Module Recycling and Disposal

Important Notice to our international costumers:

The following information refer solely to the recycling & disposal of lithium cells and lithium batteries according to ADR. In non-ADR-states provisions may differ to align to national regulations.

Lithium cells and lithium batteries same as all other cells and batteries don´t belong into the waste bin!

How can one dispose of lithium cells and lithium batteries in a regulation conform way when they have reached the end of their capacity and life performance? What happens to devices with built in lithium batteries with regards to recycling/disposal?

These are the two most important questions that need to be answered. In contrast to other battery types like alkalines or nickel metalhydride used lithium batteries are subject to dangerous goods regulations in transport.

The following overviews and information will guide you through the regulation jungle.

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1. Disposal/Recycling of lithium cells / lithium batteries without equipment

Disposal/Recycling of „small“ lithium cells and lithium batteries

The disposal of used „small“ lithium cells and batteries is relatively easy for the user. No matter whether you are a company or a private person. The cell/battery manufacturer must take the batteries back free of charge and is responsible for the recycling/disposal. For this reason different collection and return systems exist. In Germany GRS the „Gemeinsame Rücknahmesystem“ (collective return system) is the most common. One can recognize it by the green collection boxes that are most often seen in Do-It-Yourself-Stores, supermarkets and at a lot of companies. There are also other return systems e.g. CCR Rebat, Ökorecall or ERP.

Let´s start with the question: What kind of „small“ batteries are allowed in these collection boxes? „Small“ are all cells and batteries with a weight not exceeding 500 g.
And furthermore all lithium ion cells not exceeding a Watt-hour rating of 20 Wh and lithium ion batteries not exceeding 100 Wh.
For lithium metal cells the limit is a lithium content not exceeding 1 g and for lithium metal batteries a lithium content not exceeding 2 g.

In real life the limit of 500 g seems to be the easiest to keep since the other parameters most often are hard to determine for used cells / batteries.

Other cell and battery types may also be put into the collection boxes. A mixed collection is explicitly allowed in the ADR. It is recommendable to cover at least the poles of the the lithium cells/batteries with non-conductive tape to prevent possible short circuits.

These collection boxes don´t need a design type approval according to the dangerous goods transport regulations if the gross weight of each box does not exceed 30 kg.

This easy way of disposal is regulated in Special Provision 636 of the ADR in combination with Packing Instruction P909. This Special Provision describes the exceptions for small lithium cells and lithium batteries from almost all Dangerous Goods Regulations in the ADR. Only the following requirements apply for companies providing collection/return services:

- The collection boxes must be strong enough to withstand transport shocks and loadings.

- A quality management system must be established to ensure that the total amount of lithium cells and batteries per transport unit (= vehicle or vehicle with trailer) does not exceed 333 kg.

- The collection boxes must be marked
„LITHIUM BATTERIES FOR DISPOSAL“
or
„LITHIUM BATTERIES FOR RECYCLING“.

Yet this very simplified type of transport is only allowed from the consumer or from a collection facility to the intermediate processing facility.

When there are larger amounts of “small” lithium cells / batteries, there are drums or boxes available for collection. But they need a dangerous goods approval (UN specification code) then. And all the above requirements apply to these collection boxes also.

Recycling/Disposal of „large“ lithium cells / batteries

For larger lithium cells / batteries with more than 500 g cell / battery weight and more than 20 Wh per cell / more than 100 Wh per battery resp. 1 g lithium content per cell / 2 g lithium content per battery, for example those for e-bikes, large handicraft equipment, some smoke detectors and storage modules for photovoltaic systems the exeptions of Special Provision 636 may not be used. Here all regulations of the ADR need to be obeyed.

For such cells / batteries Special Provision 377 in combination with Packing Instruction 909 applies.

Special Provision 377 states:

Lithium ion and lithium metal cells and batteries and equipment containing such cells and batteries carried for disposal or recycling, either packed together with or packed without nonlithium batteries, may be packaged in accordance with packing instruction P909 of 4.1.4.1.
These cells and batteries are not subject to the requirements of 2.2.9.1.7 (a) to (e).
Packages shall be marked "LITHIUM BATTERIES FOR DISPOSAL" or "LITHIUM

BATTERIES FOR RECYCLING".
Identified damaged or defective batteries shall be carried in accordance with special provision 376 and packaged in accordance with P908 of 4.1.4.1 or LP904 of 4.1.4.3, as applicable.

The remark that 2.2.9.1.7 a) to e) need not be met, means that for the recycling / disposal of lithium cells / batteries one need not take into account the UN test series 38.3 or the production of the cells / batteries according to a quality management system. Aditionally technical details like safety venting devices or the prevention of dangerous reverse current flow need not be taken into account.

According to Packing Instruction P909 all lithium cells and batteries must be protected against short circuit. The packaging needs a dangerous goods approval (UN specification code). There is an exception for batteries with a max. gross mass of at least 12 kg in an impact-resistant outer casing where no design type test is required.

For the transport of these „large“ lithium cells / batteries the packaging needs to bear the danger label model of class 9 and the marking of the UN number in addition to the marking „LITHIUM BATTERIES FOR DISPOSAL“ or „LITHIUM BATTERIES FOR RECYCLING“ as required by Special Provision 377.

UN 3480

LITHIUM BATTERIES FOR RECYCLING

(or LITHIUM BATTERIES FOR DISPOSAL whichever expression describes the content more accurately)

In this case a transport document according to ADR needs to be issued with all relevant information concerning the dangerous goods. This could look like this:

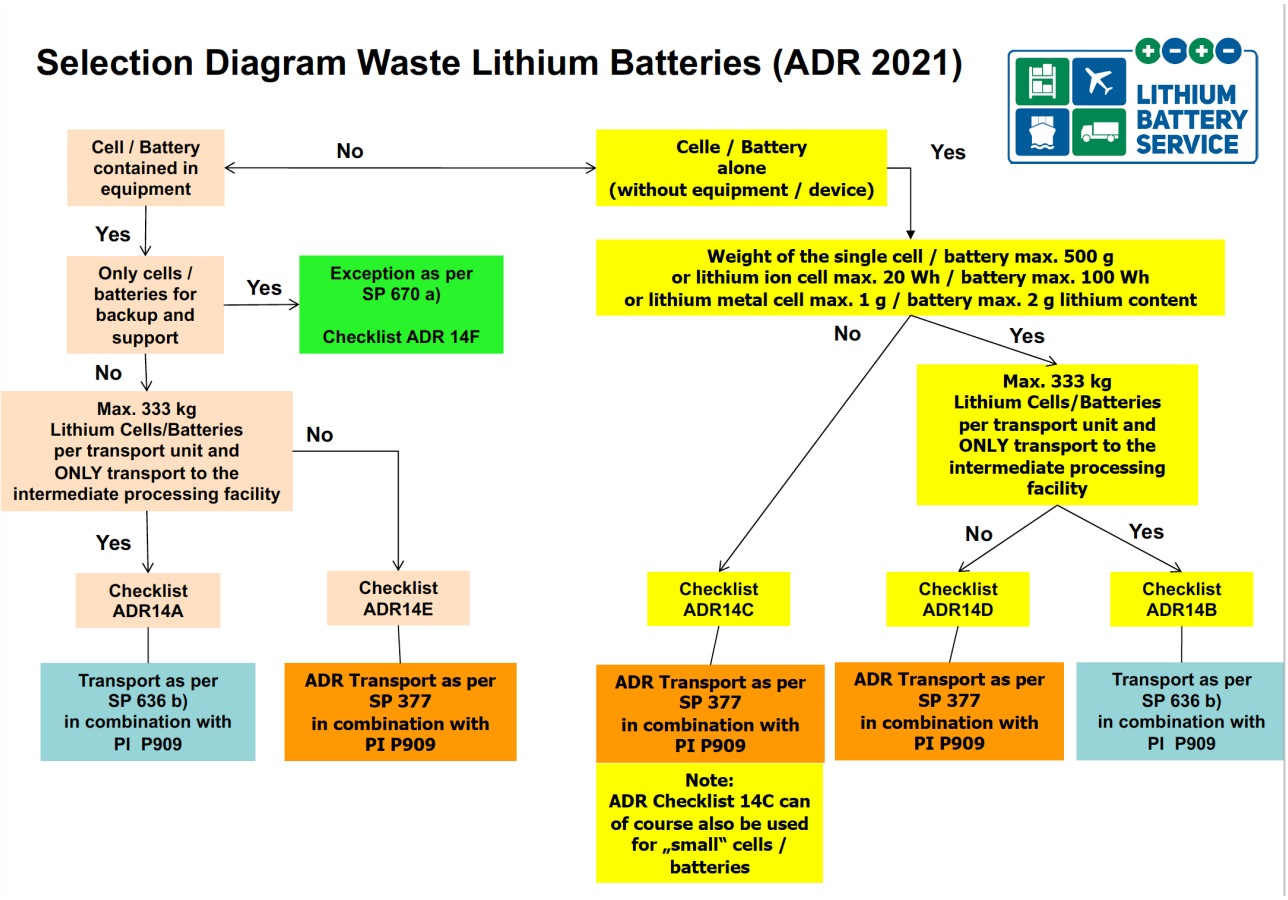
Consignor + Consignee Information
UN 3480 Waste, Lithium Ion Batteries, 9, (E)

UN 3090, Waste, Lithium Metal Batteries, 9 (E)
4 plastic drums
320 kg (Transport Category 2)

960 points according to 1.1.3.6 ADR

Complete checklists including examples of transport documents and labels can be purchased via our portal:
1. Go to „www.lithium-battery-service.com“
2. Click on „FIND A SINGLE CHECKLIST“.
3. Then click on your battery type (lithium ion or lithium metal)
4. Here click on „2-3 # Waste cells/batteries

The article contains checklists for all varieties of the recycling / disposal of used lithium cells / batteries and the following selection diagram for guidance:



2. Disposal/Recycling of waste electronic articles containing lithium cells / batteries

For disposal / recycling of waste electronic articles containing lithium cells / batteries there are two provisions.

a) Only buffer cells / batteries

When only buffer cells / batteries are installed and these are not the main energy source then there is a complete exemption from the dangerous goods transport regulations as described in special provision 670 (a).

SP 670 (a) reads:
Lithium 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 providions of ADR including special provision 376 and 2.2.9.1.7 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 of these cells and batteries covered by this paragraph are button cells used for data integrity in household appliances (e.g. refrigerators, washing maschines, dishwashers) or in other electrical or electronic equipment.

b) Cells / Batteries as main energy source

Waste electronic articles containing lithium batteries which are the main energy source of the equipment are subject to the dangerous goods transport regulations of the ADR. Articles containing lithium ion batteries are assigned to UN 3481 and articles containing lithium metal batteries are assigned to UN 3091.
For recycling / disposal of electronic articles the facilitation of Special Provision 670 (b) also may be used. It reads:

Up to the intermediate processing facility

- lithium 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 and 2.2.9.1.7 when
  - (i) the requirements of Packing Instruction P 909 of 4.1.4.1 are valid except for the additional requirements 1 and 2;
  - (ii) 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.

(iii) Packages are marked
"LITHIUM BATTERIES FOR DISPOSAL" or
"LITHIUM BATTERIES FOR RECYCLING" as appropriate.
If equipment containing lithium cells or batteries is carried unpacked 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.

When using this simplified variety for transporting equipment there are no parameter limitations regarding cell/battery or regarding the weight of the installed cells / batteries.

Once the above mentioned requirements of SP 636 respective SP 670 (b) are not met, e.g. because the 333 kg limit was surpassed there is only the "standard transport" for recycling/disposal according to SP 377 in conjunction with packing instruction P909 to be used. P909 includes the following requirement:

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.

The remark „...need not meet the requirements of 4.1.1.3" means that no packagings of an approved design type are required. 2015 has already adapted this change. In other ADR states please check with the appropriate authorities.

Suitable packagings could e.g. be large boxes, wooden slats, Intermediate Bulk Containers (IBCs) or even a pallet box with an inner lining to ensure that small parts remain inside.

In addition for this option it is required that the package bears the label model no. 9A and the UN number and a transport document needs to be issued.

A bulk transport, e.g. in 30 m³ containers, like it has been done for years in the past, is absolutely not conform with the regulations. There have already been several cases where articles being compacted or transferred have caused fires at collection companies.

Recycling companies are required to provide suitable boxes to their costumers.

3. Disposal of defective lithium cells / lithium batteries

Special Provision 377 shows the following text on the disposal of defective lithium cells and lithium batteries:

Identified damaged or defective batteries shall be carried in accordance with special provision 376 and packaged in accordance with P908 of 4.1.4.1 or LP904 of 4.1.4.3, as applicable.

Only in Special Provision 636 an exception is included for the transport of „small“ cells and batteries (definitions see above) and this explicitly includes the exception from the requirements of Special Provision 376.

Yet from our point of view it is recommendable not to use the regular collection boxes for obviously defective small lithium cells and lithium batteries and to use the extensive measures described in Special Provision 376 in this case also. The disposal companies resp. return systems can provide suitable packagings. Just ask there about them.

For the transport of defective cells and batteries we also have a suitable checklist in our portal describing the details.