

## **Consequences of Hidden Dangerous Goods Containing Lithium Batteries on Flight Safety**

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### **Abstract**

Lithium Batteries are used by many people today, the goods they use almost all contain lithium batteries, from children's toys to items that are near them in daily life. Without them knowing that Lithium Batteries are hidden dangerous goods. Neither in flight, many airlines restriction the carrying of goods containing lithium batteries. Moreover, there are many cases of aviation incidents and accidents caused by the explosion of lithium batteries, short circuit and other things, so that various regulations arise regarding restrictions on goods that contain lithium batteries, therefore airline companies must carry out various instructions to passengers or shipper regarding carrying lithium battery, seen from the capacity allowed until things are not permitted to be done while on the plane. In addition, flight operators must be responsible for carrying goods containing lithium batteries by passengers or shippers. This paper describes the consequences of carrying items containing lithium batteries in flight safety.

**Keywords:** Lithium Batteries, Hidden, Dangerous Goods, Flight safety, Air Cargo

### **Introduction**

The growth of shipments of goods through air transportation is increasing every year. There are many items sent by air freight, both from individuals and companies. Of the various types of goods sent by air transportation, one of them is dangerous goods. Dangerous goods delivery through air transport is increasing rapidly. However, with increasing shipments of dangerous goods, the risk and consequences of flight safety also increase. There are regulations that have been made regarding Dangerous Goods shipment by air freight. The regulations for the transport of Dangerous Goods are UN Recommendations on the Transport of Dangerous Goods, International Air Transport Association (IATA) Dangerous Goods Regulations and International Civil Aviation Organization (ICAO) Technical Instructions.

Dangerous goods are materials or goods that can cause harm or risk to the environment, both safety, health and other matters. In this day where technology is very sophisticated, almost all human needs in everyday life contain dangerous goods in it. There are still some equipment that look like Dangerous Goods but actually has contain Dangerous Goods or Dangerous Goods that has packed by equipment. One of them is cell phones and Power bank which contain dangerous goods, one of which is a lithium battery.

As the fact, equipment that contain lithium batteries in it, which are clearly listed on the UN Dangerous Goods Regulation, Lithium ion batteries has been amended to show "forbidden" to identify that these batteries are now restricted to Cargo Aircraft Only (UN 3480).

In the case of aviation, there were fire on cargo plane carrying a Lithium Ion battery pack. This caused the IATA to issue a new rule in the limitation of carrying lithium battery. After the case of a cell phone explosion with the power of a lithium battery, now airlines around the world apply the rule that not to carry goods with the use of lithium or battery batteries themselves. Therefore, the UN panel (United Nations) approved the ban on aircraft to deliver cargo with lithium batteries.

To reduce the potential risk of explosion or fire hazard in lithium batteries which endanger safety during flight, Directorate General of Civil Aviation, has issued a Safety Circular regarding the provision of carrying spare lithium batteries on aircraft. This Circular is intended for domestic and foreign airlines flying in or from Indonesian territory.

## **Method**

In this journal, the method used is descriptive method. Descriptive research involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection (Glass & Hopkins, 1984).

The research from this paper that is used is descriptive comparative, which is, comparative research. This research was conducted to compare the similarities

and differences between two or more facts and the properties of objects that were examined based on a certain frame of mind. In this research the variables are still independent but for samples that are more than one or at different times.

The comparative research method is *ex post facto*. That is, the data is collected after all the events collected have been completed. Researchers can see the effects of a phenomenon and examine the causal relationship of available data.

From that explanation it can be concluded that the comparative descriptive method is gathering information about the real situation and as an activity includes collecting data in order to test hypotheses or answer questions concerning the state of the current time by comparing between two groups or more than a certain fact and object researched. In addition to using the level of comparison based on a particular perspective, by investigating the possible cause and effect relationships from observations due to existing and looking for factors that cause through certain data.

Using the comparative descriptive method in this paper that is about limitation of lithium batteries on air freight, we can explain why lithium batteries are undoubtedly Dangerous Goods, especially since many equipment contain lithium batteries that make lithium batteries as Hidden Dangerous Goods, other than that of lithium batteries and how to carry lithium batteries when transported on airlines, the regulations that apply in lithium batteries within the airline, as well as what requirements must be issued by a flight mask both inside and outside the country to improve the safety of Lithium Batteries sent via transport air.

In this research, the method we use is based on a problem that has happened or is happening about lithium batteries based on the information from internet, books, documents and conduct interviews with worker openly that relate to this problem.

## **Discussion and Result**

According to the International Civil Aviation Organization (ICAO), Annex 18 concerning the Safe Transport of Dangerous Goods by Air, Dangerous Goods

are substances or substances that have the potential to significantly harm health, safety or property if transported by airplane. The danger posed will result in flight safety, human health and aircraft equipment, but it is permissible if through dangerous goods procedures that apply.

Dangerous Goods are defined as those goods which meet the criteria of one or more UN hazard classes. Dangerous Goods consist of 9 classes, which are Class 1. Explosive, Class 2. Gas Flammable, Class 3. Flammable Liquid, Class 4. Flammable Solid, Class 5. Oxidizing Substances & Organic Peroxides, Class 6. Toxic solid / liquid substances, Class 7. Radioactive, Class 8. Corrosive, Class 9. Miscellaneous Dangerous Goods. The 9 classes relate to the type of hazard when the packing groups relate to the degree of danger within the class.

The Classes applicable, to one of three UN Packing Groups. Which are, Packing Group I, great danger, and most protective packaging required, Packing Group II, medium danger, Packing group III, lowest danger among regulated goods, and least protective packaging within the transportation requirement.

In this era, batteries have become one of the most popular technologies in which the electronics that we use in daily life. Batteries are a set of objects that store chemical energy and energy into electrical energy. Batteries are divided into three general classes: primary batteries are used once and are immediately discarded; secondary, a rechargeable battery that can be charged and then recover to its original state by reversing the current flow through the cell; and special batteries designed for specific purposes (Winter, 2004; Ralph, 2004). But according to Armand (2008), the battery is divided into two types, namely primary batteries and secondary batteries or also non-refill and refill.

Lithium metal batteries contain lithium metal which is highly flammable and provides very high energy in small sizes. Which often used in goods containing Lithium Metal Batteries are toys, medical applications, consumer electronics, etc. While Lithium Ion provides high energy, and can be recharged from time to time. Which often used in items that use lithium ion batteries are electronic devices, hospital equipment and some scientific equipment. Electronic

devices such as electronic flight bags, personal entertainment devices, credit card readers, containing lithium metal or lithium ion cells or batteries and spare lithium batteries for such devices carried aboard an aircraft by the operator for use on the aircraft during the flight or series of flights (IATA,2018)

Lithium batteries are included in class 9 Dangerous Goods which are called miscellaneous dangerous goods. Miscellaneous dangerous goods are items which are considered dangerous and can threaten flight safety if they are not handled according to their handling, where the Dangerous Goods in the goods are not visible but the hazardous substances remain in the contents of the item (Hidden Dangerous Goods). Lithium Batteries are still very dangerous and prohibited in some airlines, but among them airlines also allow passengers carrying lithium batteries to be packed by equipment and contained by equipment.

**Table 1**

| The pilot-in-command must be informed of the location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |     |     |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|----|
| Permitted in or as carry-on baggage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |     |     |    |
| Permitted in or as checked baggage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |     |     |    |
| The approval of the operator is required                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |     |     |    |
| △ <b>Lithium Batteries: Portable electronic devices (PED) containing lithium metal or lithium ion cells or batteries</b> , including medical devices such as portable oxygen concentrators (POC) and consumer electronics such as cameras, mobile phones, laptops and tablets, when carried by passengers or crew for personal use (see 2.3.5.9). For lithium metal batteries the lithium metal content must not exceed 2 g and for lithium ion batteries the Watt-hour rating must not exceed 100 Wh. Devices in checked baggage must be completely switched off and must be protected from damage. Each person is limited to a maximum of 15 PED. Baggage equipped with a lithium battery, other than lithium button cells, the battery must be removable. If offered as checked baggage the battery must be removed and carried in the cabin. *The operator may approve the carriage of more than 15 PED. | NO* | YES | YES | NO |
| <b>Lithium batteries, spare/loose, including power banks, see Batteries, spare/loose</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |     |     |    |
| <b>Lithium battery-powered electronic devices.</b> Lithium ion batteries for portable (including medical) electronic devices, a Wh rating exceeding 100 Wh but not exceeding 160 Wh. For portable medical electronic devices only, lithium metal batteries with a lithium metal content exceeding 2 g but not exceeding 8 g. Devices in checked baggage must be completely switched off and must be protected from damage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | YES | YES | YES | NO |
| <b>Lithium batteries, spare/loose</b> with a Watt-hour rating exceeding 100 Wh but not exceeding 160 Wh for consumer electronic devices and PMED or with a lithium metal content exceeding 2 g but not exceeding 8 g for PMED only. Maximum of two spare batteries in carry-on baggage only. These batteries must be individually protected to prevent short circuits.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | YES | NO  | YES | NO |

Source: IATA DGR 59<sup>th</sup> Edition, 2018

Electronic devices containing lithium metal batteries and lithium ion batteries including medical devices and electronic passenger equipment are permitted to be checked and carry-on baggage.

Batteries must meet manual UN test requirements and criteria. And with a lithium metal content exceeding 2g but not more than 8g. Whereas for Lithium ion battery rating watt hours exceed 100wH but not exceed 160wH.

Portable electronic devices, which may include medical devices such as portable oxygen concentrators (POC) and consumer electronics such as cameras, mobile phones, laptops and tablets containing batteries when carried by passengers or crew for personal use, which should be carried in carry-on baggage. Spare batteries must be individually protected to prevent short circuits by placement in the original retail packaging or by otherwise insulating terminals by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch and carried in carry-on baggage only. (IATA,2018)

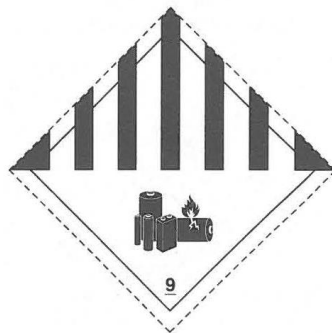
The factor why some airlines limit the carrying of lithium batteries especially in the form of spare parts, because it refers to events in the United States, when items containing lithium batteries explode in the cabin or luggage. Therefore, the Ministry of Transportation stated that, goods such as cell phones and Power bank are dangerous goods and that there is no policy on luggage. Especially if in a charge state in the cabin, because they never know how the pressure in the air causes the battery to experience a burst and smoke due to a short circuit.

Where such variations are more restrictive than the provisions contained in these Regulations, they apply to the transport of dangerous goods by air to, from or through all territory subject to the sovereignty of the notifying State by all operators and outside the territory of the notifying State to all operators for whom the notifying State is the State of the operator

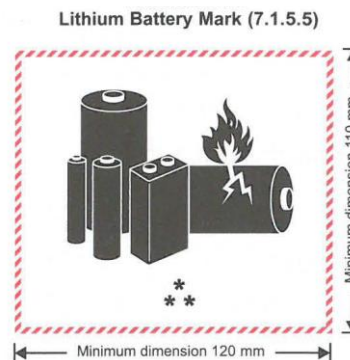
There were cases of overheating on lithium-ion batteries that occurred in January 2013, on Boeing 787 Dreamliner aircraft, occurred inside planes that were parked in Boston and the second occurred on All Nippon Airways aircraft flying in Japanese territory, and were forced to make emergency landings. . Previously there had also been a fire case on a UPS cargo plane carrying a Lithium Ion battery pack which caused two pilots to die in 2010. This caused a lot of new regulations to emerge on the transport of lithium batteries. Like the International Civil Aviation Organization (ICAO) of the United Nations which prohibits the delivery of Lithium-ion batteries as cargo with passenger aircraft which remain valid until



they have new packaging standards that are fire resistant and specifically made for battery delivery. IATA issued a regulation against restrictions on carrying lithium battery. Then, the Ministry of Transportation of the Directorate General of Civil Aviation issued a Circular Letter No. 15 of 2018 concerning the provision of carrying portable battery chargers and spare lithium batteries on aircraft.



**Figure 1**  
Source: IATA



**Figure 2**  
Source: IATA



**Figure 3**  
Source: IATA DGR 59<sup>th</sup> Edition, 2018

Therefore, the air transport company must provide instructions to do ask each passenger at Check-In for Power bank ownership or a backup lithium battery and ensure Power bank or passenger battery backup lithium not in used or dangerous positions such as Power bank are connected with other electronic devices, power bank or lithium batteries.

Air transport companies must be responsible for storing the power bank provided by passengers because they do not comply with the requirements.

If an incident occurs on a plane because of an explosion caused by a passenger carrying items such as a power bank or cell phone, there is a charge. Safrangga, Lion Air cargo, state, not to panic, and if there is smoke, immediately provide a larger container than Power bank and then fill with water and put it in the water.

Even though there are regulations, but some airlines really do not allow items that contain lithium batteries, there are only those who need it. Therefore, it is very important for parties who can conduct conversations and provide information about devices that have access to the cabin if possible, European Aviation Safety Agency (EASA).

## **Conclusion**

Dangerous Goods class 9, which is miscellaneous dangerous goods are items that are considered dangerous and can threaten flight safety if not handled according to handling. In our daily life, we are not apart from lithium batteries for electronic devices. Lithium battery is included. Lithium Batteries are divided into two types, which are primary and secondary batteries. The primary battery is a battery that can only be used once like lithium metal battery and a secondary battery is a battery that can be recharged in a charge according to its use and can be restored to its original state after being charged and the battery is fully charged like lithium battery ion.

Lithium battery is dangerous such as being able to explode or burn if used and placed or stored unlike how it should be used lithium batteries. The triggers that become factors of exploding or burning of lithium batteries, such as how the air pressure around the lithium battery, short circuit, and overheating lithium battery. Lithium batteries may not be placed in luggage or cabins and must be protected individually because if placed in the trunk or cabin. Delivery of lithium-ion batteries in cargo with passenger aircraft is prohibited until there are new



packaging standards for fire-resistant batteries and specifically for battery delivery because this is called very dangerous by the ICAO (International Civil Aviation Organization) of the United Nations.

To prevent unwanted things from happening on a flight caused by Lithium Batteries of air transport companies must instruct each passenger and staff related to Ministry of Transportation of the Directorate General of Civil Aviation issued a Circular Letter No. 15 of 2018 regarding the provisions of carrying a portable charger (power bank) and a backup lithium battery on an aircraft so as not to occur danger or risk of an existing lithium battery.

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