



Battery Powered Wheelchair and Mobility Aid Guidance Document

Safety requirements applicable to the carriage of battery powered wheelchairs and mobility aids when carried by passengers travelling by air

Based on the 2019 Regulation

Introduction

This document is based on the provisions set out in the 2019-2020 Edition of the International Civil Aviation Organization (ICAO) Technical Instruction for the Safe Transport of Dangerous Goods by Air (Technical Instructions) and the 60th Edition of the IATA Dangerous Goods Regulations (DGR).

Information on the DGR can be found here:
<https://www.iata.org/publications/dgr/Pages/index.aspx>

The batteries that power wheelchairs and mobility aids are considered dangerous goods when carried by air. These and some other dangerous goods that are permitted for carriage by passengers can be transported safely by air provided certain safety requirements are met. The requirements are detailed in the IATA Dangerous Goods Regulations, which are based on the ICAO Technical Instructions.

Training is an essential element in maintaining a safe regulatory regime. It is mandatory for all individuals involved in the preparation or transport of dangerous goods, including battery powered wheelchairs and mobility aids, to be trained to carry out their responsibilities. Depending on the job-function, this will require familiarization training or more detailed training on the specific requirements in the Regulations. It is important to remember that dangerous goods are very unlikely to cause a problem when they are prepared and handled in

compliance with the IATA Dangerous Goods Regulations.

Passengers may only travel with a battery-powered mobility aid with the airline's approval. Proper pre-notification by the user helps to ensure that:

- all in the transportation chain know what device(s) and battery type(s) they are transporting;
- how to properly load and handle them; and
- what to do if an incident or accident occurs either in-flight or on the ground.

The pilot-in-command must be informed of the location of the mobility aid with installed batteries, removed batteries and spare batteries, to best deal with any emergencies that may occur.

Inadvertent operation of battery powered mobility aids can cause friction or electrical load which could lead to a fire. If the mobility aid is loaded in the aircraft with the batteries installed, the electrical circuits must be isolated by following the manufacturer's instructions. To avoid delays during loading, it is important that these instructions and the additional information detailed in the operator approval section of this guidance document are provided in advance.

With the evolution of battery technology and through new innovations, lithium ion batteries have become the battery of choice for powering mobility aids as they store more energy than many other battery types of a similar size and mass. Lithium batteries are safe to use, however if not treated

with care or if abused, they can overheat and in extreme circumstances can catch fire. This poses many challenges as the regulators attempt to keep pace with ever changing designs and consumer demands.

The purpose of this document is to provide guidance for complying with the provisions applicable to the transport by air of battery-powered wheelchairs and other mobility aids when carried by passengers as set out in the DGR. Specifically, the document provides information on:

- Definitions;
- Limitations and Classification;
- Operator Approval;
- Training;
- Handling;
- Frequently Asked Questions.

Definitions

Air Carrier means an air transport undertaking with a valid operating licence.

Airline see **Operator**

Battery manager is an electronic device incorporated in the battery circuit to protect the battery and/or cells from events such as over-charge, over-discharge, over-current, over-temperature and cell imbalance.

Note: The battery management function may be integrated into the battery or distributed over the control and drive system.

Disabled person or person with reduced mobility means any person whose mobility when using transport is reduced due to any physical disability (sensory or locomotor, permanent or temporary), intellectual disability or impairment, or any other cause of disability, or age, and whose situation needs appropriate attention and the adaptation to his or her particular needs of the service made available to all passengers.

Lithium-ion batteries (sometimes abbreviated Li-ion or LiPo batteries). The term "lithium battery" refers to a family of batteries with different chemistries, comprising many types of cathodes and electrolytes. Lithium ion batteries are a

secondary (rechargeable) battery where the lithium is only present in an ionic form in the electrolyte. Also included within the category of lithium-ion batteries are lithium polymer batteries. Examples of lithium ion battery chemistries are lithium cobalt oxide and lithium iron phosphate



Figure 1 - Example of Lithium Ion Batteries

Note: The watt-hour (Wh) rating is a measure by which lithium ion batteries are regulated. Lithium ion batteries are required to be marked with the Watt-hour (Wh) rating.

The Watt-hour rating of a lithium ion battery can also be calculated from the battery's nominal voltage (V) and capacity in ampere-hours (Ah):

$$Ah \times V = Wh$$

If only the milliampere-hours (mAh) are marked on the battery, then divide that number by 1000 to get ampere-hours (Ah) (e.g. 4400 mAh / 1000 = 4.4. Ah).

If you are unsure of the Watt-hour rating of your lithium ion battery, refer to the device User Manual or contact the manufacturer.

Non-spillable wet batteries have an absorbed electrolyte (AGM, absorbed glass mat, gel battery, gel cell, sealed lead-acid (SLS), dry and dry cell) and do not leak any electrolyte or liquid even if the battery case is ruptured or cracked. The batteries must be capable of passing certain vibration and pressure differential tests



Figure 2 - Examples of Non-Spillable Wet Batteries



Note: For the purpose of this guidance document, this definition also includes batteries which comply with IATA DGR Special Provision A123 or A199. Examples of such batteries are: alkali-manganese, zinc-carbon, nickel-cadmium and nickel-metal hydride batteries.

Operator is a person, organisation or enterprise engaged in or offering to engage in an aircraft operation. For the purposes of this guidance document, the term also includes operators operating under a code sharing and wet-leasing arrangements.

Spillable wet batteries have a number of openings on top where a liquid electrolyte (corrosive) is poured in to maintain the chemical reactions required to generate electrical energy.



Figure 3 - Example of Spillable Wet Battery

Tour operator means, with the exception of an air carrier, an organizer or retailer of package tours and tourism services for sale either directly to travellers or through intermediaries.

WCBD – mobility aid with non-spillable batteries.

WCBW – mobility aid with wet cell batteries.

WCLB – mobility aid with lithium ion batteries.

Wheelchair system is the electrical and electronic traction control system for a wheelchair including the battery, its manager, the motor speed controller, the user interface and all wiring and safety devices.

Limitations and Classification (DGR 2.3.2)

Battery-powered wheelchairs and mobility aids are classified in the following 3 categories:

1. Wheelchairs/Mobility Aids with Non-Spillable Wet Batteries or Batteries which Comply with Special Provision A123 or A199

Examples of batteries complying with special provision A123 and A199 are: alkali- manganese, zinc-carbon, nickel-cadmium and nickel-metal hydride batteries.

Non-spillable wet cell batteries must comply with special provision A67:

A67: Wet cell batteries can be considered as non-spillable provided that they are capable of withstanding the vibration and pressure differential tests given below, without leakage of battery fluid.

Vibration test: The battery is rigidly clamped to the platform of a vibration machine and a simple harmonic motion having an amplitude of 0.8 mm (1.6 mm maximum total excursion) is applied. The frequency is varied at the rate of 1 Hz/min between the limits of 10 Hz to 55 Hz. The entire range of frequencies and return is traversed in 95 ± 5 minutes for each mounting position (direction of vibration) of the battery. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for equal time periods.

Pressure differential test: Following the vibration test, the battery is stored for six hours at $24^\circ\text{C} \pm 4^\circ\text{C}$ while subjected to a pressure differential of at least 88 kPa. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for at least six hours in each position.

A passenger may carry a maximum of one spare battery, which must be carried in a strong, rigid box provided by the user and carried in the cargo compartment.



2. Wheelchairs/Mobility Aids with Spillable Wet Batteries

If the wheelchair or mobility aid cannot be loaded, stowed, secured and unloaded always in an upright position, the battery must be removed. Having the dimensions of the device in advance of travel will enable the operator to determine if the battery needs to be removed prior to loading in the aircraft.

3. Wheelchairs/Mobility Aids with Lithium Batteries

The batteries must be of a type which meets the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3.

Where the battery is removed by the user, if the mobility aid is specifically designed to allow it to be, following the manufacturer's instructions, the battery must not exceed 300 Wh, or for a device that is fitted with two batteries required for its operation, each battery must not exceed 160 Wh.

If the battery is not removed, there is no limit to the Wh rating for the installed battery(ies)

A passenger may carry a maximum of one spare battery not exceeding 300 Wh or two spares each not exceeding 160 Wh.

Any battery removed from the mobility aid and any spare batteries must be carried in the passenger cabin. The removed or spare batteries must be protected from damage (e.g. by placing each battery in a protective pouch).

Operator Approval (DGR 2.3)

The approval of the operator is required – Prior to travel, the user of the mobility aid, travel agent, tour operator or other 3rd party booking website should seek approval from the operator at least 48 hours in advance, or as soon as possible, for the mobility aid to be carried on a booked flight. The operator is required to have a documented approval process which needs to be published in accessible formats and technologies, such as electronic, web-based, large print and audio, in a timely manner and

without additional cost to the passenger. Details should be easily accessible and clearly described on the airline's website and/or available to call centre staff.

Web-based material and internet booking should be accessible to persons with disabilities in accordance with international web accessibility standards found at

<http://www.w3.org/standards/webdesign/accessibility>

The minimum information required as part of the approval process includes:

- **Does the mobility aid have a battery?**

The presence of a battery will impact how the mobility aid is transported. Having this information in advance will enable operators to meet international transportation regulations.

- **Who is the device manufacturer and what is the model number?**

In case the user of the mobility device is unable to locate the manufacturer's instructions, providing this information may enable the operator to obtain the information from the manufacturer's website or from other sources.

- **What type of battery is used to power the mobility aid?**

Providing the battery type is an important piece of information the operator requires to determine how to prepare the mobility device prior to and during loading onto the aircraft. The three battery types are: lithium ion, non-spillable and spillable.

- for lithium ion batteries, the number and Watt hour rating of installed and spare battery(ies) is required.
- for non-spillable batteries, if the passenger is travelling with a spare battery, they must pack this in a strong, rigid box.
- spillable batteries, the mobility aid must always be kept upright during loading and unloading.

If the passenger is unsure of the battery type, the passenger should be asked if anyone is able to help them determine this in advance of their travel.

- **What is the total weight of the mobility aid, including installed batteries and accessories?**

This information is required to enable the operator to plan the loading of the device onto the aircraft and help them determine if additional resources are required prior to or during loading and securing within the aircraft.

- **What is the length, width and height (including accessories) of the mobility aid as presented for air travel?**

The dimensions of the device are required to determine that the aircraft door and cargo compartment can accommodate the mobility device. Depending on the aircraft type operating a particular routing, including any connecting flights, the mobility device may be too big to fit in the aircraft. Having the dimensions in advance will provide the operator an opportunity to offer an alternative routing or flights to accommodate passengers travelling with larger mobility aids.

- **Does the mobility aid have any removable or adjustable parts (such as a custom seat cushion, joy stick or headrest)?**

In the event the mobility aid as presented for travel will not fit in the aircraft cargo compartment, are there any removable or adjustable parts that will help to reduce the height/width of the mobility aid? Reducing the size may help operators to safely accommodate the mobility aid. Smaller removable parts should be placed in a suitable container or bag and stowed in the cabin with the passenger.

- **Is the battery specifically designed to be removed for transport?**

The dangerous goods transport regulations require the battery to be removed for carriage where the battery is specifically designed to be removed for transport. This typically applies where the battery is not protected by the design of the mobility aid and the manufacturer of the device intends that the battery must be removed for the device to be folded, or otherwise prepared for transport.

If the answer to this question is yes, the passenger should be prepared to provide instructions on how to remove the battery prior to loading.

Note: If the user is unable to answer this question, the agent/operator should work with the passenger, their representative or the manufacturer of the device to obtain instructions before transport.

- **Is the user aware of how to disconnect power from the device?**

To prevent accidental activation during flight, the operator is required to verify the power is disconnected and electrical circuits are isolated. The user should provide instructions on how to do this before transport.

Note: If the user is unable to answer this question, the agent/operator should work with the passenger, their representative or the manufacturer of the device to obtain instructions before transport.

- **Is the user aware of how to engage/disengage the freewheel mode for the mobility aid?**

Prior to loading the device onto the aircraft, it must be put into freewheel mode. The passenger should be asked for instructions on how to do this before transport.

Note: If the user is unable to answer this question, the agent/operator should work with the passenger, their representative or the manufacturer of the device to obtain instructions before transport.

Training

General

Training for all staff in the air travel service delivery is vital for providing quality service to persons with reduced mobility in a consistent and respectful manner. It is essential that staff know their responsibilities and can perform them competently. Training should address the attitudinal, environmental/physical and organizational barriers that affect persons with reduced mobility in air transport. Training is required to prepare staff to aid persons with reduced mobility in a manner that respects their dignity, and as a professional service to which the person is entitled, rather than as a favour or compassionate gesture.



Training is required to include the policies and procedures of the organization and should be appropriate to the duties of the person being trained and include emergency response procedures.

In addition to general training, aircraft and airport operators must ensure that they train their employees and contractors who are required to handle battery powered mobility aids. This will include procedures for preparing, securing, carrying and stowing of mobility aids for air transport.

Handling

The following general handling requirements apply to all battery types:

Prior to loading, the operator must verify:

- a) the battery terminals are protected from short circuits. This does not necessarily mean removing the battery. An example of protecting the terminals would be to enclose the battery within a battery container; and
- b) the battery is either:
 1. securely attached to the wheelchair or mobility aid and the electrical circuits are isolated following the manufacturer's instructions; or
 2. removed by the user, if the mobility aid is specifically designed to allow it to be, following the manufacturer's instructions

Note:

i. *For mobility aids containing spillable batteries, the battery is only required to be removed when the mobility aid cannot be maintained in an upright position. Removed batteries must be carried in strong, rigid packagings as follows:*

(a) *packagings must be leak-tight, impervious to battery fluid and be protected against upset by securing to pallets or by securing them in cargo compartments using appropriate means of securement (other than by bracing with freight or baggage) such as by use of restraining straps, brackets or holders;*

(b) *batteries must be protected against short circuits, secured upright in these packagings and*

surrounded by compatible absorbent material sufficient to absorb their total liquid contents; and

- (c) *these packagings must be marked "BATTERY, WET, WITH WHEELCHAIR" or "BATTERY, WET, WITH MOBILITY AID" and be labelled with the "Corrosive" label and with the "Package Orientation" label. Spillable batteries installed and removed should also be fitted, where feasible, with spill-resistant vent caps.*
- ii. *For mobility aids containing lithium batteries, the battery removed from the mobility aid must not exceed 300 Wh, or for mobility aids fitted with two batteries, each battery must not exceed 160 Wh.*

Any exposed terminals including non-shielded cable connectors must be insulated to prevent short-circuit.

Once the mobility aid has been prepared for air transport, to verify that electrical circuits have been isolated, place the device into drive mode (i.e. not freewheel mode), see if the mobility aid will power up and if so whether use of the joystick results in the mobility aid moving. It must also be verified that the circuits of supplemental motorised systems such as seating systems have been isolated to prevent inadvertent operation, e.g. by the separation of cable connectors. If a battery-powered mobility aid has not been made safe for carriage, it must not be loaded.

The wheelchair or mobility aid must be secured against movement in the cargo compartment, by use of straps, tie-downs or other restraint devices. The mobility aid, including batteries, electrical cabling and controls must be protected from damage, including damage caused by

the movement of baggage, mail and cargo. Accordingly, any battery-powered mobility aid must not be stowed within a unit load device or netted section of a cargo compartment together with loose loaded (bulk) items.

Examples of good practice for securing the mobility aid include:

- Use tie down points
- Keep the mobility aid in an upright position where possible
- Secure the mobility aid using the base frame – BASE IS BEST



- Secure removable and fragile parts with the passenger in the cabin
- Avoid unnecessary tilting of the mobility aid
- Disengage freewheel mode
- Disconnect / isolate power
- Ensure adequate clearance when loading
- Avoid over tightening tie down straps or other securing devices
- Load last when possible

Examples of bad practice for securing the mobility aid include:

- Unnecessary tilting
- Loading and securing the mobility aid on its side
- Placing baggage, mail or cargo on the mobility aid
- Failure to disengage freewheel mode
- Failure to disconnect power
- Using excessive force to load and secure the device
- Connecting straps to the cargo compartment divider, curtains or nets
- Strapping unstable or fragile components e.g., armrests, wheels, joystick, tiller
- Driving or sitting in the mobility aid

If the battery-powered mobility aid has loose-fitting parts such as armrests, footrests or cushions, they should be placed in a suitable bag / container, prior to loading in the hold, to prevent any loose parts from being lost or damaged. It is recommended that passengers provide their own suitable bag / container for any removed parts. Many passengers prefer to carry this type of equipment on-board the aircraft to prevent loss or damage.

Operators should also consider loading large complex devices always in an upright position. These mobility aids tend to be custom made and may have additional attachments specifically designed and fitted for individual users. These devices are designed and tested for use in an upright position only. Turning these devices on their side is not usually recommended by the manufacturer and will inevitably result in the device being damaged. Loading devices on their side in the cargo compartment, or ULD, also creates challenges for securing these devices in the aircraft or ULD, as the straps or other means of securing the device will be across the side of the device, which is potentially the weakest point.

Where the cargo compartment on the aircraft is too small to load the mobility aid upright, operators should consider offering alternative routings or flights that can accommodate larger devices rather than taking the risk of damaging the device.

Mobility aids with removed batteries

Where a battery-powered wheelchair or mobility aid is loaded with the batteries removed, it may then be carried as checked baggage without restriction (it must still be secured against movement and protected from damage by the movement of baggage, mail or other cargo).

Frequently Asked Questions

1. I do not know the Watt-hour rating of the lithium battery.

A passenger arrives at the passenger assistance desk with a lithium ion battery-powered mobility aid where the battery is specifically designed to be removed from the mobility aid but does not know the Watt hour rating of the lithium ion battery.

The customer service agent needs to know the Watt-hour (Wh) rating of the battery to ensure it is within the limits specified in IATA DGR 2.3.2.4(d) when the battery is specifically designed for the battery to be removed (a single battery must not exceed 300 Wh, or for a device that is fitted with two batteries required for operation, each battery must not exceed 160 Wh).

For batteries manufactured after 31 December 2011, the Watt-hour rating must be marked on the outside case. The Watt-hour rating of the battery can be calculated by multiplying the battery's nominal voltage (V) by the capacity in ampere-hours (Ah):
$$Ah \times V = Wh$$

Note: If only the milliampere-hours (mAh) are marked on the battery, then divide that number by 1000 to get ampere-hours (Ah) (e.g. 4400 mAh / 1000 = 4.4 Ah). If the Watt-hour rating cannot be located, the user will need to either check the user guide or contact the supplier/manufacturer.



2. How can batteries be effectively protected against short circuit?

Methods to protect against short circuit include, but are not limited to:

- The battery packs of installed batteries are often fully enclosed by the casing which protects the terminals from short-circuit;
- Exposed terminals or connectors must be protected with non-conductive caps, non-conductive tape or by other appropriate means;
- Removed batteries must be fully enclosed within inner packagings made of non-conductive material (such as a plastic bag) and kept away from conductive items.

If not impact resistant, the outer packaging must not be used as the sole means of protecting the battery terminals from damage or short-circuiting. Removed batteries should be packed to prevent shifting which could loosen terminal caps or reorient the terminals to produce short circuits.

Terminal protection methods include but are not limited to the following:

- Securely attaching covers of sufficient strength to protect the terminals;
- Placing the battery in a rigid plastic package;
- Constructing the battery with terminals that are recessed or otherwise protected so that the terminals will not be subjected to damage if the package is dropped.

3. What if the passenger does not provide advance notification or obtain approval from the operator in advance of travel?

If the passenger cannot provide pre-notification, for example, if they need to travel at short notice, the airport and the operator must make all reasonable efforts to provide the special assistance to enable the passenger to travel. However, if an operator is unable to satisfy itself of the steps required for a battery-powered mobility aid to be carried safely, its carriage may be denied.

4. How do you ensure electrical circuits are isolated?

The passenger travelling with the device should be asked prior to loading if this information has not

been provided in advance. Details will also be available in the device manufacturer's instructions. Depending upon the design of the battery-powered mobility aid, the following methods are preferable for ensuring the electrical circuits are isolated:

1. If a key is fitted, switch off the device, remove the key and pass to the passenger for safekeeping;
2. Remove the joystick module;
3. Separate power cable plugs or connectors as near to the batteries as possible; or
4. If the design of the battery-powered mobility aid means that none of the above actions are possible, it is acceptable to:
 - a) 'lock out' the mobility aid, e.g. by making a combination of movements with the joystick as instructed by the manufacturer or passenger; or
 - b) disconnect cables from the battery terminals.

Note: This option is not recommended as it can be very difficult to do and if not done properly can increase the risk of short circuit leading to fire.

Additional Information

Further guidance information is widely available on the internet. Below is a sample list of useful links.

Note: IATA cannot be held responsible for the information contained on 3rd party websites.

- Regulation (EC) No 1107/2006 of the European Parliament and of the Council of 5 July 2006 concerning the rights of disabled persons and persons with reduced mobility when travelling by air
<http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32006R1107>
- Reduced mobility rights – website gives information on passenger rights and provides useful tips for travelers with a disability
<http://www.reducedmobility.eu/>
- The European Network for Accessible Tourism. ENAT is a non-profit association for organizations that aim to be 'frontrunners' in the study, promotion and practice of accessible tourism. <http://www.accessibletourism.org/>



- UK CAA Safety Notice number SN-2012/003 – Safety Requirements applicable to the carriage of battery-powered mobility aids
<https://publicapps.caa.co.uk/docs/33/SafetyNotice2012003.pdf>
- You can also contact the airline of your choice or your national civil aviation authority if you have any further concerns about travelling with battery-powered wheelchairs or mobility aids.

If you have questions or concerns which may not have been addressed in this document you can also contact the IATA Dangerous Goods Support team: dangood@iata.org