International Civil Aviation Organization

WORKING PAPER

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DANGEROUS GOODS PANEL (DGP)

MEETING OF THE WORKING GROUP OF THE WHOLE

Montreal, 18 to 22 April 2005

Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions* for incorporation in the 2007/2008 edition
2.8: Part 8 - Provisions Concerning Passengers and Crew

METHANOL MICRO FUEL CELL

(Presented by H. Okayama)

1. INTRODUCTION

1.1 A new entry of " FUEL CELL CARTRIDGES containing flammable liquids", proposed by the United States of America, was adopted at the meeting of the UN Sub-committee of Experts on the Transport of Dangerous Goods which was held in Geneva in December 2004.

1.2 The products of micro fuel cells are expected to be introduced on the consumers' market in the very near future. Since the micro fuel cells have an advantage of possibility to supply electric power conveniently as required at anytime and anywhere, we assume there would be an anxious desire from passengers to take these micro fuel cells with spare fuel cell cartridges into the cabin of aircraft in carry-on baggage.

1.3 Therefore, we would like to propose to the DGP Working Group to give consideration on the exclusion of passengers and crew members carrying the methanol fuel cell powered equipments with spare fuel cell cartridges in carry-on baggage on aircraft. And we would like to have your comments and advices on the contents of following proposal at this opportunity of the ICAO DGP WG05 meeting in order to revise and improve this proposal with a target for finalizing as early as possible at DGP/20.

2. Verification of safety measures for micro fuel cells carried by passengers in carry-on baggage, based on the developed IEC TC 105 Standards

Principles of generation of power

The methanol micro fuel cell generates electric power as a consequence of chemical reaction between methanol and oxygen with air, which operates an electronic equipment and/or gives a charge of electricity to the built-in rechargeable battery.

Fuel leakage from the cartridge

The cartridge is provided with a sturdy and rigid plastic container with valve(s). Since the valve is always closed while the cartridge is detached from the equipment, fuel cannot be released from the cartridge.

In addition, the cartridge is designed and constructed to prevent fuel from leaking based on "IEC TC105 Standard for Micro Fuel Cells Safety"(hereinafter called, 'Safety Standard'). The cartridge is much safer than a conventional methanol reagent bottles.

The cartridge is designed as a non-refillable type. Accordingly, the cartridge is to be replaced with a new one whenever the fuel in the cartridge is depleted.

Fuel leakage during operation

The micro fuel cell is provided with a valve at the connector with the cartridge. The valve will open to feed the fuel into the micro fuel cell, only when the cartridge is loaded. The connector is designed to prevent the fuel from leaking. Safety Standard secures safety both in normal use and foreseeable wrong use.

Thermal runaway concerns

There is no threat or danger of thermal runaway inside the micro fuel cell.
Compliance with Safety Standard secures that the micro fuel cell will never catch fire or explode.

Surface temperature of micro fuel cell-powered equipment

The surface temperature of the micro fuel cell-powered equipment is designed not to exceed the allowable temperature. The thermal protection circuits etc. will be actuated under abnormal temperature.

To secure safety at the extreme temperature encountered during air transport

Based on the Safety Standard, safety of micro fuel cells will be secured within the appropriate temperature range. The thermal protection circuits etc. will be actuated under abnormal temperature.

Shutoff function when the equipment is switched on in baggage

To prevent the overcharge of the lithium-ion battery installed in a portable equipment by micro fuel cell, overcharge protection circuit is provided in it. In addition, the micro fuel cell will stop charging when the lithium-iron battery is fully charged.

When used for direct operation of the equipment, the micro fuel cell will not generate electric power when the equipment is turned off, even if the micro fuel cell is switched on.

Safety measures for the fuel cartridges

The fuel cartridge shall comply with the Safety Standard to prevent a user from intentionally taking fuel out of, refilling, or using the cartridge for other wrong purposes.

External short circuit concerns

There is no danger of fire or heat generation due to external short circuit, because fuel cell voltage will immediately drop and will generate no electric power when short circuit occurs. In addition, a protection circuit will cut-off the short circuit current.

3. PROPOSAL

3.1 The Working Group is requested to give due consideration on establishing a new paragraph in Part 8;1.1.2 as follows.

r) Methanol micro fuel cell-powered equipments (e.g. portable electronic equipments such as personal computers, consumer electronics, etc.), fuel cell cartridges contained in the equipments, and spare fuel cell cartridges, subject to the following conditions.

- in carry-on baggage
- the maximum capacity of each fuel cell cartridge is limited to not more than 200mL
- the quantity of spare fuel cell cartridges per person must not exceed 5 pieces.

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