

Advisory Circular

GUIDANCE FOR CARRIAGE OF LITHIUM BATTERIES BY AIR

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1. **GENERAL.** Pursuant to paragraph 88B of the Air Navigation Order, the Director General of the Civil Aviation Authority of Singapore (DGCA) may, from time to time, issue advisory circulars (ACs) on any aspect of safety in civil aviation. This AC contains information about standards, practices and procedures acceptable to CAAS. The revision number of the AC is indicated in parenthesis in the suffix of the AC number
2. **PURPOSE.** This AC is to provide guidance for the carriage of lithium batteries, being classified as dangerous goods, by air.
3. **APPLICABILITY.** This AC applies to all Singapore air operators, foreign air operators operating aircraft into and from Singapore, postal operators, ground handling agents, cargo agents and shippers intending to carry or involved in the carriage of lithium batteries as cargo and baggage. Cargo agents are strongly encouraged to disseminate the contents of this AC to your customers/shippers. This AC also applies to entities offering dangerous goods training programmes.
4. **CANCELLATION.** This AC supersedes AC DGR-2(2) issued on 12 October 2015.
5. **EFFECTIVE DATE.** This AC is effective from 29 March 2016.
6. **REFERENCES.**
 - Air Navigation Order (ANO); and
 - ICAO Technical Instructions (TI) for the Safe Transport of Dangerous Goods by Air (Doc 9284).
7. **BACKGROUND.**
 - 7.1 Lithium batteries are commonly transported both as cargo consignments in postal mail packages, by passenger and crew in their carry-on, checked baggage or on the person when installed in, packed with equipment or as spare batteries. Tests conducted by other authorities had shown that there is a fire risk to the aircraft and its occupants when lithium batteries are transported by air.

7.2 A number of air transport-related incidents linking to lithium batteries and devices powered by lithium batteries have been reported worldwide. These incidents involved both passenger and cargo aircraft and occurred during pre-loading, loading, in-flight and unloading. Some incidents have resulted in in-flight fire leading to emergency landings. CAAS had also received reports of undeclared and mis-declared lithium batteries offered by shippers and their agents as cargo consignments to air operators for carriage by air. To minimize the risk, compliance with the ICAO TI requirements is essential for their safe handling and carriage by air.

8. COMPLIANCE WITH THE TECHNICAL INSTRUCTIONS.

8.1 To promote the safe transport of lithium batteries, compliance with the requirements of the ICAO TI is critical.

CARRIAGE OF LITHIUM BATTERIES AS CARGO

8.2 Lithium batteries are classified as dangerous goods under the ICAO TI. The ICAO TI contains specific requirements for the proper preparation and transport of lithium batteries as cargo consignments. Air operators, shippers and their agents must comply with the classification, packing, marking, labeling and documentation requirements including special provisions and quantity limitations applicable to the following articles and their corresponding packing instructions:

UN No.	Proper Shipping Name	Packing Instructions
UN3480	Lithium ion batteries	965
UN3481	Lithium ion batteries packed with equipment	966
UN3481	Lithium ion batteries contained in equipment	967
UN3090	Lithium metal batteries	968
UN3091	Lithium metal batteries packed with equipment	969
UN3091	Lithium metal batteries contained in equipment	970

8.3 Due to significant fire risk to the aircraft and its occupants, lithium metal batteries identified under UN3090 are forbidden to be transported by air as cargo consignments on passenger aircraft since 01 January 2015. They may be transported on cargo aircraft only.

8.4 From 1 April 2016, the following changes to the requirements of the ICAO TI concerning the carriage of lithium metal batteries identified under UN3090 and prepared in accordance with Section II requirements of packing instructions 968 will become effective:

- Shippers are not permitted to offer more than one package of Section II lithium metal batteries in a single consignment (i.e. per master air waybill);
- When an overpack is used, shippers are not permitted to offer more than one package of Section II lithium metal batteries in each overpack, however, the overpack may contain other packages of dangerous or non-dangerous goods;
- When an overpack is prepared in accordance with the requirements of Section IA and/or IB of packing instructions 965 or 968, it must not contain more than one package of Section II lithium metal batteries.
- Consignments of Section II lithium metal batteries must be offered to air operators separately from non-dangerous goods cargo and must not be loaded into a unit load device (ULD) by a shipper or its agent prior to offering it to any air operator for carriage by air.

8.5 In addition, for lithium ion batteries, identified under UN3480, recent test had demonstrated that a fire involving high-density packages of such batteries may exceed the capability of aircraft cargo fire protection systems. To minimize the risk to the traveling passenger, from 1 April 2016, the transport of lithium ion batteries as cargo onboard passenger aircraft is prohibited. These batteries may be transported on cargo aircraft only provided the following requirements, as identified in the ICAO TI, can be met:

- Shippers must ensure that all consignments of lithium ion batteries identified under UN3480, and prepared in accordance with the requirements of Section IA, Section IB and Section II of

packing instructions 965, must be transported on cargo aircraft only at a state of charge¹ not exceeding 30% of their rated design capacity.

- Shippers and air operators who wish to offer and transport consignments of lithium ion batteries whose state of charge exceeds 30% of their rated design capacity must seek approvals from the authorities of the State of origin and State of the air operator. Such consignments may only be transported on cargo aircraft only under the written conditions established by these authorities.
 - Shippers are not permitted to offer more than one package of Section II lithium ion batteries in a single consignment (i.e. per master air waybill);
 - When an overpack is used, shippers are not permitted to offer more than one package of Section II lithium ion batteries in each overpack, however, the overpack may contain other packages of dangerous or non-dangerous goods;
 - When an overpack is prepared in accordance with the requirements of Section IA and/or IB of packing instructions 965 or 968, it must not contain more than one package of Section II lithium ion batteries.
 - Consignments of Section II lithium ion batteries must be offered to air operators separately from non-dangerous goods cargo and must not be loaded into a unit load device (ULD) by a shipper or its agent prior to offering it to any air operator for carriage by air.
- 8.6 When the prohibition in paragraph 8.5 comes into effect, shippers or air operators who wish to offer for transport or to transport lithium ion or lithium metal batteries as cargo on passenger aircraft must seek exemptions from the authorities of the States of origin, air operator, transit, overflight and destination in accordance with special provision A201. Lithium ion and lithium metal batteries must not be transported in unaccompanied baggage consigned as cargo on passenger aircraft.
- 8.7 Global aviation communities continue to be concern over the fire risk in the carriage of lithium batteries by air. Air operators of cargo aircraft who wish to transport lithium batteries should conduct a safety risk assessment and to consider all factors associated with transporting lithium batteries by air. Air operators who wish to continue transporting lithium batteries and had previously performed a risk assessment should re-evaluate their assessment in light of the potential increase in consignments of lithium batteries offered for transport on cargo aircraft as a result of prohibition on passenger aircraft.
- 8.8 Air operators are encouraged to consider the history of compliance by shippers and freight forwarders with the dangerous goods regulations prior to accepting consignments of lithium batteries (including those packed with or contained in equipment) as cargo on its aircraft.

CARRIAGE OF LITHIUM BATTERIES BY PASSENGERS AND CREW

- 8.9 When carried by passengers and crew for personal use, portable electronic devices (such as watches, calculating machines, cameras, cellular phones, laptop computers, camcorders, etc.) and portable medical electronic devices (such as automated external defibrillators, nebulizer, continuous positive airway, etc.) containing lithium metal or lithium ion cells or batteries may be permitted in checked or carry-on baggage.
- 8.10 Spare batteries must be individually protected so as to prevent short circuits (by placement in original retail packaging or by otherwise insulating terminals, e.g. by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch) and carried in carry-on baggage only. The carriage of spare lithium metal or lithium ion cells or batteries in checked baggage is forbidden.
- 8.11 In addition, each installed or spare battery must not exceed the following:
- for lithium metal batteries, a lithium content of not more than 2 grams; and
 - for lithium ion batteries, a watt-hour rating of not more than 100 Wh.

¹ Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria (Access <http://www.unece.org> to download the manual and its amendments).

- 8.12 For passengers and crew who wish to bring onboard any portable electronic devices or portable medical electronic devices containing lithium batteries (including spare batteries) beyond the capacity limitations specified in paragraph 8.11, check-in staff should seek the approval of the air operator. The air operator may approve, installed or spare batteries not exceeding the following:
- for lithium metal batteries, more than 2 grams but not more than 8 grams; and
 - for lithium ion batteries, a watt-hour rating more than 100Wh but not more than 160Wh.
- 8.13 Appendix A contains the detailed provisions on the carriage of portable electronic devices and portable medical electronic devices containing lithium batteries in a table format for easy reference.
- 8.14 Lithium ion and lithium metal batteries contained in equipment, meeting the requirements of paragraphs 8.9, 8.11 and 8.12, may be transported in mishandled baggage or excess baggage. Spare lithium ion and lithium metal batteries must not be transported in mishandled or excess baggage.
- 8.15 Electronic cigarettes (e-cigarettes) containing lithium batteries may only be carried on board an aircraft in carry-on baggage or on the person only. Refer to AC DGR-8 for more guidance on the carriage of e-cigarettes by passengers and crew.
- 8.16 The air operator is encouraged to advise its passengers on the proper carriage of dangerous goods, including lithium batteries. Where applicable, the operator should require its check-in staff to assist passengers to identify lithium batteries or equipment containing lithium batteries that are forbidden to be carried in checked or carry-on baggage. Check-in staff should seek confirmation from a passenger about the contents of any item whenever there is any suspicion that it may contain lithium batteries.

CARRIAGE OF LITHIUM BATTERIES AS POSTAL MAIL

- 8.17 Subject to approval from CAAS, Singapore Post Limited, being the only public postal operator, may offer lithium metal or lithium ion batteries that are contained in equipment in postal mail to any air operator for carriage by air from Singapore. Postal operators, including Extra-Territorial Office of Exchanges² (ETOE) of foreign postal operators are not permitted to offer dangerous goods (including lithium metal or ion batteries contained in equipment) to any air operator for carriage by air from Singapore.
- 8.18 A public postal operator may offer to air operators postal mail containing lithium batteries contained in equipment only and in any single package not exceeding the following:
- No more than four lithium ion cells or two lithium ion batteries contained in equipment (UN 3481) meeting the provisions of Section II of Packing Instruction 967; and
 - No more than four lithium metal cells or lithium metal batteries contained in equipment (UN 3091) meeting the provisions of Section II of Packing Instruction 970.

9. PENALTY.

- 9.1 To comply with the ICAO TI, paragraph 50E, together with the Nineteenth Schedule, of the ANO require the air operator and shipper to, among other responsibilities, ensure that all dangerous goods including lithium batteries are properly:
- Classified;
 - Packed;
 - Marked and Labelled;
 - Documented;
 - Accepted; and
 - Loaded and Stowed.
- 9.2 If convicted, any person who contravenes the above shall be liable to a fine not exceeding S\$100,000 or to imprisonment for a term of not more than five years, or both.

² An ETOE is defined as an office or facility operated by or in connection with a designated operator on the territory of another country, and that these offices are established by designated operators for commercial purposes to draw business in markets outside their own national territory.

10. TRAINING SERVICE PROVIDERS.

- 10.1 Entities offering dangerous goods training programmes are to address the understanding of the ICAO TI requirements associated with the carriage of lithium batteries by air and to emphasize the need to comply with these requirements in the interest of safety.

11. CONTACT PERSON AND INFORMATION.

- 11.1 Should you have any queries relating to the contents of this advisory circular, please e-mail to us at CAAS_Dangerousgoods@caas.gov.sg.

APPENDIX A

Portable electronic devices (such as watches, calculating machines, cameras, cellular phones, laptop computers, camcorders)

Items or articles	Location			Approval of the operator(s) is required	The pilot-in-command must be informed	Restrictions
	Check baggage	Carry-on baggage	On the person			
Portable electronic devices (including medical devices) containing lithium metal or lithium ion cells or batteries (articles containing lithium metal or lithium ion cells or batteries the primary purpose of which is to provide power to another device must be carried as spare batteries in accordance with the item below)	Yes	Yes	Yes	No	No	<ul style="list-style-type: none"> a) carried by passengers or crew for personal use; b) should be carried as carry-on baggage; c) each battery must not exceed the following: <ul style="list-style-type: none"> – for lithium metal batteries, a lithium content of not more than 2 grams; or – for lithium ion batteries, a Watt-hour rating of not more than 100 Wh; d) if devices are carried in checked baggage, measures must be taken to prevent unintentional activation; and e) batteries and cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3.
Spare batteries for portable electronic devices (including medical devices) containing lithium metal or lithium ion cells or batteries	No	Yes	Yes	No	No	<ul style="list-style-type: none"> a) carried by passengers or crew for personal use; b) must be individually protected so as to prevent short circuits (by placement in original retail packaging or by otherwise insulating terminals, e.g. by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch); c) each battery must not exceed the following: <ul style="list-style-type: none"> – for lithium metal batteries, a lithium content of not more than 2 grams; or – for lithium ion batteries, a Watt-hour rating of not more than 100 Wh; and d) batteries and cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3.

Items or articles	Location			Approval of the operator(s) is required	The pilot-in-command must be informed	Restrictions
	Check baggage	Carry-on baggage	On the person			
Portable electronic devices containing lithium ion batteries exceeding a Watt-hour rating of 100 Wh but not exceeding 160 Wh	Yes	Yes	Yes	Yes	No	<ul style="list-style-type: none"> a) carried by passengers or crew for personal use; b) should be carried as carry-on baggage; and c) batteries and cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3.
Spare batteries for portable electronic devices containing lithium ion batteries exceeding a Watt-hour rating of 100 Wh but not exceeding 160 Wh	No	Yes	Yes	Yes	No	<ul style="list-style-type: none"> a) carried by passengers or crew for personal use; b) no more than two individually protected spare batteries per person; c) must be individually protected so as to prevent short circuits (by placement in original retail packaging or by otherwise insulating terminals, e.g. by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch); and d) batteries and cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3.

Portable medical electronic devices (automated external defibrilators (AED), nebulizer, continuous positive airway pressure (CPAP), etc.) containing lithium metal or lithium ion cells or batteries

Items or articles	Location			Approval of the operator(s) is required	The pilot-in-command must be informed	Restrictions
	Check baggage	Carry-on baggage	On the person			
Portable medical electronic devices containing lithium metal cells or batteries not exceeding 2 grams or lithium ion cells or batteries not exceeding 100 Wh	Yes	Yes	Yes	No	No	<ul style="list-style-type: none"> a) carried by passengers for medical use; and b) batteries or cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3.
Spare batteries for portable medical electronic devices containing lithium metal cells or batteries not exceeding 2 grams or lithium ion cells or batteries not exceeding 100 Wh	No	Yes	Yes	No	No	<ul style="list-style-type: none"> a) carried by passengers for medical use; b) batteries or cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3; and c) must be individually protected so as to prevent short circuits (by placement in original retail packaging or by otherwise insulating terminals, e.g. by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch).
Portable medical electronic devices containing lithium metal batteries exceeding 2 grams but not exceeding 8 grams or lithium ion batteries exceeding 100 Wh but not exceeding 160 Wh	Yes	Yes	Yes	Yes	No	<ul style="list-style-type: none"> a) carried by passengers for medical use; and b) batteries or cells must be of a type which meets c) the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3.
Spare batteries for portable medical electronic devices containing lithium metal batteries exceeding 2 grams but not exceeding 8 grams or lithium ion batteries exceeding 100 Wh but not exceeding 160 Wh	No	Yes	Yes	Yes	No	<ul style="list-style-type: none"> a) carried by passengers for medical use; b) batteries or cells must be of a type which meets the requirements of each test in the <i>UN Manual of Tests and Criteria</i>, Part III, subsection 38.3; c) must be individually protected so as to prevent short circuits (by placement in original retail packaging or by otherwise insulating terminals, e.g. by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch); and d) no more than two spare batteries exceeding 2 grams lithium content for lithium metal or a watt-hour rating exceeding 100 Wh for lithium ion may be carried