of its nature and quantity, is similar to that from private households. Equipment likely to be used by both private households and users other than private households shall in any event be considered to be equipment from private households.*

P903 PACKING INSTRUCTION P903
This instruction applies to UN Nos. 3090, 3091, 3480 and 3481.
For the purpose of this packing instruction, "equipment" means apparatus for which the cells or batteries will provide electrical power for its operation. The following packagings are authorized provided that the general provisions of 4.1.1 and 4.1.3 are met:

(1) For cells and batteries:

Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2);

Jerricans (3A2, 3B2, 3H2).

Cells or batteries shall be packed in packaging so that the cells or batteries are protected against damage that may be caused by the movement or placement of the cells or batteries within the packaging.

Packagings shall conform to the packing group II performance level.

(2) In addition, for cells or batteries with a gross mass of 12 kg or more employing a strong, impact resistant outer casing:

(a) Strong outer packagings;

(b) Protective enclosures (e.g., in fully enclosed or wooden slatted crates); or

(c) Pallets or other handling devices.

Cells or batteries shall be secured to prevent inadvertent movement, and the terminals shall not support the weight of other superimposed elements.

Packagings need not meet the requirements of 4.1.1.3.

(3) For cells or batteries packed with equipment:

Packagings conforming to the requirements in paragraph (1) of this packing instruction, then placed with the equipment in an outer packaging; or

Packagings that completely enclose the cells or batteries, then placed with equipment in a packaging conforming to the requirements in paragraph (1) of this packing instruction.

The equipment shall be secured against movement within the outer packaging.

(4) For cells or batteries contained in equipment:

Strong outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use. They shall be constructed in such a manner as to prevent accidental operation during carriage. Packagings need not meet the requirements of 4.1.1.3.

Large equipment can be offered for carriage unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

When intentionally active, devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be carried when intentionally active in strong outer packagings.

NOTE: *For carriage in a transport chain including air carriage, these devices, when active, shall meet defined standards for electromagnetic radiation to ensure that the operation of the devices does not interfere with aircraft systems.*

(5) For packagings containing both cells or batteries packed with equipment and contained in equipment:

(a) For cells and batteries, packagings that completely enclose the cells or batteries, then placed with equipment in a packaging conforming to the requirements in paragraph (1) of this packing instruction; or

(b) Packagings conforming to the requirements in paragraph (1) of this packing instruction, then placed with the equipment in a strong outer packaging constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use. The outer packaging shall be constructed in such a manner as to prevent accidental operation during carriage and need not meet the requirements of 4.1.1.3.

The equipment shall be secured against movement within the outer packaging. Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be carried when intentionally active in strong outer packagings.

NOTE: For carriage in a transport chain including air carriage, these devices, when active, shall meet defined standards for electromagnetic radiation to ensure that the operation of the devices does not interfere with aircraft systems.

Additional requirement:

Cells or batteries shall be protected against short circuit.

P908	PACKING INSTRUCTION	P908

This instruction applies to damaged or defective cells and batteries, including those contained in equipment, of UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552.

The following packagings are authorized provided the general provisions of 4.1.1 and 4.1.3 are met:

For cells and batteries and equipment containing cells and batteries:

Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G)

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2)

Jerricans (3A2, 3B2, 3H2)

Packagings shall conform to the packing group II performance level.

1. Each damaged or defective cell or battery or equipment containing such cells or batteries shall be individually packed in inner packaging and placed inside an outer packaging. The inner packaging or outer packaging shall be leak-proof to prevent the potential release of electrolyte.
2. Each inner packaging shall be surrounded by sufficient non-combustible and electrically non-conductive thermal insulation material to protect against a dangerous evolution of heat.
3. Sealed packagings shall be fitted with a venting device when appropriate.
4. Appropriate measures shall be taken to minimize the effects of vibrations and shocks, prevent movement of the cells or batteries within the package that may lead to further damage and a dangerous condition during carriage. Cushioning material that is non-combustible and electrically non-conductive may also be used to meet this requirement.
5. The non-combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured.

For leaking cells or batteries, sufficient inert absorbent material shall be added to the inner or outer packaging to absorb any release of electrolyte.

A cell or battery with a net mass of more than 30 kg shall be limited to one cell or battery per outer packaging.

Additional requirement:

Cells or batteries shall be protected against short circuit.

P909	PACKING INSTRUCTION	P909

This instruction applies to UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552 carried for disposal or recycling, either packed together with or packed without non-lithium batteries.

(1) Cells and batteries shall be packed in accordance with the following:

(a) The following packagings are authorized, provided that the general provisions of 4.1.1 and 4.1.3, are met:

Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H2); and

Jerricans (3A2, 3B2, 3H2).

(b) Packagings shall conform to the packing group II performance level.

(c) Metal packagings shall be fitted with an electrically non-conductive lining material (e.g. plastics) of adequate strength for the intended use.

(2) However, lithium ion or sodium ion cells with a Watt-hour rating of not more than 20 Wh, lithium ion or sodium ion batteries with a Watt-hour rating of not more than 100 Wh, lithium metal cells with a lithium content of not more than 1 g and lithium metal batteries with an aggregate lithium content of not more than 2 g may be packed in accordance with the following:

(a) In strong outer packaging up to 30 kg gross mass meeting the general provisions of 4.1.1, except 4.1.1.3, and 4.1.3.

(b) Metal packagings shall be fitted with an electrically non-conductive lining material (e.g. plastics) of adequate strength for the intended use.

(3) For cells or batteries contained in equipment, strong outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3. Equipment may also be offered for carriage unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

(4) In addition, for cells or batteries with a gross mass of 12 kg or more employing a strong, impact resistant outer casing, strong outer packagings constructed of suitable material and of adequate strength and design in relation to the packaging's capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3.

Note: *The packagings authorized in (3) and (4) may exceed a net mass of 400 kg (see 4.1.3.3)*

Additional requirements:

1. Cells and batteries shall be designed or packed to prevent short circuits and the dangerous evolution of heat.

2. Protection against short circuits and the dangerous evolution of heat includes, but is not limited to:

- individual protection of the battery terminals,
- inner packaging to prevent contact between cells and batteries,
- batteries with recessed terminals designed to protect against short circuits, or
- the use of an electrically non-conductive and non-combustible cushioning material to fill empty space between the cells or batteries in the packaging.

3. Cells and batteries shall be secured within the outer packaging to prevent excessive movement during carriage (e.g. by using a non-combustible and electrically non-conductive cushioning material or through the use of a tightly closed plastics bag).

P910	PACKING INSTRUCTION	P910

This instruction applies to UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552 production runs consisting of not more than 100 cells or batteries and to pre-production prototypes of cells or batteries when these prototypes are carried for testing.

The following packagings are authorized provided that the general provision of **4.1.1** and **4.1.3** are met

(1) For cells and batteries. including when packed with equipment:

Drums (1A2, 1B2, 1N2, 1H2, 1D,1G);

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2);

Jerricans (3A2, 3B2, 3H2).

Packaging shall conform to the packing group II performance level and shall meet the following requirements:

a) Batteries and cells, including equipment, of different sizes, shapes or masses shall be packaged in an outer packaging of a tested design type listed above provided the total gross mass of the package does not exceed the gross mass for which the design type has been tested;

b) Each cell or battery shall be individually packed in an inner packaging and placed inside an outer packaging;

c) Each inner packaging shall be completely surrounded by sufficient non-combustible and electrically non-conductive thermal insulation material to protect against a dangerous evolution of heat;

d) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the cells or batteries within the package that may lead to damage and a dangerous condition during carriage. Cushioning material that is non-combustible and electrically non-conductive may be used to meet this requirement;

e) Non-combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured;

f) A cell or battery with a net mass of more than 30 kg shall be limited to one cell or battery per outer packaging.

(2) For cells and batteries contained in equipment:

Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2);

Jerricans (3A2, 3B2, 3H2).

Packaging shall conform to the packing: group II performance level and shall meet the following requirements:

a) Equipment of different sizes, shapes or masses shall be packed in an outer packaging of a tested design type listed above provided the total gross mass of the package does not exceed the gross mass for which the design type has been tested;

b) The equipment shall be constructed or packaged in such a manner as to prevent accidental operation during carriage;

c) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the equipment within the package that may lead to damage and a dangerous condition during carriage. When cushioning material is used to meet this requirement, it shall be non-combustible and electrically non-conductive; and

d) Non-combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured.

(3) The equipment or the batteries may be carried unpackaged under conditions specified by the competent authority of any Contracting Party to ADR, which may also recognize an approval granted by the competent authority of a country which is not a Contracting Party to ADR, provided that this

approval has been granted in accordance with the procedures applicable according to RID, ADR, ADN, the IMDG Code or the ICAO Technical Instructions. Additional conditions that may be considered in the approval process include but are not limited to:

a) The equipment or the battery shall be strong enough to withstand the shocks and loadings normally encountered during carriage, including trans-shipment between cargo transport units and between cargo transport units and warehouses as well as any removal from a pallet for subsequent manual or mechanical handling; and

b) The equipment or the battery shall be fixed in cradles or crates or other handling devices in such a way that it will not become loose during normal conditions of carriage.

Note: *The packagings authorized in (3) and (4) may exceed a net mass of 400 kg (see 4.1.3.3)*

Additional requirements

The cells and batteries shall be protected against short circuit:

Protection against short circuits includes, but is not limited to,

- individual protection of the battery terminals,
- inner packaging to prevent contact between cells and batteries,
- batteries with recessed terminals designed to protect against short circuit, or
- the use of electrically non-conductive and non-combustible cushioning material to fill empty space between the cells or batteries in the packaging.

P911	PACKING INSTRUCTION	P911

This instruction applies to damaged or defective cells and batteries of UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552 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 carriage.

The following packagings are authorized, provided that the general provision of **4.1.1** and **4.1.3** are met:

For cells and batteries and equipment containing cells and batteries:

Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2);

Jerricans (3A2, 3B2, 3H2)

The packagings shall conform to the packing group I performance level.

(1) The packaging shall be capable of meeting the following additional performance requirements in case of rapid disassembly, dangerous reaction, production of a flame or a dangerous evolution of heat or a dangerous emission of toxic, corrosive or flammable gases or vapours of the cells or batteries:

(a) The outside surface temperature of the completed package shall not have a temperature of more than 100°C. A momentary spike in temperature up to 200°C is acceptable;

(b) No flame shall occur outside the package;

(c) No projectiles shall exit the package;

(d) The structural integrity of the package shall be maintained; and

(e) The packagings shall have a gas management system (e.g. filter system, air circulation, containment for gas, gas tight packaging etc.), as appropriate.

(2) The additional packaging performance requirements shall be verified by a test as specified by the competent authority of any ADR Contracting Party who may also recognize a test specified by the

competent authority of a country which is not an ADR Contracting Party provided that this test has been specified in accordance with the procedures applicable according to RID, ADR, ADN, the IMDG Code or the ICAO Technical Instructions[a].

A verification report shall be available on request. As a minimum requirement, the name of the batteries, their type as defined in Section 38.3.2.3 of the Manual of Tests and Criteria, the maximum number of batteries, the total mass of batteries, the total energy content of batteries, the large packaging identification and the test data according to the verification method as specified by the competent authority shall be listed in the verification report. A set of specific introductions describing the way to use the package shall also be part of the verification report.

(3) When dry ice or liquid nitrogen is used as a coolant, the requirements of section 5.5.3 shall apply. The inner packaging and outer packaging shall maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

Additional requirements

Cells or batteries shall be protected against short circuit.

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[a] The following criteria, as relevant, may be considered to assess the performance of the packaging:

(a) The assessment shall be done under a quality management system (as described e.g. in section 2.2.9.1.7.1 (e)) allowing for the traceability of tests results, reference data and characterization models used;

(b) The list of hazards expected in case of thermal run-away for the cell or battery type, in the condition it is carried (e.g. usage of an inner packaging, state of charge (SOC), use of sufficient non-combustible, electrically non-conductive and absorbent cushioning material etc.), shall be clearly identified and quantified; the reference list of possible hazards for lithium cells or batteries (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) can be used for this purpose. The quantification of this hazards shall rely on available scientific literature;

(c) The mitigating effects of the packaging shall be identified and characterized, based on the nature of the protections provided and the construction material properties. A list of technical characteristics and drawings shall be used to support this assessment (Density [kg · m^{-3}], specific heat capacity [J · kg^{-1} · K^{-1}] heating value [kJ · kg^{-1}], thermal conductivity [W · m^{-1} · K^{-1}], melting temperature and flammability temperature [K], heat transfer coefficient of the outer packaging [W · m^{-2} · K^{-1}], ...);

(d) The test and any supporting calculations shall assess the result of a thermal run-away of the cell or battery inside the packaging in the normal conditions of carriage;

(e) In case the SOC of the cell or battery is not known, the assessment used, shall be done with the highest possible SOC corresponding to the cell or battery use conditions;

(f) The surrounding conditions in which the packaging may be used and carried shall be described (including for possible consequences of gas or smoke emissions on the environment, such as ventilation or other methods) according to the gas management system of the packaging;

(g) The tests or the model calculation shall consider the worst case scenario for the thermal run-away triggering and propagation inside the cell or battery: this scenario includes the worst possible failure in the normal carriage condition, the maximum heat and flame emissions for the possible propagation of the reaction;

(h) These scenarios shall be assessed over a period of time long enough to allow all the possible consequences to occur (e.g. 24 hours).

(i) In the case of multiple batteries and multiple items of equipment containing batteries, additional requirements such as the maximum number of batteries and items of equipment, the total maximum energy content of the batteries, and the configuration inside the package, including separations and protections of the parts, shall be considered.

LP903	PACKING INSTRUCTION	LP903
This instruction applies to large cells with a gross mass of more than 500 g, large batteries with a gross mass of more than 12 kg, and equipment containing large cells or batteries of UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552.		
The following large packagings are authorized for a single battery and for a single item of equipment containing batteries, provided that the general provisions of **4.1.1** and **4.1.3** are met: Rigid large packagings conforming to the packing group II performance level, made of: steel (50A); aluminium (50B); metal other than steel or aluminium (50N); rigid plastics (50H); natural wood (50C); plywood (50D); reconstituted wood (50F); rigid fibreboard (50G). Cells, battery or the equipment shall be placed in inner packagings or separate by other suitable means, such as placement in trays or by dividers, to ensure protection against damage that may be caused under normal conditions of carriage by: (a) Its movement or placement within the large packaging; (b) Contact with other cells, batteries or equipment within the large packaging; and (c) Any loads arising from the superimposed weight of cells, batteries, equipment and packaging components above the cell, battery or equipment within the large packaging. When multiple cells, batteries or items of equipment, are packed in the large packaging, bags (e.g. plastics) alone shall not be used to satisfy requirements.		
Additional requirement: Batteries shall be protected against short circuit.		

LP904	PACKING INSTRUCTION	LP904
This instruction applies to single damaged or defective batteries and to single items of equipment containing damaged or defective cells and batteries of UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552.		
The following large packagings are authorized for a single damaged or defective battery and for a single item of equipment damaged or defective cells and batteries, provided the general provisions of **4.1.1** and **4.1.3** are met. For batteries and equipment containing cells and batteries: Rigid large packagings conforming to the packaging group II performance level, made of: steel (50A) aluminium (50B) metal other than steel or aluminium (50N) rigid plastics (50H) plywood (50D) Large packagings shall also meet the following requirements:		

1. The damaged or defective battery or equipment containing such cells or batteries shall be individually packed in an inner packaging and placed inside an outer packaging. The inner or outer packaging shall be leakproof to prevent the potential release of electrolyte.

2. The inner packaging shall be surrounded by sufficient non-combustible and electrically non-conductive thermal insulation material to protect against a dangerous evolution of heat.

3. Sealed packagings shall be fitted with a venting device when appropriate.

4. Appropriate measures shall be taken to minimize the effects of vibrations and shocks, prevent movement of the battery or equipment within the package that may lead to further damage and a dangerous condition during carriage. Cushioning material that is non-combustible and electrically non-conductive may also be used to meet this requirement.

5. The non-combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured.

For leaking cells and batteries, sufficient inert absorbent material shall be added to the inner or outer packaging to absorb any release of electrolyte.

Additional requirement:

Cells and batteries shall be protected against short circuit.

LP905	PACKING INSTRUCTION	LP905

This instruction applies to UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552 production runs consisting of not more than 100 cells and batteries and to pre-production prototypes of cells and batteries when these prototypes are carried for testing.

The following large packagings are authorized for a single battery and for a single item of equipment containing cells or batteries, provided that the general provisions of **4.1.1** and **4.1.3** are met:

(1) For a single battery:

Rigid large packagings conforming to the packing group II performance level, made of:

steel (50A);

aluminium (50B);

metal other than steel or aluminium (50N);

rigid plastics (50H);

natural wood (50C);

plywood (50D);

reconstituted wood (50F);

rigid fibreboard (50G).

Large packagings shall also meet the following requirements:

(a) A battery of different size, shape or mass may be packed in an outer packaging of a tested design type listed above provided the total gross mass of the package does not exceed the gross mass for which the design type has been tested;

(b) The battery shall be packed in an inner packaging and placed inside the outer packaging;

(c) The inner packaging shall be completely surrounded by sufficient non-combustible and electrically non-conductive thermal insulation material to protect against a dangerous evolution of heat;

(d) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the battery within the package that may lead to damage and a dangerous condition during carriage. When cushioning material is used to meet this requirement it shall be non-combustible and electrically non-conductive; and

(e) The non-combustibility shall be assessed according to a standard recognized in the country where the large packaging is designed or manufactured.

(2) For a single item of equipment containing cells or batteries:

Rigid large packagings conforming to the packing group II performance level, made of:

Steel (50A);

Aluminium (50B);

Metal other than steel or aluminium (50N);

Rigid plastics (50H);

Natural wood (50C);

Plywood (50D);

Reconstituted wood (50F);

Rigid fibreboard (50G).

Large packagings shall also meet the following requirements:

(a) A single item of equipment of different size, shape or mass may be packed in an outer packaging of a tested design type listed above provided the total gross mass of the package does not exceed the gross mass for which the design type has been tested;

(b) The equipment shall be constructed or packed in such a manner as to prevent accidental operation during carriage;

(c) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the equipment within the package that may lead to damage and a dangerous condition during carriage. When cushioning material is used to meet this requirement, it shall be non-combustible and electrically non-conductive; and

(d) The non-combustibility shall be assessed according to a standard recognized in the country where the large packaging is designed or manufactured.

Additional requirement:

Cells and batteries shall be protected against short circuit.

LP906	PACKING INSTRUCTION	LP906

This instruction applies to damaged or defective batteries of UN Nos. 3090, 3091, 3480, 3481, 3551 and 3552 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 carriage.

The following large packagings are authorized, provided the general provisions of **4.1.1** and **4.1.3** are met:

For a single battery and for a single item of equipment, containing batteries:

Rigid large packagings conforming to the packing group I performance level, made of:

steel (50A);

aluminium (50B);

metal other than steel or aluminium (50N);

rigid plastics (50H);

plywood (50D);

rigid fibreboard (50G)

(1) The large packaging shall be capable of meeting the following additional performance requirements in case of rapid disassembly, dangerous reaction, production of a flame or a dangerous

evolution of heat or a dangerous emission of toxic, corrosive or flammable gases or vapours of the battery:

(a) The outside surface temperature of the completed package shall not have a temperature of more than 100 °C. A momentary spike in temperature up to 200 °C is acceptable;

(b) No flame shall occur outside the package;

(c) No projectiles shall exit the package;

(d) The structural integrity of the package shall be maintained; and

(e) The large packagings shall have a gas management system (e.g. filter system, air circulation, containment for gas, gas tight packaging etc.), as appropriate.

(2) The additional large packaging performance requirements shall be verified by a test as specified by the competent authority of any ADR Contracting Party who may also recognize a test specified by the competent authority of a country which is not an ADR Contracting Party provided that this test has been specified in accordance with the procedures applicable according to RID, ADR, ADN, the IMDG Code or the ICAO Technical Instructions[a].

A verification report shall be available on request. As a minimum requirement, the name of the batteries, their type as defined in Section 38.3.2.3 of the Manual of Tests and Criteria, the maximum number of batteries, the total mass of batteries, the total energy content of batteries, the large packaging identification and the test data according to the verification method as specified by the competent authority shall be listed in the verification report. A set of specific introductions describing the way to use the package shall also be part of the verification report.

(3) When dry ice or liquid nitrogen is used as a coolant, the requirements of section 5.5.3 shall apply. The inner packaging and outer packaging shall maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

(4) The specific instructions for use of the package shall be made available by the packaging manufactures and subsequent distributors to the consignor. They shall include at least the identification of the batteries and the items of equipment that may be contained inside the packaging, the maximum number of batteries contained in package and the maximum total of the batteries´ energy content, as well as the configuration inside the package, including the separations and protections used during the performance verifications test.

Additional requirement:

Batteries shall be protected against short circuit.

[a] The following criteria, as relevant, may be considered to assess the performance of the large packaging:

(a) The assessment shall be done under a quality management system (as described e.g. in section 2.2.9.1.7 (e)) allowing for the traceability of tests results, reference data and characterization models used;

(b) The list of hazards expected in case of thermal runaway for the battery type, in the condition it is carried (e.g. usage of an inner packaging, state of charge (SOC), use of sufficient non-combustible, electrically non-conductive and absorbent cushioning material etc.), shall be clearly identified and quantified; the reference list of possible hazards for lithium batteries (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) can be used for this purpose. The quantification of this hazards shall rely on available scientific literature;

(c) The mitigating effects of the large packaging shall be identified and characterized, based on the nature of the protections provided and the construction material properties. A list of technical characteristics and drawings shall be used to support this assessment (Density [kg · m^{-3}], specific heat capacity [J · kg^{-1} · K^{-1}] heating value [kJ · kg^{-1}], thermal conductivity [W · m^{-1} · K^{-1}], melting temperature and flammability temperature [K], heat transfer coefficient of the outer packaging [W · m^{-2} · K^{-1}], ...);

(d) The test and any supporting calculations shall assess the result of a thermal run-away of the battery inside the large packaging in the normal conditions of carriage;

(e) In case the SOC of the battery is not known, the assessment used, shall be done with the highest possible SOC corresponding to the battery use conditions;

(f) The surrounding conditions in which the large packaging may be used and carried shall be described (including for possible consequences of gas or smoke emissions on the environment, such as ventilation or other methods) according to the gas management system of the large packaging;

(g) The tests or the model calculation shall consider the worst case scenario for the thermal run-away triggering and propagation inside the battery: this scenario includes the worst possible failure in the normal carriage condition, the maximum heat and flame emissions for the possible propagation of the reaction;

(h) These scenarios shall be assessed over a period of time long enough to allow all the possible consequences to occur (i.e. 24 hours).

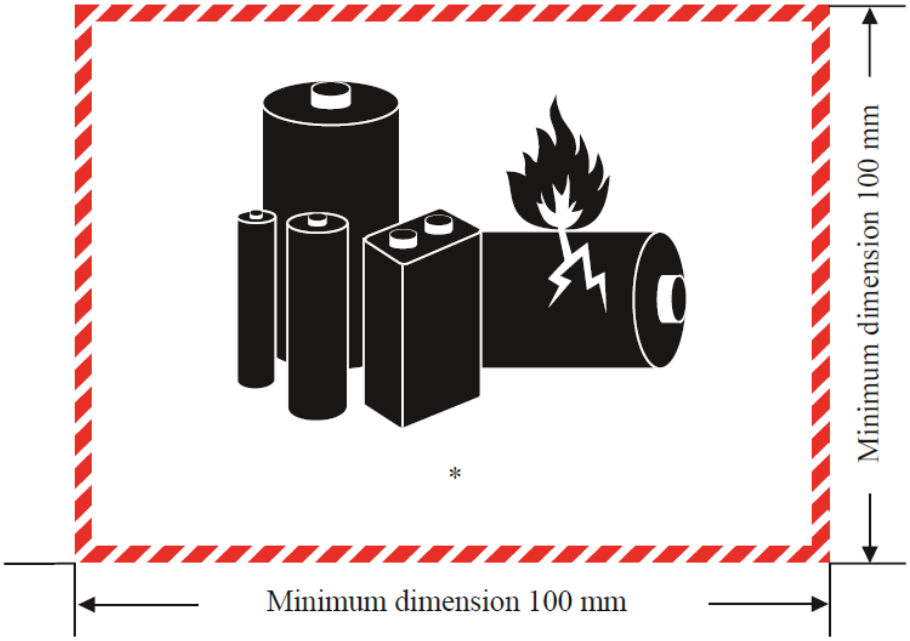
(i) In the case of multiple batteries and multiple items of equipment containing batteries, additional requirements such as the maximum number of batteries and items of equipment, the total maximum energy content of the batteries, and the configuration inside the package, including separations and protections of the parts, shall be considered.

5.2.1.9 Battery mark

Packages containing lithium cells or batteries or sodium ion cells or batteries prepared in accordance with special provision 188 of Chapter 3.3 shall be marked as shown in Figure 5.2.1.9.2.

The mark shall indicate the UN number preceded by the letters "UN", i.e. 'UN 3090' for lithium metal cells or batteries, 'UN 3480' for lithium ion cells or batteries or "UN 3551" for sodium ion cells or batteries. Where the lithium cells or batteries are contained in, or packed with, equipment, the UN number preceded by the letter "UN", i.e. 'UN 3091', 'UN 3481' or "UN 3552", as appropriate shall be indicated. Where a package contains lithium cells or batteries assigned to different UN numbers, all applicable UN numbers shall be indicated on one or more marks.

Figure 5.2.1.9.2



Battery mark

* Place for UN number(s)

The mark shall be in the form of rectangle or a square with hatched edging. The dimensions shall be a minimum of 100 mm wide x 100 mm high and the minimum width of the hatching shall be 5 mm. The symbol (group of batteries, one damaged and emitting flame, above the UN number(s) shall be black on white or suitable contrasting background. The hatching shall be red. If the size of the packages so requires, the dimensions may be reduced to not less than 100 mm wide x 70 mm high. Where dimensions are not specified, all features shall be in approximate proportion to those shown.