



WORKING PAPER

DANGEROUS GOODS PANEL (DGP)

TWENTY-EIGHTH MEETING

Virtual, 15 to 19 November 2021

Agenda Item 4: Managing safety risks posed by the carriage of lithium batteries by air (Ref: Job Card DGP.003.03)

**DAMAGED OR DEFECTIVE LITHIUM BATTERY INSTALLED IN ENGINE, MACHINERY,
VEHICLE OR LIFE-SAVING APPLIANCE**

(Presented by D. Brennan)

SUMMARY

This working paper proposes revisions to the packing instructions for engines and machinery, vehicles and life-saving appliances to identify that where the article contains a lithium battery and the lithium battery is damaged or defective the article is forbidden for transport.

Action by the DGP: The DGP is invited to consider including the provision of not permitting damaged or defective lithium batteries installed in engines and machinery (UN 3528, UN 3529 and UN 3530), vehicles (UN 3166 and UN 3171) and life-saving appliances (UN 2990 and UN 3072) in the relevant packing instructions and associating Special Provision A154 with the entries as shown in the appendix to this working paper.

1. INTRODUCTION

1.1 In the UN Model Regulations, all engine and machinery entries that can potentially be installed with lithium battery(ies) have provisions for damaged or defective lithium battery(ies).

1.1.1 UN 3528 (Engine or Machinery, internal combustion, flammable liquid powered and Engine or Machinery, fuel cell, flammable liquid powered), UN 3529 (Engine or Machinery, internal combustion, flammable gas powered and Engine or Machinery, fuel cell, flammable gas powered) and UN 3530 (Engine or Machinery, internal combustion) are associated with Special Provision 363 of the UN Model Regulations, where subparagraph (f) requires that lithium batteries shall meet the provisions of 2.9.4, except 2.9.4 (a) that is related to pre-production prototype batteries or batteries of a small production run, consisting of not more than 100 batteries are installed in machinery or engines. Other than

the provisions of 2.9.4, Special Provision 363 (f) also requires that “where a lithium battery installed in an engine or a machinery is damaged or defective, the machinery or engine shall be transported as defined by the competent authority.”.

1.1.2 UN 3166 (Vehicle, fuel cell, flammable gas powered, Vehicle, flammable gas powered, Vehicle, fuel cell, flammable liquid powered and Vehicle, flammable liquid powered) and UN 3171 (Battery-powered vehicle and Battery-powered equipment) are associated with Special Provision 388, which has a requirement that “where a lithium battery installed in a vehicle or equipment is damaged or defective, the vehicle or equipment shall be transported as defined by the competent authority.”.

1.2 In air transport, Special Provision A154 mandates that lithium batteries identified as being defective for safety reasons, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport. By the same principle and based on the provisions in the UN Model Regulations, all the dangerous goods entries that may contain lithium batteries must also include a provision of not permitting damaged or defective lithium batteries.

1.3 However, neither in Part 3 Table 3-1 Dangerous Goods List nor in the relevant packing instructions, the condition of damaged or defective lithium batteries are forbidden for transport is associated with the aforementioned dangerous goods entries.

1.4 In addition, due to the difference between the UN Model Regulations and Technical Instructions, the provision on damaged or defective lithium batteries is also omitted for UN 2990 (Life-saving appliances, self-inflating) and UN 3072 (Life-saving appliances, not self-inflating) that may contain lithium batteries.

2. ACTION BY THE DGP

2.1 The DGP is invited to consider including the provision of not permitting damaged or defective lithium batteries installed in engines and machinery (UN 3528, UN 3529 and UN 3530), vehicles (UN 3166 and UN 3171) and life-saving appliances (UN 2990 and UN 3072) in the relevant packing instructions and associating Special Provision A154 with the entries as shown in the appendix to this working paper.

APPENDIX

PROPOSED AMENDMENT TO PARTS 3 AND 4 OF THE TECHNICAL INSTRUCTIONS

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Part 3

DANGEROUS GOODS LIST, SPECIAL PROVISIONS AND LIMITED AND EXCEPTED QUANTITIES

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Chapter 3

Table 3-1. Dangerous Goods List

| Name | UN No. | Class or division | Subsidiary hazard | Labels | State variations | Special provisions | UN packing group | Excepted quantity | Passenger aircraft | | Cargo aircraft | |
|---|--------|-------------------|-------------------|------------------|------------------|--|------------------|-------------------|---------------------|-------------------------------|---------------------|-------------------------------|
| | | | | | | | | | Packing instruction | Max. net quantity per package | Packing instruction | Max. net quantity per package |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 |
| ... | | | | | | | | | | | | |
| Battery-powered vehicle | 3171 | 9 | | Miscellaneous | | A67 A87 A94 <u>A154</u> A164 A214 | | E0 | 952 | No limit | 952 | No limit |
| Engine, fuel cell, flammable gas powered † | 3529 | 2.1 | | Gas flammable | | A70 A87 <u>A154</u> A176 A208 | | E0 | FORBIDDEN | | 220 | No limit |
| Engine, fuel cell, flammable liquid powered † | 3528 | 3 | | Liquid flammable | | A70 A87 <u>A154</u> A176 A208 | | E0 | 378 | No limit | 378 | No limit |
| Engine, internal combustion | 3530 | 9 | | Miscellaneous | | A87 <u>A154</u> A208 | | E0 | 972 | No limit | 972 | No limit |
| Engine, internal combustion, flammable gas powered | 3529 | 2.1 | | Gas flammable | | A70 A87 <u>A154</u> A208 | | E0 | FORBIDDEN | | 220 | No limit |
| Engine, internal combustion, flammable liquid powered | 3528 | 3 | | Liquid flammable | | A70 A87 <u>A154</u> A208 | | E0 | 378 | No limit | 378 | No limit |

| Name | UN No. | Class or division | Subsidiary hazard | Labels | State variations | Special provisions | UN packing group | Excepted quantity | Passenger aircraft | | Cargo aircraft | |
|---|--------|-------------------|-------------------|------------------|------------------|--|------------------|-------------------|---------------------|-------------------------------|---------------------|-------------------------------|
| | | | | | | | | | Packing instruction | Max. net quantity per package | Packing instruction | Max. net quantity per package |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Life-saving appliances, not self-inflating containing dangerous goods as equipment | 3072 | 9 | | Miscellaneous | | A48 A87 A154 A182 A223 | | E0 | 955 | No limit | 955 | No limit |
| Life-saving appliances, self-inflating | 2990 | 9 | | Miscellaneous | | A48 A87 A154 A223 | | E0 | 955 | No limit | 955 | No limit |
| Machinery, fuel cell, flammable gas powered † | 3529 | 2.1 | | Gas flammable | | A70 A87 A154 A176 A208 | | E0 | FORBIDDEN | | 220 | No limit |
| Machinery, fuel cell, flammable liquid powered † | 3528 | 3 | | Liquid flammable | | A70 A87 A154 A176 A208 | | E0 | 378 | No limit | 378 | No limit |
| Machinery, internal combustion | 3530 | 9 | | Miscellaneous | | A87 A154 A208 | | E0 | 972 | No limit | 972 | No limit |
| Machinery, internal combustion, flammable gas powered | 3529 | 2.1 | | Gas flammable | | A70 A87 A154 A208 | | E0 | FORBIDDEN | | 220 | No limit |
| Machinery, internal combustion, flammable liquid powered | 3528 | 3 | | Liquid flammable | | A70 A87 A154 A208 | | E0 | 378 | No limit | 378 | No limit |
| Vehicle, flammable gas powered | 3166 | 9 | | Miscellaneous | | A70 A87 A118 A120 A154 A214 | | E0 | FORBIDDEN | | 951 | No limit |
| Vehicle, flammable liquid powered | 3166 | 9 | | Miscellaneous | | A70 A87 A118 A120 A154 A214 | | E0 | 950 | No limit | 950 | No limit |
| Vehicle, fuel cell, flammable gas powered † | 3166 | 9 | | Miscellaneous | | A70 A87 A118 A120 A154 A176 A214 | | E0 | FORBIDDEN | | 951 | No limit |

| Name | UN No. | Class or division | Subsidiary hazard | Labels | State variations | Special provisions | UN packing group | Excepted quantity | Passenger aircraft | | Cargo aircraft | |
|--|--------|-------------------|-------------------|---------------|------------------|---|------------------|-------------------|---------------------|-------------------------------|---------------------|-------------------------------|
| | | | | | | | | | Packing instruction | Max. net quantity per package | Packing instruction | Max. net quantity per package |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Vehicle, fuel cell, flammable liquid powered † | 3166 | 9 | | Miscellaneous | | A70 A87 A118 A120 <u>A154</u> A176 A214 | | E0 | 950 | No limit | 950 | No limit |

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Part 4

PACKING INSTRUCTIONS

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Chapter 4

CLASS 2 — GASES

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Packing Instruction 220

Cargo aircraft only for UN 3529 only

(See Packing Instruction 378 for flammable liquid-powered engines or machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles, Packing Instruction 952 for battery-powered equipment and vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

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ADDITIONAL PACKING REQUIREMENTS

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Batteries

All batteries must be installed and securely fastened in the battery holder of the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

- 1) if spillable batteries are installed, and it is possible for the machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 492 or 870 as applicable;
- 2) if lithium batteries are installed, they must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin, must be securely fastened in the machinery or equipment and must be protected in such a manner so as to prevent damage and short circuits. In accordance with Special Provision A154, where a lithium battery installed in a machinery or an engine is damaged or defective the machinery or engine is forbidden for transport; and
- 3) if sodium batteries are installed they must conform to the requirements of Special Provision A94.

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Chapter 5

CLASS 3 — FLAMMABLE LIQUIDS

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Packing Instruction 378

Passenger and cargo aircraft for UN 3528 only
(See Packing Instruction 220 for flammable gas-powered engines or machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles, Packing Instruction 952 for battery-powered equipment and vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

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ADDITIONAL PACKING REQUIREMENTS

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Batteries

All batteries must be installed and securely fastened in the battery holder of the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

- 1) if spillable batteries are installed, and it is possible for the machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 492 or 870 as applicable;
- 2) if lithium batteries are installed, they must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin, must be securely fastened in the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In accordance with Special Provision A154, where a lithium battery installed in a machinery or an engine is damaged or defective the machinery or engine is forbidden for transport; and
- 3) if sodium batteries are installed they must conform to the requirements of Special Provision A94.

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Chapter 11**CLASS 9 — MISCELLANEOUS DANGEROUS GOODS**

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Packing Instruction 950

Passenger and cargo aircraft for UN 3166 only

(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 951 for flammable gas-powered vehicles, Packing Instruction 952 for battery-powered equipment and vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

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ADDITIONAL PACKING REQUIREMENTS

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Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle and must be protected in such a manner so as to prevent damage and short circuits. In addition:

- 1) if spillable batteries are installed, and it is possible for the vehicle to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 492 or 870 as applicable;
- 2) if lithium batteries are installed, they must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin, must be securely fastened in the vehicle and must be protected in such a manner so as to prevent damage and short circuits. In accordance with Special Provision A154, where a lithium battery installed in a vehicle is damaged or defective the vehicle is forbidden for transport; and
- 3) if sodium batteries are installed they must conform to the requirements of Special Provision A94.

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Packing Instruction 951

Cargo aircraft only for UN 3166 only

(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 952 for battery-powered equipment and vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

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ADDITIONAL PACKING REQUIREMENT

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Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle and must be protected in such a manner so as to prevent damage and short circuits. In addition:

- 1) if spillable batteries are installed, and it is possible for the vehicle to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 492 or 870 as applicable;

- 2) if lithium batteries are installed, they must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin, must be securely fastened in the vehicle and must be protected in such a manner so as to prevent damage and short circuits. In accordance with Special Provision A154, where a lithium battery installed in a vehicle is damaged or defective the vehicle is forbidden for transport; and
- 3) if sodium batteries are installed they must conform to the requirements of Special Provision A94.

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Packing Instruction 952

Passenger and cargo aircraft for UN 3171 only

(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

ADDITIONAL PACKING REQUIREMENTS

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Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle, machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

- 1) if spillable batteries are installed, and it is possible for the vehicle, machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 492 or 870 as applicable;
- 2) if lithium batteries are installed in a vehicle, they must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin. In accordance with Special Provision A154, where a lithium battery installed in a vehicle is damaged or defective the vehicle is forbidden for transport. Where the lithium battery is removed from the vehicle and is packed separate from the vehicle in the same outer packaging, the package must be consigned as UN 3481— **Lithium ion batteries packed with equipment** or UN 3091 — **Lithium metal batteries packed with equipment** and packed according to Packing Instruction 966 or 969, as applicable; and
- 3) if sodium batteries are installed they must conform to the requirements of Special Provision A94.

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Packing Instruction 955

Passenger and cargo aircraft for UN 2990 and UN 3072 only

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ADDITIONAL PACKING REQUIREMENTS

Life-saving appliances may only contain the dangerous goods listed below:

- a) Division 2.2 gases, must be contained in cylinders which conform to the requirements of the appropriate national authority of the country in which they are approved and filled. Such cylinders may be connected to the life-saving appliance. These cylinders may include installed actuating cartridges (cartridges, power device of Division 1.4C and 1.4S) provided the aggregate quantity of deflagrating (propellant) explosives does not exceed 3.2 grams per unit. When the cylinders are shipped separately, they must be classified as appropriate for the Division 2.2 gas contained and need not be marked, labelled or described as explosive articles;

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e) lithium batteries:

1) must meet the applicable requirements of 2;9.3;

2) in accordance with Special Provision A154, where lithium batteries installed in a life-saving appliance are damaged or defective the appliances are forbidden for transport;~~3~~) must be disconnected or electrically isolated and protected against short circuits; and~~4~~) must be secured against movement within the appliance.

f) first aid kits which may include flammable, corrosive and toxic articles or substances.

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Packing Instruction 972

Passenger or cargo aircraft for UN 3530 only

(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles or Packing Instruction 952 for battery-powered equipment and vehicles)

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ADDITIONAL PACKING REQUIREMENTS

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Batteries

All batteries must be installed and securely fastened in the battery holder of the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

1) if spillable batteries are installed, and it is possible for the machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 492 or 870 as applicable;

2) if lithium batteries are installed, they must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin, must be securely fastened in the machinery or equipment and must be protected in such a manner so as to prevent damage and short circuits. In accordance with Special Provision A154, where a lithium battery installed in a machinery or an engine is damaged or defective the machinery or engine is forbidden for transport; and

3) if sodium batteries are installed they must conform to the requirements of Special Provision A94.

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