# **Transport and Storage of Lithium Batteries:**A Multi Modal Guide



How to find the applicable UN number for Lithium Batteries?

How to find the **applicable provision** for the transport?

#### **Mode of Transport:**

- ADR/RID/ADN
- IMDG Code
- IATA DGR

#### Storage:

- Regulations for sprinkler protection

This guide is intended to help you to find your way through the jungle of legal requirements for the various modes of transport and includes standards for the sprinkler protection to get an impression about what is expected by the insurance industry.



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Prof. Dr. Norbert Müller

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#### Introduction

Lithium batteries have become the most popular energy storage system. They need to be transported

- stand alone
- contained in equipment and vehicles
- packed with equipment and vehicles
- contained in and packed with equipment and vehicles.

Lithium batteries are dangerous goods without any exemption. As a result their transport is subject to dangerous goods regulations.

This guide will help you to find a path through the jungle of dangerous goods regulations to identify the correct applicable provision for the corresponding transportation case.

Recommendation: check first the flow chart "How to find the applicable UN number" of this guide to identify the applicable regulation for all modes of transport.

Storage is very often an unavoidable necessity in the supply chain. The provisions for the storage of lithium batteries are differing from country to country. The European Association of Insurance Companies Associations and FM Global have set individual standards for the sprinkler protection of warehouses containing lithium (ion) batteries, stand alone and in equipment. This guide includes these standards to get an impression about what is expected by the insurance industry.

#### Companies which

- pack and/or mark and/or label packages and/or over-packages
- load
- consign
- transport
- unload

lithium batteries, stand-alone and/or contained in equipment and/or packed with equipment have to take care that their respective employees, including the drivers, have undergone an appropriate training; in Air transport the training (and examination) is regulated by the CBTA.

In countries, which are contract parties of the ADR, RID and/or ADN, companies which

- pack and/or mark and/or label packages and/or over-packages
- load
- consign
- transport
- unload

lithium batteries, stand-alone and/or contained in equipment and/or packed with equipment have to appoint a Dangerous Goods Safety Adviser (DGSA) if the weight of the load on a cargo transport unit (road vehicle, rail wagon, container) is more than 333 kg of such batteries. Except for lithium batteries which are critically damaged or defective according to Special Provision 376 of ADR/RID/ADN: In this case a DGSA has to be appointed independent of the weight of the load.

#### The 2<sup>nd</sup> edition of this Guide

- reflects the provisions as from 1st of January 2025, as published in November 2023 for aviation regulations from 1st of January 2024.
- contains some corrections and amendments to the 1st edition.

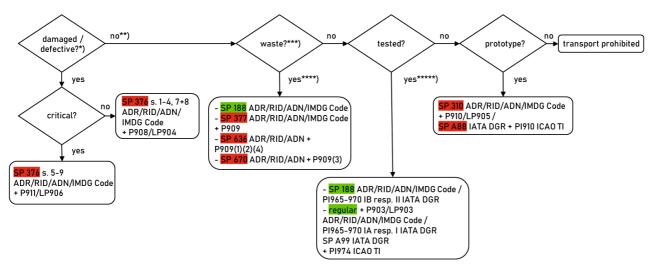
All changes to the 1st edition are highlighted in red color for easy identification.

Please indicate any question related to the application of the quide to the publisher.

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## How to find the applicable provision for the transport of a lithium cell / battery?

- > stand alone (UN 3090, UN 3480)
- > contained in equipment or packed with equipment or contained in & packed with equipment (UN 3091, UN 3481)



<sup>\*)</sup> according to SP 376 ADR/RID/IMDG Code resp. SP A154 IATA DGR;

Test summary (section 38.3.5 of the UN Manual of Tests & Criteria) required

Test summary not required

<sup>\*\*)</sup> battery would pass all applicable tests according to chapter 38.3 of the UN Manual of Tests and Criteria;

<sup>\*\*\*)</sup> for recycling (recovery, not reuse) or for disposal (elimination);

<sup>\*\*\*\*)</sup> additionally regulations for the transport of waste apply;

<sup>\*\*\*\*\*)</sup> inclusive used batteries.

# Mode of Transport Road/Rail/Inland Navigation Vessels - ADR/RID/AND

ADR / RID / ADN										
UN 3090 LITHIUM METAL BAT Special Provision Test		1		Package		Cor	ntainer	Transport document		
		Summary?	Packaging	Marking	Labeling	Marking Placarding				
(1a)	(1b)	(2)	(3a)	(3b)	(3c)	(4a)	(4b)	(5)		
188	≤1g per cell, ≤2g per battery	Yes SP188(c)	SP188(d),(g),(h)	UN 3090	-	-	-	-		
-	> 1 g per cell, > 2 g per battery	Yes 2.2.9.1.7.1(g)	P903(1),(2) LP903	UN 3090		-	**************************************	UN 3090 LITHIUM METAL BATTERIES, 9, (E)		
310	pre-production prototypes or production runs ≤ 100 cells or batteries	No	P910(1),(3) LP905(1)	UN 3090		-	•	UN 3090 LITHIUM METAL BATTERIES, 9, (E), CARRIAGE IN ACCORDANCE WITH SPECIAL PROVISION 310		
376	damaged / defective, non critical	No	P908 LP904	UN 3090 DAMAGED / DEFECTIVE LITHIUM METAL BATTERIES		-	<u>a</u>	UN 3090 LITHIUM METAL BATTERIES, 9, (E), CARRIAGE IN ACCORDANCE WITH SPECIAL PROVISION 376		
376 677	damaged / defective, critical	No	P911 LP906	UN 3090 DAMAGED / DEFECTIVE LITHIUM METAL BATTERIES		-	**************************************	UN 3090 LITHIUM METAL BATTERIES, 9, (E), CARRIAGE IN ACCORDANCE WITH SPECIAL PROVISION 376, TRANSPORT CATEGORY 0		

# **Mode of Transport Ocean - IMDG Code**

IMDG Co	IMDG Code											
UN 3090	UN 3090 LITHIUM METAL BATTERIES											
Specia	ial Test		Package		Con	tainer	Transport document					
Provisi	ion Summary	y? Packaging	Marking	Marking	Placarding							
	(1b) (2)	(3a)	(3b)	(3c)	(4a) (4b)		(5)					
188 ≤ 1 g cell, ≤ 2 g batte	SP188.3 g per	SP188.4,.7,.8	UN 3090	-	-	-	- (unless required by carrier)					
- > 1 g cell, > 2 g batte	2.9.4.7 g per	P903(1),(2) LP903	UN 3090 LITHIUM METAL BATTERIES		<b>3090</b> if > 4 tons	9	UN 3090 LITHIUM METAL BATTERIES, 9					
proto or prod runs cells	duction totypes duction s ≤ 100	P910(1),(3) LP905(1)	UN 3090 LITHIUM METAL BATTERIES		3090 if > 4 tons	2	UN 3090 LITHIUM METAL BATTERIES, 9, TRANSPORT IN ACCORDANCE WITH SPECIAL PROVISION 310					
		P908 LP904	UN 3090 DAMAGED / DEFECTIVE LITHIUM METAL BATTERIES		<b>3090</b> if > 4 tons	<u>a</u>	UN 3090 LITHIUM METAL BATTERIES, 9, TRANSPORT IN ACCORDANCE WITH SPECIAL PROVISION 376					
defec critic		P911 LP906	UN 3090 DAMAGED / DEFECTIVE LITHIUM METAL BATTERIES		<b>3090</b> if > 4 tons	<u>a</u>	UN 3090 LITHIUM METAL BATTERIES, 9, TRANSPORT IN ACCORDANCE WITH SPECIAL PROVISION 376					
	export to the U.S.A. (U.S	5. CFR 49, §171.25(b)(3))	ETTION METAL BATTERIES	•	if > 4 tons	9	TRANSPORT IN					

# Mode of Transport Air - IATA DGR

IATA	IATA DGR									
UN 3	UN 3090 LITHIUM METAL BATTERIES									
	Special Provision	Test		Transport document						
		Summary?	Packaging	Marking	Labeling					
(1a)	(1b)	(2)	(3a)	(3b)	(3c)	(4)				
-	≤ 1 g per cell, ≤ 2 g per battery, ≤ 2,5 kg net mass per cell or battery	Yes 3.9.2.6.1.1(g)	PI 968 IB	UN 3090 LITHIUM METAL BATTERIES	**	UN 3090 LITHIUM METAL BATTERIES, 9, PI 968 IB				
-	> 1 g per cell, > 2 g per battery, ≤ 35 kg net mass per cell or battery	Yes 3.9.2.6.1.1(g)	PI 968 IA	UN 3090 LITHIUM METAL BATTERIES		UN 3090 LITHIUM METAL BATTERIES, 9, PI 968				
A99	> 1 g per cell, > 2 g per battery, > 35 kg net mass per cell or battery	Yes 3.9.2.6.1.1(g)	PI 974(1) of ICAO TI	UN 3090 LITHIUM METAL BATTERIES		UN 3090 LITHIUM METAL BATTERIES, 9, PI 974, SP A99				
A88	pre-production prototypes or production runs ≤ 100 cells or batteries	No	PI 910(1) of ICAO TI	UN 3090 LITHIUM METAL BATTERIES		UN 3090 LITHIUM METAL BATTERIES, 9, PI 910, SP A88				
A154	damaged / defective, non critical			Forbidden						
	damaged / defective, critical	Forbidden								

# **Appendix 3: Restrictions of IATA Airlines**

Airline		UN 3	3480	UN 3481			UN 30	90		UN 3	3091		UN 3556	
		PI965		with in				with		in				
				PI966		PI967		PI968			PI969	PI970		PI952
		IA	IB	ı	II	ı	II	IA	IB	ı	II	I	II	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Aerolineas	Α				Α		Α							
Argentinas	R													
Aeromexico	A M													
AeroUnion	6		•	shipper mu	st be registere	d					shipper must	be registered		if self
	R										A		A	balancing with additional provisions only
Air Atlanta Europe	C													CAO
Air Atlanta Icelandic	C													CAO
Air Baltic	B													
Air Bridge Cargo	R	with approval only		with approval only	А	with approval only	А	with approval only		with appr oval only	A	with approval only	А	
Air Canada	A C				А		Α				А		А	
Air Canada Rouge	R V				А		Α				А		А	
Air China	C A													
Air Europa	U X													
Air Europa	Х													
Express	5													
Air France	A F				≤ 1,6	m		≤ 1,6 m						
Air Hong Kong	L D													
Air Mauritius	M K													

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### FM Global Data Sheet "Commodity Classification" (DS 8-1, January 2023)

 $\underline{https://www.fmglobal.com/research-and-resources/fm-global-data-sheets}$ 

UN 3480 SoC	ceiling height	storage height	storage arrangement	packaging	ceiling protection (Quick Response sprinklers only)	in-rack protection
(1)	(2)	(3)	(4)	(5)	(6)	(7)
				wood, metal or corrugated carton with cellulose	K320 or K360,	
			on-floor	and/or unexpanded plastic internal packaging	12 sprinklers,	
		≤ 3 levels,	+	only	2.4 bar	-
	≤ 12 m	≤ 4.5 m	in-rack	corrugated carton with expanded plastic internal	CEP *)	
				packaging	according to DS 8-9	
≤ 60 %				plastic external packaging	UUP **)	
					according to DS 8-9	
				uncartonated		see section
	> 12 m	-	in-rack		per surrounding	2.4.2.2 of DS 8-1
> 60 %	-			cartonated or uncartonated	occupancy	(each second level).
*) = Carton	ated Expa	nded Plastic;	**) = Uncartona	ted Unexpanded Plastic.		

UN 3481	ceiling height	storage height	storage	packaging	ceiling protection	in-rack protection		
SoC			arrangement		(Quick Response sprinklers only)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)		
≤ 60 %	According to the product commodity classification.							
> 60 %			per surrounding occupancy		see section 2.4.2.2 of DS 8-1			
						(each second level).		