International Civil Aviation Organization

DGP-WG/23-WP/4
12/4/23

WORKING PAPER

DANGEROUS GOODS PANEL (DGP) WORKING GROUP MEETING (DGP-WG/23)

Rio de Janeiro, Brazil, 15 to 19 May 2023

Agenda Item 4: Managing safety risks posed by the carriage of lithium batteries by air (Ref: Job Card DGP.003.04)

REDUCED CHARGE FOR VEHICLES POWERED BY LITHIUM ION BATTERIES

(Presented by D. Brennan)

SUMMARY

This working paper proposes that vehicles powered by lithium ion batteries (UN 3556) be offered for air transport with the battery "fuel gauge" at 25% or less.

Action by the DGP-WG is in paragraph 2.

1. INTRODUCTION

1.1 The UN Subcommittee at their 61st session in December 2022 adopted a new UN number and proper shipping name, UN 3556 — **Vehicle, lithium ion battery powered**, see DGP-WG/23-WP/13.

1.2 The adoption of this new entry into Table 3-1 and the associated hazard communication with the application of the Class 9 — lithium battery (and sodium ion) hazard label, Figure 5-26, when the vehicle is placed in a packaging provides the ability to discriminate between vehicles powered by lithium ion batteries and other battery-powered vehicles.

1.3 While the differentiation of vehicles powered by lithium ion batteries and other battery powered vehicles will allow operators to undertake a more granular safety risk assessment to consider the particular hazard posed by these vehicles, it is believed that there is also an opportunity to directly reduce the risk by restricting the charge in the lithium ion batteries in vehicles.

1.4 At the twenty-eighth meeting of the DGP (DGP/28, Virtual, 15 to 19 November 2021), a working paper was presented that proposed to require that vehicles powered by lithium ion batteries be offered for transport at the lowest practical state of charge (SoC), but not exceeding 30 per cent (see paragraph 4.3 of the DGP/28 Report). The proposal in the working paper was not accepted, in part because the proposal as written was considered ambiguous and difficult to implement and enforce.

However, the primary issue raised in the working paper remains valid, being that lithium ion batteries installed in vehicles can be very large, significantly in excess of 35 kg for large passenger electric vehicles, and allowing these to be shipped at 100 per cent SoC does not address the known risk.

1.5 Looking at the packing instructions for vehicles, there is a long-standing requirement for vehicles powered by a flammable liquid that the fuel tank must be drained of fuel as far as practicable, and if any fuel remains, it must not exceed one-quarter of the tank capacity. In practice, operators and their ground service provider request that the shipper leave some fuel in the fuel tank so that the vehicle can be moved under its own power for ease of loading and unloading. It is also a standard practice during the acceptance check to verify that the fuel tank does not exceed 25 per cent by turning the key to check that the fuel gauge does not indicate more than one-quarter full.

1.6 For large electric vehicles, it is believed that the same conditions could be implemented to require that the "fuel gauge" does not indicate more than 25 per cent capacity. This could be verified at acceptance by the operator or their ground service provider when performing the acceptance check of the vehicle. Again, having some charge remaining would allow the operator to move the vehicle under its own power when loading and unloading.

1.7 In discussion with representatives of some large automobile manufacturers, the "fuel gauge" on large electric passenger vehicles has a margin below indicated empty and above indicated full of approximately 5 to 10 per cent. This margin is built in by the manufacturer to protect the battery and to manage the life of the battery. Based on this, an indication of 25 per cent capacity on the fuel gauge would equate to approximately 30 to 35 SoC.

1.8 Small electric vehicles, such as e-bikes, e-skateboards and e-scooters, will generally be packed in fibreboard boxes and it will not be possible for the operator to verify the amount of indicated battery charge. However, this is no different to flammable liquid powered vehicles when these are offered for transport in a crate or other packaging and where the operator takes the signature on the dangerous goods transport document and the certification statement as evidence that the shipper has declared "that all of the applicable air transport requirements have been met.".

1.9 While it will not be possible for operators to always verify the charge remaining for vehicles powered by lithium ion batteries, the shipper will still be able to do so when preparing the vehicle for air transport. Even the small electric vehicles have a battery indicator that shows the amount of charge remaining. This may be by the number of bars, or number of lights illuminated, and the shipper can use this to ensure that the battery indication is as low as possible, but does not exceed 25 per cent of indicated battery capacity.

2. ACTION BY THE DGP-WG

2.1 The DGP-WG is invited to consider the changes to Packing Instruction 952 as shown in the appendix to this working paper to include a requirement to have vehicles powered by lithium ion batteries offered for transport with the battery discharged as far as possible, but no more than 25 per cent indicated capacity.

— — — — — — — —

APPENDIX

PROPOSED AMENDMENT TO PART 4 OF THE TECHNICAL INSTRUCTIONS

Part 4

PACKING INSTRUCTIONS

Chapter 11

CLASS 9 — MISCELLANEOUS DANGEROUS GOODS

11.1 PACKING INSTRUCTIONS

. . .

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

. . .

Battery-powered vehicles, machines or equipment must meet the following requirements:

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:

   i) lithium batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

   ii) lithium batteries must meet the provisions of Part 2;9.3, unless otherwise approved by the appropriate authority of the State of Origin, except that pre-production prototypes of lithium batteries or cells, when these prototypes are transported for testing, or low production runs of lithium batteries or cells that have not been tested to the requirements in Part III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

   iii) 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.

iv) vehicles powered by lithium ion batteries (UN 3556) must have the battery discharged as far as practicable, and where charge remains, the indicated range or indicated battery capacity must not exceed 25 per cent.

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

. . .

— END —