

Technical Notice

Transport Regulations for Lithium Batteries

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1. Exemptions

Lithium metal batteries are dangerous goods, UN No. 3090. Therefore they are generally subject to transport regulations, depending on the transport mode. However, most Tadiran Lithium Batteries listed in the product data catalogue are exempted from the regulations if the following conditions are given:

- The batteries have not more than 2 g lithium content, each cell not more than 1 g lithium content (see table 1).
- The batteries have passed the UN tests (see table 1).
- The batteries shall be packed in inner packagings that completely enclose them. They shall be protected so as to prevent short circuits.
- The package and the shipping documents are marked with a notice indicating that it contains lithium batteries and shall - if damaged - be quarantined, inspected and repacked (Example see Appendix B, page 9).
- The gross mass does not exceed 30 kg per package (2.5 kg for air transport).
- The packaging shall be strong and capable of withstanding a 1.2 m drop test.
- For more conditions see special provision 188 (ADR/RID/IMDG-Code) and section II of packing instructions 968-970 (IATA DGR).

2. Classification of lithium batteries

Tadiran Lithium Batteries are lithium metal batteries. Table 1 indicates which Tadiran Lithium Batteries are exempted from the dangerous goods regulations and which are not. The regulations for not exempted batteries are summarized in table 2.

Size		Exempted	Lithium content	UN Tests passed
			g	
BEL	SL-340 SL-740 SL-840	Yes ¹⁾	0,13	YES
1/6 D	SL-386 SL-786 SL-886	Yes ¹⁾	0,5	YES
1/10 D	SL-389 SL-789 SL-889	Yes ¹⁾	0,3	YES
1/2 AA	SL-350 SL-550 SL-750 SL-850	Yes ¹⁾	0,35	YES
2/3 AA	SL-361 SL-561 SL-761 SL-861	Yes ¹⁾	0,5	YES
AA	SL-360 SL-460 SL-560 SL-760 SL-860	Yes ¹⁾	0,65	YES
C	SL-770 SL-2770 SL-2870	No	2,5	YES
D	SL-780 SL-2780 SL-2880	No	5	YES
DD	SL-790 SL-2790	No	10	YES
Hybrid	HLC-1020 (3.7 V and 3.9 V)	Yes ¹⁾	0,01	YES
Layer	HLC-1520 (3.7 V)	Yes ¹⁾	0,02	YES
Capacitors	HLC 1520 (3.9 V)	Yes ¹⁾	0,04	YES
	HLC-1550 (3.7 V)	Yes ¹⁾	0,07	YES
	HLC-1550 (3.9 V)	Yes ¹⁾	0,13	YES
¹⁾ If conditions mentioned in the text are fulfilled				

Table 1
Classification of Tadiran Lithium Batteries

3. UN tests

Table 1 also shows the status of UN-tests for Tadiran Lithium Batteries according to the UN Handbook of Tests and Criteria, part III, sub-section 38.3. Regarding Tadiran Lithium Batteries not listed in table 1, please apply to Tadiran Batteries for a confirmation.

4. Overview dangerous goods by transport mode

Transport regulations for lithium metal batteries					
UN-No. and class	Limitations and instructions	Passenger aircraft IATA DGR	Cargo aircraft IATA DGR	Road/Railway transport ADR/RID	Sea transport IMDG Code
Lithium metal batteries					
UN 3090 Class 9	Maximum gross mass per package	2.5 kg, metal packaging	35 kg	according to packaging approval	according to packaging approval
	Packing group	II	II	II	II
	Packing instruction	968	968	P 903, a, b	P 903
	Marking	Class 9 label	Class 9 label Handling Label For Cargo Aircraft only	Class 9 label	Class 9 label
Lithium metal batteries contained in equipment / packed with equipment					
UN 3091 Class 9	Max. Qty. of batteries per piece of equipment	5 kg / -	35 kg / -		
	Max. Qty. of batteries per overpack, excluding equipment	- / 5 kg	- / 35 kg		
	Packing group	II	II	II	II
	Packing instruction	970 / 969	970 / 969	903, a, b	903
	Marking	Class 9 label	Class 9 label Handling Label For Cargo Aircraft Only	Class 9 label	Class 9 label
	Further instructions	see packing instructions		see special provision 230	

Table 2

Transport regulations for lithium metal batteries: more than 2 g lithium content (refer to table 1)

It is necessary to refer to the listed regulations and instructions for detailed information. They are revised on a regular basis. The tables are based on the revisions effective in January 2010.

The applicable documents are:

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road,

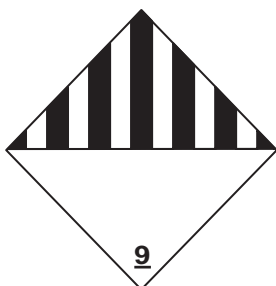
IATA DGR: International Air Transport Association, Dangerous Goods Regulations,

ICAO: International Civil Aviation Organization, Technical Instructions for the Safe Transport of Dangerous Goods by Air,

IMDG Code: International Maritime Dangerous Goods Code,

RID: International Statutory Order on the Conveyance of Dangerous Goods by Rail,

UN: United Nations Recommendations on the Transport of Dangerous Goods.



Class 9 label,
reduced size,
black on white



Handling Label for
Cargo Aircraft Only,
reduced size,
black on orange

Transport Regulations for Road and Rail Transport
ADR 2009
Overview

UN 3090	LITHIUM METAL BATTERIES				see chapter (ADR 2009)
UN 3091	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT				
Class	9	Miscellaneous	x	x	2.2
Classification code	M4	Lithium batteries	x	x	2.2.9.1.7
Packing group	II	Medium danger	x	x	2.1.1.3
Labels	9	Class 9 Hazard label	x	x	5.2.2
Special provisions	188	Exempted if	x	x	3.3
	230	Class 9 if ...	x	x	
	310	Prototypes		x	
	636	Used batteries etc.	x	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
	P903a	Used lithium batteries	x	x	
	P903b	Used cells and batteries collected for disposal	x	x	
Transport category	2	Exemptions under 333 kg	x	x	1.1.3.6
Tunnel restriction code	E	Forbidden in tunnels of category E			8.6

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, 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 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 which may be carried in accordance with this special provision and without this marking until 31 December 2010;
- (c) Each cell or battery is of the type proved to meet the requirements of each test in the *Manual of Tests and Criteria*, Part III, sub-section 38.3;
- (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 conductive materials 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. 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) Except for packages containing no more than four cells installed in equipment or no more than two batteries installed in equipment, each package shall be marked with the following:
 - (i) an indication that the package contains "lithium metal" or "lithium ion" cells or batteries, as appropriate;
 - (ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - (iii) an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - (iv) a telephone number of additional information;
- (g) Each consignment of one or more packages marked in accordance with paragraph (f) shall be accompanied with a document including the following:
 - (i) an indication that the package contains "lithium metal" or "lithium ion" cells or batteries, as appropriate;
 - (ii) an indication that the package shall be handled with care and that a flammability hazard exists if the package is damaged;
 - (iii) an indication that special procedures shall be followed in the event the package is damaged, to include inspection and repacking if necessary;

and
(iv) a telephone number for additional information;

- (h) Except when 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
- (i) Except when 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.

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.

Special Provision 230

This entry applies to cells and batteries containing lithium in any form, including lithium polymer and lithium ion cells and batteries.

Lithium cells and batteries may be carried under this entry 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, subsection 38.3;
- (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.)

Special Provision 310

The testing requirements in sub-section 38.3 of the *Manual of Tests and Criteria* do not apply to production runs consisting of not more than 100 cells and batteries, or to pre-production prototypes of cells and batteries when these prototypes are carried for testing, if:

- (a) the cells and batteries are carried in an outer packaging that is a metal, plastics or plywood drum or a metal, plastics or wooden box and that meets the criteria for packing group I; and
- (b) each cell and battery is individually packed in an inner packaging inside an outer packaging and is surrounded by cushioning material that is non-combustible, and non-conductive.

Special Provision 636

- (a) Cells contained in equipment shall not be capable of being discharged during carriage to the extent that the open circuit voltage falls below 2 volts or two thirds of the voltage of the undischarged cell, whichever is the lower.
- (b) Used lithium cells and batteries with a gross mass of not more than 500 g each collected and presented for carriage for disposal between the consumer collecting point and the intermediate processing facility, together with other non-lithium cells or batteries, are not subject to the other provisions of ADR if they meet the following conditions:
 - (i) The provisions of packing instruction P903b are complied with;
 - (ii) A quality assurance system is in place to ensure that the total amount of lithium cells or batteries per transport unit does not exceed 333 kg;
 - (iii) Packages shall bear the inscription: "USED LITHIUM CELLS".

ADR Packing instruction P903

This instruction applies to UN Nos. 3090, 3091, 3480 and 3481.

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

Packagings confirming to the packing group II performance level.

When cells and batteries are packed with equipment, they shall be packed in inner fibreboard packagings the meet the requirement for packing group II. When cells and batteries included in Class 9 are contained in equipment, the equipment shall be packed in strong outer packagings in such a manner as to prevent accidental operation during carriage.

In addition, batteries with a strong, impact resistant outer casing of a gross mass of 12 kg or more, and assemblies of such batteries, may be packed in strong outer packagings, in protective enclosures (e.g. in fully enclosed or wooden slatted crates) unpackaged or on pallets. Batteries shall be secured to prevent inadvertent movement, and the terminals shall not support the weight of other superimposed elements.

Additional requirement:

Batteries shall be protected against short circuit.

ADR Packing instruction P903a

This instruction applies to used cells and batteries of UN Nos. 3090, 3091, 3480 and 3481.

The following packagings are authorized, provided the general provisions of 4.1.1, except 4.1.1.3, and 4.1.3 are met:

Packagings conforming to the packing group II performance level.

Non-approved packagings shall, however, be permitted provided that:

- they meet the general provisions of 4.1.1 and 4.1.3;
- the cells and batteries are packed and stowed so as to prevent any risk of short circuits;
- the packages weigh not more than 30 kg.

Additional requirement:

Batteries shall be protected against short circuit.

ADR Packing instruction P903b

This instruction applies to used cells and batteries of UN Nos. 3090, 3091, 3480 and 3481.

Used lithium cells and batteries, with a gross mass of not more than 500 g each, collected for disposal, may be carried together with other used non-lithium batteries or alone without being individually protected, under the following conditions:

- (1) In 1H2 drums or 4H2 boxes conforming to the packing group II performance level for solids;
- (2) In 1A2 drums or 4A boxes fitted with a polyethylene bag and conforming to the packing group II performance level for solids. The polyethylene bag
 - shall have an impact resistance of at least 480 grams in both parallel and perpendicular planes with respect to the length of the bag;
 - shall have a minimum of 500 microns of thickness with an electrical resistivity of more than 10 Mohms and a water absorption rate over 24 hours at 25 °C lower than 0.01 %;
 - shall be closed; and
 - may only be used once;
- (3) In collecting trays with a gross mass of less than 30 kg made from non-conducting material meeting the general conditions of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.8.

Additional requirements:

The empty space in the packaging shall be filled with cushioning material. The cushioning material may be dispensed with when the packaging is entirely fitted with a polyethylene bag and the bag is closed.

Hermetically sealed packagings shall be fitted with a venting device according to 4.1.1.8. The venting device shall be so designed that an overpressure caused by gases does not exceed 10 kPa.

Transport Regulations Aircraft
IATA DGR 2010
Overview

UN 3090	LITHIUM METAL BATTERIES					see Chapter
UN 3091	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or					
	LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT					
Class	9	Miscellaneous dangerous goods	x	x	x	3.9
Sub Risk	-					
Packing Group	II	Medium danger	x	x	x	3.0.3
Packing instructions	968	Lithium batteries			x	5.9
	970	Lithium batteries contained in equipment		x		5.9
	969	Lithium batteries packed with equipment	x			5.9
Hazard label	9	Miscellaneous	x	x	x	7.3.18
Exempted Quantity	EQ0	No	x	x	x	2.7
Limited Quantity	-	No	x	x	x	
Max. Gross mass	2.5 kg	see also packing instructions	¹⁾	¹⁾	x	
Cargo aircraft	Max. gross mass	35 kg	see also packing instructions	¹⁾	¹⁾	x
	Handling label	Yes	Cargo Aircraft Only	x	x	x
Special Provisions	A45	deleted				4.4
	A48	Packaging tests		x		
	A88	Prototypes			x	
	A99	over 35 kg			x	
	A154	Defective batteries	x	x	x	
	A164	Heat development	x	x	x	
ERG ²⁾ Code	9F		x	x	x	ICAO ³⁾

¹⁾ see applicable packing instruction

²⁾ Emergency Response Drill Code

³⁾ Doc 9481-AN/928

IATA Special Provision A 45

Not used.

Note:

The provisions of A45 have been incorporated into the applicable packing instructions for lithium metal and lithium ion batteries (see Section II of Packing Instruction 965, 966 or 967 for lithium ion batteries, lithium ion batteries packed with equipment or lithium ion batteries contained in equipment, respectively, and Section II of Packing Instruction 968, 969 or 970 for lithium metal batteries, lithium metal batteries packed with equipment or lithium metal batteries contained in equipment, respectively).

IATA Special Provision A 88

Prototype lithium batteries and cells to be tested that are packed with not more than 24 cells or 12 batteries per packaging that have not been tested to the requirements in sub-section 38.3 of the *UN Manual of Tests and Criteria* may be transported aboard cargo aircraft, if approved by the appropriate authority of the State of origin and the following requirements are met:

- (a) the cells and batteries must be transported in an outer packaging that is a metal, plastic or plywood drum or a metal, plastic or wooden box and that meets the criteria for Packing Group I packagings;
- (b) each cell and battery must be individually packed in an inner packaging inside an outer packaging and surrounded by cushioning material that is non-combustible, and non-conductive. Cells and batteries must be protected against short-circuiting.

IATA Special Provision A 99

Irrespective of the limit specified in Column L of the List of Dangerous Goods (Subsection 4.2), a lithium battery or battery assembly that has successfully passed the tests specified in the *UN Manual of Tests and Criteria*, Part III, sub-section 38.3 and that meets the requirements of Packing Instruction 965 for lithium ion batteries, and Packing Instruction 968 for lithium metal batteries as prepared for transport may have a mass exceeding 35 kg G, if approved by the appropriate authority of the State of origin. A copy of the document of approval must accompany the consignment.

IATA Special Provision A 154

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

IATA Special Provision A 164

Any electrical battery or battery powered device, equipment or vehicle having the potential of a dangerous evolution of heat must be prepared for transport so as to prevent:

- (a) a short circuit (e.g. in the case of batteries by the effective insulation of exposed terminals; or in the case of equipment, by disconnection of the battery and protection of exposed terminals); and
- (b) unintentional activation.

PACKING INSTRUCTION 968

STATE VARIATIONS: USG-02/03

OPERATOR VARIATIONS: AM-09, BA-02, CO-10, CS-10, CZ-08, FX-10, MX-09, SK-01, UX-07, VS-01

This instruction applies to lithium metal or lithium alloy cells and batteries (UN 3090) on passenger and Cargo Aircraft Only.

The general requirements apply to all lithium metal batteries prepared for transport according to this packing instruction. Section I then applies to cells and batteries that are fully regulated for transport and assigned to Class 9; Section II contains the requirements applicable to "small" cells and batteries that when packed and labelled as described are otherwise excepted from the Regulations.

General Requirements

The following requirements apply to all lithium metal or lithium alloy cells and batteries:

- (a) each cell and battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;
- (b) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- (c) cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.

Section I – Fully Regulated Class 9 Lithium Metal and Lithium Alloy Cells and Batteries

These requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

The General Packing Requirements of 5.0.2 must be met.

Each cell or battery must:

1. Meet the General Requirements, above;
2. Incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- 2 volts; or
- two –thirds of the voltage of the undischarged cell;

and batteries containing one or more such cells, are forbidden for transport.

Additional Requirements – Section I

- packagings must meet Packing Group II performance standards;
- lithium batteries with a mass of 12 kg or greater and having a strong, impact-resistant outer casing, or assemblies of such batteries, may be transported when packed in strong outer packagings in protective enclosures. The packagings need not meet the requirements of Section 6 of these Regulations. The packagings must be approved by the appropriate national authority of the State of origin. A copy of the document of approval must accompany the consignment.

Lithium metal and lithium alloy cells and batteries prepared for transport on Passenger Aircraft as Class 9:

- must be packed in either a rigid metal intermediate or a metal outer packaging;
- cells and batteries must be surrounded by cushioning material that is non-combustible and non-conductive before being placed in either the metal intermediate or metal outer packaging.

COMBINATION PACKAGINGS															
	Quantity per package Passenger aircraft						Quantity per package Cargo Aircraft Only								
Lithium metal cells and batteries	2.5 kg G						35 kg G								

OUTER PACKAGINGS															
Type	Drums					Jerricans			Boxes						
Desc.	Steel	Alumi- nium	Ply- wood	Fibre	Plastic	Steel	Alumi- nium	Plastic	Steel	Alumi- nium	Wood	Ply- wood	Recon- stituted wood	Fibre- board	Plastic
Spec.	1A2	1B2	1D	1G	1H2	3A2	3B2	3H2	4A	4B	4C1 4C2	4D	4F	4G	4H2

Section II – Excepted Lithium Metal and Lithium Alloy Cells and Batteries

Lithium metal or lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Regulations if they meet the requirements in this section, in addition to the General Requirements, above.

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

1. a lithium metal or lithium alloy cell, the lithium content is not more than 1 g;
2. a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;

Cells and batteries must be packed in strong outer packagings that conform to 5.0.2.4, 5.0.2.6.1 and 5.0.2.12.1.

Additional Requirements – Section II

Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.

Each package must be capable of withstanding a 1.2 m drop test in any orientation without:

- damage to cells or batteries contained therein;
- shifting of the contents so as to allow battery to battery (or cell to cell) contact;
- release of contents.

Each consignment must be accompanied with a document such as an air waybill with an indication that:

- the package contains lithium metal cells or batteries;
- the package must be handled with care and that a flammability hazard exists if the package is damaged;
- special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- a telephone number for additional information.

Each package must be labelled with a lithium battery handling label (Figure 7.4.I);

A Shipper's Declaration for Dangerous Goods is not required.

The words "Lithium metal batteries", "not restricted" and "PI 968" must be included in the Additional Handling Information on the air waybill, when an air waybill is used.

Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

Overpacks-Section II

Individual packages each complying with the requirements of Section II may be placed in an overpack. The overpack may also contain packages of dangerous goods or goods not subject to these Regulations provided that there are no packages enclosing different substances which might react dangerously with each other. An overpack must be marked with the word "Overpack" and labelled with the lithium battery label (Figure 7.4.I), unless the label(s) on the package(s) inside the overpack are visible.

COMBINATION PACKAGINGS			
	Quantity per package Passenger aircraft		Quantity per package Cargo Aircraft Only
Lithium metal cells and batteries	2.5 kg G		2.5 kg G

OUTER PACKAGINGS			
Type	Drums	Jerricans	Boxes

PACKING INSTRUCTION 969

STATE VARIATIONS: USG-02/03

OPERATOR VARIATIONS: AM-09, CO-10, CS-10, CZ-08, MX-09, SK-01, VS-01

This instruction applies to lithium metal or lithium alloy cells and batteries packed with equipment (UN 3091) on passenger and Cargo Aircraft Only.

The general requirements apply to all lithium metal batteries packed with equipment prepared for transport according to this packing instruction. Section I then applies to cells and batteries that are fully regulated for transport and assigned to Class 9; Section II contains the requirements applicable to "small" cells and batteries that when packed and labelled as described are otherwise excepted from the Regulations.

General requirements

The following requirements apply to all lithium metal or lithium alloy cells and batteries:

- each cell and battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;
- cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.

Section I – Fully Regulated Class 9 Lithium Metal Cells and Batteries

These requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9

The General Packing Requirements of 5.0.2 must be met.

Each cell or battery must:

- meet the General Requirements, above;
- Incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- 2 volts; or
- two-thirds of the voltage of the undischarged cell;

and batteries containing one or more such cells, are forbidden for transport.

Additional Requirements – Section I

- the cells and batteries must be placed in a packaging that meets Packing Group II performance standards;
- the equipment and the packages of lithium cells or batteries must be placed in an overpack. The overpack must bear applicable marks and labels as set out in 7.1.4 and 7.2.7;
- For the purpose of this packing instruction, "equipment" means apparatus requiring the lithium batteries with which it is packed for its operation.

Lithium metal and lithium alloy cells and batteries prepared for transport on Passenger Aircraft as Class 9:

- must be packed in either a rigid metal intermediate or a metal outer packaging;

- cells and batteries must be surrounded by cushioning material that is non-combustible and non-conductive, and being placed in either the metal intermediate or metal outer packaging.

COMBINATION PACKAGINGS		
	Passenger aircraft	Cargo Aircraft Only
Quantity (gross weight) of lithium metal cells and batteries and packaging per overpack, excluding weight of equipment.	5 kg	35 kg

OUTER PACKAGINGS															
Type	Drums					Jerricans			Boxes						
Desc.	Steel	Aluminium	Ply-wood	Fibre	Plastic	Steel	Aluminium	Plastic	Steel	Aluminium	Wood	Ply-wood	Reconstituted wood	Fibre-board	Plastic
Spec.	1A2	1B2	1D	1G	1H2	3A2	3B2	3H2	4A	4B	4C1 4C2	4D	4F	4G	4H2

Section II – Excepted Lithium Metal and Lithium Alloy Cells and Batteries

Lithium metal or lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Regulations if they meet the requirements in this section, in addition to the General Requirements, above.

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

- a lithium metal or lithium alloy cell, the lithium content is not more than 1 g;
- a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;

Cells and batteries must be packed in strong outer packagings, that conform to 5.0.2.4, 5.0.2.6.1 and 5.0.2.12.1.

Additional Requirements – Section II

Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.

The maximum number of batteries in each package must be the minimum number required to power the equipment plus two spares.

Each package of cells or batteries must be capable of withstanding a 1.2 m drop test in any orientation without:

- damage to cells or batteries contained therein;
- shifting of the contents so as to allow battery to battery (or cell to cell) contact;
- release of contents.

Each consignment must be accompanied with a document such as an air waybill with an indication that:

- the package contains lithium metal cells or batteries;
- the package must be handled with care and that a flammability hazard exists if the package is damaged;
- special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- a telephone number for additional information.

Each package must be labelled with a lithium battery handling label (Figure 7.4.I).

A Shipper's Declaration for Dangerous Goods is not required.

The words "Lithium metal batteries", "not restricted" and "PI 969" must be included in the Additional Handling information on the air waybill, when an air waybill is used.

Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

OUTER PACKAGINGS															
Type	Drums					Jerricans			Boxes						

PACKING INSTRUCTION 970

STATE VARIATIONS: USG-02/03

OPERATOR VARIATIONS: AM-09, CO-10, CS-10, CZ-08, MX-09, SK-01, UX-07, VS-01

This instruction applies to lithium metal or lithium alloy cells and batteries contained in equipment (UN 3091) on passenger and Cargo Aircraft Only.

The general requirements apply to all lithium metal and lithium alloy cells and batteries contained in equipment prepared for transport according to this packing instruction. Section I then applies to cells and batteries that are fully regulated for transport and assigned to Class 9; Section II contains the requirements applicable to "small" cells and batteries that when packed and labelled as described are otherwise excepted from the Regulations.

General requirements

The following requirements apply to all lithium metal or lithium alloy cells and batteries:

- (a) each cell and battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;
- (b) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- (c) cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- (d) equipment must be equipped with an effective means of preventing accidental activation;
- (e) equipment containing cells or batteries must be packed in strong outer packagings that conform to 5.0.2.4, 5.0.2.6.1 and 5.0.2.12.1.
- (f) the equipment containing the cells or batteries must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.

Section I – Fully Regulated Class 9 Lithium Metal and Lithium Alloy Cells and Batteries

These requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9

The General Packing Requirements of 5.0.2 must be met.

Each cell or battery must:

- 1. meet the General Requirements, above;
- 2. Incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- 2 volts; or
 - two-thirds of the voltage of the undischarged cell;
- and batteries containing one or more such cells, are forbidden for transport.

Additional Requirements – Section I

- outer packaging must be waterproof or made waterproof through the use of a liner, such as a plastic bag unless the equipment is made waterproof by nature of its construction;
- the quantity of lithium metal contained in any piece of equipment must not exceed 12 g per cell and 500 g per battery.

COMBINATION PACKAGINGS

	Passenger aircraft	Cargo Aircraft Only
Quantity (net weight) of lithium metal cells and batteries per piece of equipment.	5 kg G	35 kg G

OUTER PACKAGINGS

Type	Drums	Jerricans	Boxes
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Section II – Excepted Lithium Metal and Lithium Alloy Cells and Batteries

Lithium metal or lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Regulations if they meet the requirements in this section, in addition to the General Requirements, above.

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

1. a lithium metal or lithium alloy cell, the lithium content is not more than 1 g;
2. a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;

Additional Requirements - Section II

The equipment must be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the cell or battery is afforded equivalent protection by the equipment in which it is contained.

Each package containing more than four cells or more than two batteries installed in equipment must be labelled with a lithium battery handling label (Figure 7.4.I);

Each consignment with packages bearing the lithium battery handling label must be accompanied with a document such as an air waybill with an indication that:

- the package contains lithium metal cells or batteries;
- the package must be handled with care and that a flammability hazard exists if the package is damaged;
- special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- a telephone number for additional information.

A Shipper's Declaration for Dangerous Goods is not required.

The words "Lithium metal batteries", "not restricted" and "PI 970" must be included in the Additional Handling Information on the air waybill, when an air waybill is used.

Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

Overpacks - Section II

Individual packages each complying with the requirements of Section II may be placed in an overpack. The overpack may also contain packages of dangerous goods or goods not subject to these Regulations provided that there are no packages enclosing different substances which might react dangerously with each other. An overpack must be marked with the word "Overpack" and labelled with the lithium battery label (Figure 7.4.I), unless the label(s) on the package(s) inside the overpack are visible, or a label is not required.

OUTER PACKAGINGS

Type	Drums	Jerricans	Boxes
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Figure 7.4.1
Lithium Battery Label



Name: Lithium Battery Label
Minimum dimensions:: 120 mm x 110 mm
Colour: The border of the label must have red diagonal hatchings.
Text and symbols black on a contrasting background.

Comments from Tadiran Batteries GmbH:

NOTE 1: The shipping document (airway bill) should reflect for example the following text where appropriate:

"Contains lithium metal batteries. Handle with care. If package is damaged, batteries must be quarantined, inspected and repacked.

For information call xxx.xxx.xxxx

NOT RESTRICTED, PI 9xx"

NOTE 2: When shipping to/from/via the U.S.A., the following should be added:

"Lithium Metal Batteries – forbidden for transport aboard passenger aircraft (USA Only)"

Transport Regulations for Sea Transport

IMDG Code 2002

Overview

UN 3090 LITHIUM BATTERIES

UN 3091 LITHIUM BATTERIES CONTAINED IN EQUIPMENT or
LITHIUM BATTERIES PACKED WITH EQUIPMENT

			see chapter
Class	9	Miscellaneous dangerous substances and articles	2.9
Subsidiary risk	---		
Packing group	II	Medium danger	2.0.1.3
Special provisions	188	Exempted if	3.3
	230	Class 9 if	
	310	Small lots	
Limited Quantities	none		
Packing Instructions	P903	Lithium Batteries	4.1.4.1
EmS ¹⁾	F-A	Fire Schedule Alfa	
	S-I	Spillage Schedule India (flammable solids, repacking possible)	
Storage and segregation	Category A		
Properties and observations	Electrical batteries containing lithium or lithium alloy encased in a rigid metallic body. Lithium batteries may also be shipped in, or packed with, equipment. Electrical lithium batteries may cause fire due to an explosive rupture of the body caused by improper construction or reaction with contaminants.		

¹⁾ See "The EmS Guide-Emergency Response procedures for Ships Carrying Dangerous Goods", including Emergency Schedules".

Special Provision 188

Lithium cells and batteries offered for transport are not subject to other provisions of this Code if they meet the following:

- .1 For a lithium metal or lithium alloy cell, the lithium content is not more than 1 g, and for a lithium-ion cell, the equivalent lithium content is not more than 1.5 g;
- .2 For a lithium metal or lithium alloy battery the aggregate lithium content is not more than 2 g, and for a lithium-ion battery, the aggregate equivalent lithium content is not more than 8 g;
- .3 Each cell or battery is of the type proved to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- .4 Cells and batteries are separated so as to prevent short circuits and are packed in strong packagings, except when installed in equipment; and
- .5 Except when installed in equipment, each package containing more than 24 lithium cells or 12 lithium batteries shall in addition meet the following requirements:
 - .1 Each package shall be marked indicating that it contains lithium batteries and that special procedures shall be followed in the event that the package is damaged;
 - .2 Each shipment shall be accompanied with a document indicating that packages contain lithium batteries and that special procedures shall be followed in the event a package is damaged;
 - .3 Each package is capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents; and
 - .4 Except for lithium batteries packed with equipment, packages may not exceed 30 kg gross mass.

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

Special Provision 230

This entry applies to cells and batteries containing lithium in any form, including lithium polymer and lithium ion cells and batteries.

Lithium cells and batteries may be transported under this entry if they meet the following conditions:

- .1 Each cell or battery is of the type proved to meet the requirements of each test of the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- .2 Each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under normal conditions of transport;
- .3 Each cell and battery is equipped with an effective means of preventing external short circuits; and
- .4 Each battery containing cells or series of cells connected in parallel is equipped with effective means as necessary to prevent reverse current flow (such as diodes, fuses, etc.).

Special Provision 310

The testing requirements in Chapter 38.3 of the UN Manual of Tests and Criteria do not apply to production runs consisting of not more than 100 lithium cells and batteries, or to pre-production prototypes of lithium cells and batteries when these prototypes are transported for testing, if:

- .1 the cells and batteries are transported in an outer packaging that is a metal, plastics or plywood drum or a metal, plastics or wooden box and that meets the criteria for packing group I packagings; and
- .2 each cell and battery is individually packed in an inner packaging inside an outer packaging and is surrounded by cushioning material that is non-combustible, and non-conductive.

Packing Instruction P 903

This instruction applies to UN 3090 and UN 3091.

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

Packaging conforming to the packing group II performance level.

When lithium cells and batteries are packed with equipment, they shall be packed in inner fibreboard packagings that meet the provisions for packing group II. When lithium cells and batteries included in class 9 are contained in equipment, the equipment shall be packed in strong outer packagings in such a manner as to prevent accidental operation during transport.

Additional provision

Batteries shall be protected against short circuit.

From: **IMDG - Code Supplement – The EmS Guide**

F-A: Fire Schedule Alfa
General Fire Schedule

General comments		In a fire, exposed cargoes may explode or their containment may rupture. Fight fire from a protected position from as far away as possible.
	Packages	Create water spray from as many hoses as possible.
Cargo on fire on deck	Cargo Transport Units	
Cargo on fire under deck		Stop ventilation and close hatches. Use cargo space fixed fire-extinguishing system. If this is not available, create water spray using copious quantities of water.
Cargo exposed to fire		If practicable, remove or jettison packages which are likely to be involved in fire. Otherwise, keep cool using water.

S-I: Spillage schedule India
Flammable solids (Repacking possible)

General comments		Wear suitable protective clothing and self-contained breathing apparatus. Avoid all sources of ignition (e.g., naked lights, unprotected light bulbs, electric hand tools, friction). Wear non-sparking footwear. Stop leak if practicable.
Spillage on deck	Packages (small spillage)	Collect spillage and repack if practicable. Otherwise, wash overboard with copious quantities of water. Keep clear of effluent.
	Cargo Transport Units (large spillage)	
Spillage under deck	Packages (small spillage)	Collect spillage and repack if practicable.
	Cargo Transport Units (large spillage)	