



CONEBI Position Paper on E-Bike Battery Repair

While e-bikes have become increasingly popular in the market, so has the interest in some of its components, especially the battery. The e-bike industry has been active to prevent battery degradation over the lifetime of the e-bike as much as possible, by using high quality battery components on the one hand, and actively informing consumers on how to treat their batteries to ensure a long and safe life on the other hand. Nonetheless, the performance of the first e-bike batteries that were placed on the market several years ago may be starting to decrease due to the normal ageing of battery cells. E-bike users may be enticed to search for ways to possibly prolong the lifetime of these OEM fitted batteries through repairs. This paper wants to inform on the reasons why e-bike users should forgo battery repair – from a technical, legal, environmental and liability perspective – despite the increasing offering in the market for refurbishing, repairing or remanufacturing of used e-bike batteries.

At first glance, these offers of refurbishing, repairing or remanufacturing of batteries seem like a good opportunity from an environmental and economic perspective to prolong the lifetime of batteries. However, the European Bicycle Industry would like to state a clear warning against the repair and remanufacturing of e-bike batteries based on severe safety concerns. In addition, important considerations in terms of liability, compliance with laws and technical standards as well as certification are complex and not clearly understood by many actors. This is why in this position paper CONEBI elaborates on the reasons for these concerns and offers guidance on how to best deal with used e-bike batteries.

1. Definitions

First of all, it is important to note that while the words refurbishing, repairing or remanufacturing are very often used interchangeably, there is currently no uniform definition for these terms. However, a distinction has to be made. For the purpose of this paper CONEBI defines the terms in the following manner:

- *Refurbishing*: Only cosmetic maintenance of a battery pack to restore it to an original condition. It does not involve replacement or alteration of any parts of the battery pack, except for non-safety relevant parts as defined by the original manufacturer. It may include BMS updates to the original manufacturer's specification, and these updates must be performed using only tools and software officially provided by the original manufacturer.
- *Repurposing*: Use of a complete and unchanged battery pack for a non-original purpose, for example in a stationary storage application instead of in an e-bike.
- *Repairing*: Changes that are made to the original battery, which shows a malfunction, in order to have a fully-functioning battery again.

- **Remanufacturing:** Making changes to a battery pack which alter its functionality. This includes all changes which involve replacement of safety relevant parts. It also includes any procedures carried out on the battery pack which are not approved by the original manufacturer.

Impact on certification

| Refurbishing | Repurposing | Repairing | Remanufacturing |
|------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Certification remains intact | Batteries have to be re-certified according to their new purpose. | Exchanging parts of the battery result in loss of “type-approval”, which means that the product has to pass the full certification process, e.g. according to UN-T 38.3, as well as comply with product safety law and all applicable (safety) standards again after repairing. | Remanufactured batteries will lose “type approval”, which means that they have to undergo and pass the full certification process, e.g. according to UN-T 38.3, product safety law and all applicable (safety) standards again after remanufacturing. |

Refurbishing as per the prefixed definition does not invalidate the certification (type testing) of a battery pack, whereas repair or remanufacturing changes the battery pack or its components and thus also causes a change in its status as tested type (according to UN-T 38.3 as well as IEC 62133-2 and EN 50604 that are directly linked to the e-bike standard EN 15194) as defined above. This results in the need for a full re-certification of the battery pack, including a type test with 8 / 16 equal small / large batteries being needed for the tests in this certification.

2. Issues of concern with repairing or remanufacturing

The above stated methods of handling used or defective battery packs, instead of recycling them, cause several concerns to the e-bike industry.

Technical concerns

Currently there is no sound technical framework for repairing or remanufacturing e-bike batteries which is aligned with the type approval of batteries and thus with well-defined parts requirements and product / production process quality, product responsibility and certification and transport safety aspects as well as safety testing of batteries. Lacking this framework, any kind of battery repairing or remanufacturing can lead to loss of type approval and also to uncontrolled, potentially unsafe situations during actual use.

When we talk about transport safety aspects and safety testing of batteries, we primarily refer to the pertinent UNECE Recommendations on the Transport of Dangerous Goods¹ and the Manual of Tests and Criteria². The UNECE Recommendations and associated Manual were developed by the Economic and Social Council’s Committee of Experts on the Transport of Dangerous Goods (UNECE) and are now

¹ UNECE Recommendations on the Transport of Dangerous Goods Model Regulations (Twenty-first revised edition): <https://unece.org/transport/documents/2021/03/recommendations-transport-dangerous-goods-model-regulations-twenty>

² UNECE Manual of Tests and Criteria – Seventh revised edition (applicable as from 1 January 2021): https://unece.org/fileadmin/DAM/trans/danger/publi/manual/Rev7/Manual_Rev7_E.pdf

a legal requirement in both the international transport law and national laws governing the transport of dangerous goods, including lithium-ion batteries. Many in the lithium-ion battery sphere simply refer to the tests prescribed in the Manual as the “UN-T 38.3” tests.

According to UN-T 38.3, type testing is required for lithium-ion batteries. Type test approvals for lithium ion batteries according to UN-T 38.3 are required for series production to ensure that the product meets basic safety requirements. Therefore, type testing involves tests with test samples, which are representative for the series product, to prove the conformity with a standard. Depending on the size of the battery, a differing amount of test samples has to undergo these tests. For lithium-ion batteries type tests require 8 or 16 test samples (depending whether the tested battery is considered “small” or “large”) of a production series with equivalent component parts to be tested. The tests range from altitude simulation tests to thermal and short circuit tests. Passing the UN-T 38.3 tests successfully will result in a certificate ensuring the type approval as long as all other pieces of the series are built in the same way using the same new components. This is the prerequisite for transporting (and finally selling) the product.

Especially for lithium-ion batteries, these tests are partially damaging and/or partially destructive. It is important to note that (production) sample tests are not equivalent with type tests as they are non-destructive end-of-line tests, which are not sufficient as type tests.

When it comes to repairing or remanufacturing batteries, it is important to note that used battery cells are often unique or inhomogeneous. Thus, batteries compiled of used cells, or even made out of a mix of old and new cells, can likely not represent the series of this battery model. Therefore, the repaired or remanufactured battery does not match the type test of the original battery anymore and is no longer in conformity, i.e. no longer certified.

Similar testing and conformity issues can arise when changing the battery management system (BMS) of an e-bike battery.

Legal concerns

As outlined above, the safety tests are closely linked with legislation on the transport of dangerous goods. The Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)³ is a comprehensive set of basic rules. It contains provisions in particular for the classification, packaging, labelling and documentation of dangerous goods, for handling during transport and for the vehicles used for their transport. To categorise dangerous goods and lay down the requirements, the ADR refers to the UNECE Manual of Tests and Criteria directly. Not only has the ADR been transposed into European law and is therefore a requirement for transport between Member States in the European Union, but it is also applicable for transport within States due to direct references made to the UNECE Manual of Tests and Criteria and ADR in national laws.

According to this basic set of regulations not only type testing is required, but also specific rules apply to for instance the transportation of batteries, such as UN approved labelling, packaging and transport. Repaired and remanufactured batteries need to be type approved to be transported. In addition, services offering battery repair and remanufacturing also have to be compliant with relevant storage, safety and transportation requirements for e-bike batteries as outlined above.

³ Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (applicable as from 1 January 2021): <https://unece.org/transportdangerous-goods/adr-2021-files>

Environmental concerns

Even though the main purpose of this paper is not to address the environmental aspects of battery repairing and remanufacturing, there are also uncertainties when it comes to the actual benefit of e-bike battery repairing and remanufacturing towards sustainability. In most of the known cases, service providers replace all of the old cells with new ones. This results in an exchange of most of the components in the battery pack and therefore also an exchange of most of the raw materials.

Liability concerns

In addition, end consumers should be aware that an opening or modification of the battery may lead to the termination of warranty and warranty claims. Furthermore, it is uncertain if insurance will cover possible damages that occur with or are caused by a repaired or remanufactured battery.

In the end it should be up to original battery manufacturers to decide who is authorized to refurbish their batteries and in which way to ensure products are safe for both transport and the consumer. Here we would like to reiterate that currently no direct and explicit rules are in place for repairing and remanufacturing services to cooperate with the original manufacturers or to even re-certify the battery. Should a service provider insist on repairing or remanufacturing batteries irrespective of the various aforementioned safety and legal issues, the service provider is obliged to remove all traces (including the label) of the original producer and replace it with clear information on the service provider who has repaired or remanufactured the battery. This service provider legally becomes the new producer of said battery with all the legal requirements attached.

Summary and recommendations

All in all, CONEBI is a strong supporter of only using original OEM certified batteries on e-bikes. Already today e-bike batteries have a lifetime of 7-10 years compared to other consumer products like mobile phones whose batteries have a much shorter lifetime (on average 3-5 years). Due to the above mentioned technical, legal, environmental and liability rules and regulations we highly discourage end-users to make use of any services that are outside these parameters. It is therefore a good decision for the consumer to invest into a new, compatible, higher quality and more innovative e-bike battery at the end of the lifetime of the first battery, if available.

The e-bike industry is constantly looking for ways to improve the environmental impact of their products. Increasing the lifetime of batteries is an ongoing development process in the whole battery/mobility industry as is the investigation into the development of certified processes that may make repairing e-bike batteries possible in the future. Battery experts are already working on developing a strict set of rules to define a certified process of repairing e-bike batteries in applicable cases while keeping safety, type approval and all necessary certifications in mind and at the same time adding an environmental benefit. The e-bike industry follows these developments closely, always being fully aware of the above mentioned technical, legal, environmental and liability boundary conditions that have to be met.

Meanwhile the e-bike industry will put increasing effort in guidance to customers on optimal battery maintenance in use and further mitigating the environmental impact of used batteries while keeping in mind the currently existing safety concerns.

Ultimately, collection and recycling of e-bike batteries at their end-of-life is inevitable, using the collection (and recycling) schemes that the e-bike industry has developed together with professional

collection agencies and recyclers on the one hand as well as their suppliers and retailers on the other hand. These schemes ensure that batteries and the raw materials used in batteries are finding their way back into the circular economy loop in a safe and controlled manner. In combination with the closed loop recycling schemes this route offers the highest product performance in combination with safest operation and lowest environmental impact.

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