ETH zürich

Factsheet

Transport of Lithium-ion Accumulators

Background

Presumed you want to transport e.g. your drone, with its lithium-ion accumulators, in a vehicle from ETH Zurich to another location in Switzerland. Lithium-ion batteries and lithium-ion accumulators are classified as «dangerous goods» according to international transport law. This means that their transport is subject to various regulations for the carriage of dangerous goods. Transport by road and/or rail is governed by the ADR/RID regulations*.

The most important criterion for deciding which of the numerous transport regulations is to be followed is the power capacity of the lithium-ion batteries or lithium-ion accumulators. By way of principle, batteries are distinguished between those with a power capacity of up to 100 Wh and those which exceed 100 Wh.

An exemption from dangerous goods law applies to batteries with a power capacity of up to 100 Wh, resulting in simplified transport requirements. You find useful information on essential transport requirements in Table 1. By contrast, batteries with a power capacity exceeding 100 Wh must always be treated as Class 9 dangerous goods (Table 2).

Regardless of the power capacity, the following rule always applies: Lithium-ion accumulators must only be transported if they have a test certificate compliant with UN 38.3.

How to act correctly

- When you are planning to transport lithium-ion batteries / accumulators or a prototype without a test certificate as per UN 38.3, send an email with the following information to the SSHE department: **sgu-gefahrgut@ethz.ch**
    - Number of batteries and their respective power capacity (Wh)
    - Weight of the individual batteries
    - Complete address of sender and recipient, including their telephone numbers
    - Date of transport/shipping
    - Carrier's vehicle number
    - For prototypes: «PROTOTYPE, no test certificate as per UN 38.3»
- SSHE issues the necessary transport documents, provides the necessary labelling materials free of charge, advises you on suitable as well as necessary UN packaging, and provides instruction for the employees affected or responsible.

* ADR: Accord européen relatif au transport international des marchandises Dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road); RID: Règlement concernant le transport international ferroviaire de marchandises dangereuses (Regulation concerning the International Carriage of Dangerous Goods by Rail)

Table 1: Transport of batteries with a power capacity of up to 100 Wh by road/rail – What are the key issues?

Mode of transport	**Road/rail (ADR/RID)**		
Power capacity	**≤ 100 Wh (per battery/per accumulator)**		
What is being transported?	Batteries (without device / equipment)	Batteries packed with equipment (at least 1 battery included)[1]	Batteries contained in equipment (inserted / installed in the equipment)[1]
Packing instructions	ADR/RID Special Provision 188		
Max. number of pieces	Not applicable		
Weight limit	30 kg gross per item for transport/shipping	Not applicable	
Packaging	The inner packaging must surround batteries completely; batteries must be protected against short circuits. Strong outer packaging: e.g. shipping carton (which has passed the drop test: content is not damaged and does not shift).		Strong outer packaging. Protection against unintended activation. Protection against short circuits.
Labelling of item for transport/shipping			Not applicable, unless more than 2 batteries are installed, or unless the consignment consists of more than 2 items for transport/shipping.
Transport documents	Not applicable		Not applicable
Other	Instruction of participating employees according to their tasks and responsibilities		

[1] «Equipment» denotes a device for whose operation the lithium-ion batteries/accumulators supply electrical energy. Chargers are not regarded as «equipment» according to the regulation.

Example: Transport of lithium-ion accumulators up to 100 Wh, transported loose without equipment

- Packing instructions as per ADR Special Provision 188 (see the Annexe).
- Packaging:
  Inner packaging must surround the batteries completely; the batteries must be protected against short circuits (e.g. mask the terminals, possibly using the original cover supplied with the product).
- Strong, stable outer packaging: For example, this could be an UN-approved shipping carton (UN-approved = packaging passed the drop test: content is not damaged and does not shift).
- The weight per transport item must not exceed 30 kg gross.
- Labelling the packaging: sticker with red borders and UN number printed on it, with the sender's telephone number filled in.
- Transport documents: Early on, send an email with the following information to the SSHE department, **sgu-gefahrgut@ethz.ch**:
  Number of batteries and their power capacity (Wh), weight of individual batteries, complete addresses of sender and recipient including their telephone numbers, date of transport/shipping, carrier's vehicle number.
- SSHE will send you the necessary documents and will arrange an appointment to instruct the employees involved.

Safety, Security, Health and Environment

Table 2: Transport of batteries with a power capacity exceeding 100 Wh by road/rail – What are the key issues?

Mode of transport	**Road/rail (ADR/RID)**		
Power capacity	**> 100 Wh (per battery/per accumulator)**		
What is being transported?	Batteries (without device / equipment)	Batteries packed with equipment (at least 1 battery included)[1]	Batteries contained in equipment (inserted / installed in the equipment)[1]
Packing instructions	P903, LP903		
Max. number of pieces	ADR 1.1.3.6: max. 333 kg per transport unit (vehicle including trailer)[2] If this weight is exceeded: additional requirements apply, e.g. transport vehicle must be suitably insured and equipped; driver must have an ADR/SDR certificate.		
Weight limit	None		
Packaging	Batteries must be protected against damage that may be caused by their placement in the packaging or by their movement in the packaging. Protection against short circuits. Batteries with gross mass of more than 12 kg: additional requirements.		Strong outer packaging. Protection against unintended activation. Protection against short circuits.
Labelling of item for transport/shipping	Hazard label 9a (10 x 10 cm) ADR: UN 3480 	Hazard label 9a (10 x 10 cm) ADR: UN 3481 	
Transport documents	Yes		
Other	Instruct participating employees in accordance with their tasks and responsibilities		

[1] «Equipment» denotes a device for whose operation the lithium-ion batteries/accumulators supply electrical energy. Chargers are not regarded as «equipment» according to the regulation.
[2] An ABC fire extinguisher (minimum: 2 kg) must be carried in the vehicle. The driver must undergo instruction.

Example: Transport of lithium-ion accumulators exceeding 100 Wh, in equipment, and replacement accumulators in the same package

- **Max. 333 kg** (max. number of pieces as per ADR 1.1.3.6) / transport unit (truck including trailer): you may undertake the transport yourself, given that the requirements stated below are fulfilled.
- Packing instructions: P903, LP903 (see the Annexe). An ADR packaging must be used for transport. Examples of ADR packaging are UN cardboard boxes and UN RAKO boxes. You may order these from the following sources, among others: **https://gefahrgut-shop.ch/** or **https://www.utzgroup.ch/gefahrgutbehaelter/.**
- Labelling the packaging: hazard label no. 9A (10 cm x 10 cm), UN number (you must record this as per Table 2).
- Transport document: this is a mandatory requirement. Early on, send an email with the following information to the SSHE department, **sgu-gefahrgut@ethz.ch**:
  Number of batteries and their power capacity (Wh), weight of individual batteries, complete addresses of sender and recipient including their telephone numbers, date of transport/shipping, carrier's vehicle number.

Safety, Security, Health and Environment

- SSHE will send you the necessary documents and will arrange an appointment to instruct the employees involved.
- **Weight exceeding 333 kg**: you cannot undertake transport yourself. The vehicle must be suitably equipped and insured, and the driver must have an ADR/SDR certificate. Send an email with the following information to the Services department, **transporte@services.ethz.ch**, and to the SSHE department, **sgu-gefahrgut@ethz.ch**:
  Number of batteries and their power capacity (Wh), weight of individual batteries, complete addresses of sender and recipient including their telephone numbers, date of transport/shipping, carrier's vehicle number.
  Place a **transport order** for the Services department. Please note that the Services department can only carry out the transport of dangerous goods if it is in possession of the necessary transport documents issued by the SSHE department.

Legal basis / literature

- Chemical Risk Reduction Ordinance (ORRChem)
- Ordinance on Movements of Waste (OMW)
- DETEC (Federal Department of the Environment, Transport, Energy and Communications) Ordinance on Lists for Movements of Waste
- EPTA (European Power Tool Association) and ZVEI (German Electrical and Electronic Manufacturers' Association), factsheet: "Shipping Lithium-Ion Batteries for Cordless Power Tools and Electric Garden Equipment: Implementation of Dangerous Goods Transport Regulations", 2019
- Ordinance on the Carriage of Dangerous Goods by Road (ADR/SDR)
- Packing instructions:
  - Special Provision 188
  - Packing instruction P903

ETH Zurich
Safety, Security, Health and Environment
(SSHE)

Telephone: +41 44 632 30 30
Email: **sgu-gefahrgut@ethz.ch**
www.sicherheit.ethz.ch
Version: April 2021

Annexe: Packing instructions

Special Provision 188

Cells and batteries offered for carriage are not subject to other provisions of ADR if they meet the following conditions:

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.
c) Each cell or battery meets the provisions of 2.2.9.1.7 (a) and (e).
d) Cells and batteries, except when installed in equipment, shall be packed in inner packaging that completely enclose the cell or battery. Cells and batteries have to be protected against short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit. The inner packaging shall be packed in strong outer packaging 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 have to 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 carriage (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 packaging 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 has to be marked with the appropriate lithium 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

   (ii) packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment;
g) 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;
h) Except when batteries are installed in or packed with equipment, packages shall not exceed 30 kg gross mass.

Packing instruction P903

This instruction applies to UN nos. 3090, 3091, 3480 and 3481. The following packaging 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 have to be packed in packaging in such a way that the cells or batteries are protected against damage that may be caused by the movement or by the placement of the cells or batteries within the packaging. Packaging have to fulfil the requirements for 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, and assemblies of such cells or batteries:

a) strong outer packaging;
b) protective enclosures (e.g. fully enclosed or wooden slatted crates); or
c) pallets or other handling devices.

Cells or batteries have to be secured to prevent inadvertent movement, and the terminals shall not support the weight of other superimposed elements. Packaging need not meet the requirements of 4.1.1.3.

(3) For cells or batteries packed with equipment:

Packaging conforming to the requirements in paragraph (1) of this packing instruction, then placed with the equipment in an outer packaging; or packaging 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 has to be secured against movement within the outer packaging.

For the purpose of this packing instruction, "equipment" means apparatus which requires for its operation the lithium metal or lithium-ion cells or batteries with which it is packed.

(4) For cells or batteries contained in equipment:

Strong outer packaging constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use. They have to be constructed in such a manner as to prevent accidental operation during carriage. Packaging 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.

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 in strong outer packaging when intentionally active.

Additional instruction

Cells or batteries have to be protected against short circuits.