



## **DANGEROUS GOODS PANEL (DGP) MEETING OF THE WORKING GROUP OF THE WHOLE**

**Memphis, 30 April to 4 May 2007**

**Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2009/2010 Edition**

**2.8: Part 8 — Provisions Concerning Passengers and Crew**

### **UPDATE FROM THE FUEL CELL INDUSTRY**

(Presented by the Fuel Cell Council)

#### **SUMMARY**

This paper provides an update on progress made by the fuel cell industry to issue a Corrigendum to IEC PAS 62282-6-1, Edition 1, relating to micro fuel cell safety which the Working Group of the Whole requested at DGP-WG/06. The fuel cell industry is happy to report it has acted upon all the requests and has received favourable feedback from IEC.

## **1. INTRODUCTION**

1.1 At DGP-WG/06 (see DGP-WG/06-WP/56, paragraph 4.50.6), it was agreed that “IEC would be requested to change their standard for prototype testing to include the water bath leak test. It was anticipated the response from the IEC would be notified to the DGP by mid December after which time, members would be able to decide if the changes to the standard, in order to address the safety issue raised, was being appropriately addressed in a timely manner i.e. by spring 2007. If it was believed this was not being done, the DGP would have a number of options including an addendum to 8.1.1.2 r) stating no leakage was permitted, or even the removal of butane fuel cell cartridges from the passenger exceptions”.

1.2 Subsequent to DGP-WG/06, Bob Richard and Robert Wichert met with Charles Jacquemart of IEC in Geneva to emphasise the importance of the issue and fast track implementation of the change. IEC agreed with the proposed change and to the issuance of an IEC corrigendum as requested by the ICAO WG. The changes described above, were released to the IEC Participating and Observer Countries on December 22, 2006 together with a “request for comment” by 23 February, 2007.

1.3 Publication of the Corrigendum to IEC PAS 62282-6-1 Edition 1 is expected prior to the ICAO Working Group meeting in Memphis.

## 2. DISCUSSION

2.1 IEC PAS 62282-6-1, Edition 1, which is referenced in the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284), Part 8, Chapter 1, 1.1.2.(r) 2, 5, 6 and 9 was published in February of 2006.

(See <http://webstore.iec.ch/webstore/webstore.nsf/artnum/035728?opendocument>)

2.2 Subsequent to publication, a detailed review of the specification was conducted and several inadvertent errors noted. These changes were reviewed by the panel members and a proposed Corrigendum was prepared and sent to IEC in September, 2006.

2.3 Analysis by the US DOT FAA resulted in questions regarding the requirement for a water bath test for fuel cell cartridges containing liquefied flammable gas (butane). The DGP Working Group of the Whole at their meeting in Beijing (DGP-WG/06) requested changes to the Corrigendum to make a water bath test mandatory following all fuel cartridge type tests in IEC PAS 62282-6-1 for fuel cell cartridges containing liquefied flammable gas (butane).

2.4 The requested changes were submitted to the IEC (see Appendix A) and the IEC agreed to move forward with this request in December. Comments from the Participating and Observer IEC Countries were requested and resulted in numerous positive comments. One minor editorial comment was also received that will not be incorporated since it changes the requested language that was extracted directly from the ICAO Technical Instructions (see Appendix B, Comments Received From IEC Countries).

2.5 Following receipt of the comments, an INF document is being circulated to inform the IEC Member Countries that the Corrigendum will be issued (see Appendix C, International Electrotechnical Commission 105/xxx/INF, 2007-03).

2.6 It is now anticipated that the requested Corrigendum will be published prior to the ICAO meeting in Memphis.

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## APPENDIX A

### REQUEST TO ISSUE AN ADDITIONAL CORRIGENDUM TO IEC PAS 62282-6-1 ED. 1

#### IEC CORRIGENDUM TRANSMITTAL

#### TECHNICAL COMMITTEE 105: FUEL CELL TECHNOLOGIES

#### Request to issue an additional corrigendum to IEC PAS 62282-6-1 Ed. 1: Fuel cell technologies – Part 6-1: Micro fuel cell power systems – Safety

#### Background

In 2006-10 a document was circulated (reference 105/128/DC) requesting a technical corrigendum to IEC PAS 62282-6-1 (2006-03) in accordance with 2.10.2 of Part 1 of IEC/ISO directives.

The TC 105 P-member countries replied that they agree with the publication of the technical corrigendum covered by 105/128/DC and they furthermore agreed that the circumstances for the publication of a technical corrigendum are met.

In the course of further reviews of the IEC PAS it appeared that its normative annex F (“Butane supplement”) contains technical errors which could lead to unsafe application of the publication.

An additional corrigendum is therefore requested which is described in Annex A; it has been supported by the convenor and the secretary of WG 8 of TC 105. Further background information provided by the WG 8 secretary is given in Annex B.

This document is circulated in agreement with the TC 105 secretary with the following objectives:

- a) inform national committees of an additional technical error occurring in IEC PAS 62282-6-1; and
- b) obtain their agreement for the publication of the proposed additional corrigendum.

#### Action

The TC 105 P-member countries are invited to express their views on the following questions:

1. whether they agree to the publication of the additional corrigendum as described in annex A;
2. whether they agree that the circumstances for the publication of this additional corrigendum are met.

They are invited to send their comments to the IEC voting system **until 2007-02-23** at the latest.

If agreed by the P-member countries, this additional corrigendum will be merged with the basic one (covered by 105/128/DC), and a single technical corrigendum will be published.

**Annex A:** Proposed additional corrigendum to IEC PAS 62282-6-1 (2006-02)

**Annex B:** Justification provided by the WG 8 convenor for an additional corrigendum to IEC PAS 62282-6-1 (2006-02)

**ANNEX A**

**Publication IEC PAS 62282-6-1**  
(First Edition, 2006-02)

**FUEL CELL TECHNOLOGIES –**  
**Part 6-1: Micro fuel cell power systems – Safety**  
**ADDITIONAL CORRIGENDUM (2006-12)**

*Page 107*  
*Clause F.3.25*  
*Instead of*

**F.3.25**  
**no leakage**  
no impermissible leakage as defined in F.3.31

*Read*

**F.3.25**  
**no leakage**  
no impermissible leakage as defined in F.3.31

For the water bath test, the cartridge(s) shall be bubble-tight. No leakage is allowed.

*Page 107*  
*Clause F.3.31*  
*Instead of*

**F.3.31**  
**impermissible leakage**

When this PAS is used in conjunction with this annex, release of fuel that results in one or a combination of the following situations that are deemed unsuitable:

- a) fuel vapour in air mixture in excess of 25 % of the lower flammability limit (LFL) beyond a 10 cm distance from the micro fuel cell;
- b) fuel vapour in air concentration in excess of the lower of the TLV or MAK occupational exposure limits as indicated on the International Chemical Safety Card (ICSC);
- c) fuel vapour leakage in excess of 0,9 g/h.

NOTE This equates to the highest leak rate that will not support a flame and is less than the 1,9 g/h leak rate necessary to achieve the TLV limit of 800 ppm in a 1 cubic meter chamber with 1 air change per hour.

*Read***F.3.31  
impermissible leakage**

When this PAS is used in conjunction with this annex, release of fuel that results in one or a combination of the following situations that are deemed unsuitable:

- a) fuel vapour in air mixture in excess of 25 % of the lower flammability limit (LFL) beyond a 10 cm distance from the micro fuel cell;
- b) fuel vapour in air concentration in excess of the lower of the TLV or MAK occupational exposure limits as indicated on the International Chemical Safety Card (ICSC);
- c) fuel vapour leakage in excess of 0,9 g/h.

NOTE This equates to the highest leak rate that will not support a flame and is less than the 1,9 g/h leak rate necessary to achieve the TLV limit of 800 ppm in a 1 cubic meter chamber with 1 air change per hour.

- d) For the water bath test, the cartridge(s) shall be bubble-tight. No leakage is allowed.

*Page 108**Clause F.7**Instead of***F.7 Type tests for a fuel cartridge, a micro fuel cell power unit, and a micro fuel cell power system**

Clause 7 shall apply as written when this PAS is applied in conjunction with this annex, with the following exceptions:

7.2 shall be replaced with F.7.2.

7.3 shall apply as modified by F.7.3.

Table 8 shall be replaced with Table F.1.

*Read***F.7 Type tests for a fuel cartridge, a micro fuel cell power unit, and a micro fuel cell power system**

Clause 7 shall apply as written when this PAS is applied in conjunction with this annex, with the following exceptions:

7.2 shall be replaced with F.7.2.

7.3 shall apply as modified by F.7.3.

Table 8 shall be replaced with Table F.1.

Following each type test for the butane fuel cartridge(s), the cartridge(s) shall be subjected to a water bath test. The temperature of the water bath and the duration of the test must be such that the internal pressure in the cartridge reaches that which would be reached at 55°C. No leakage or permanent deformation may occur, except that a plastic cartridge may be deformed through softening provided that it does not leak.

**ANNEX B**

**JUSTIFICATION PROVIDED BY THE TC 105 WG 8 CONVENOR FOR  
AN ADDITIONAL CORRIGENDUM TO IEC PAS 62282-6-1 (2006-02)**

During a review of IEC PAS 62282-6-1 by the United States Department of Transportation Federal Aviation Administration Technical Center, a safety concern was identified by calculations that indicate the theoretical possibility of forming a flammable atmosphere in an overhead luggage compartment in a passenger aircraft when as few as three butane fuel cells, qualified in accordance with IEC PAS 62282-6-1, might be placed there during an airline flight as short as five hours if ventilation of the overhead luggage rack was not provided.

This information was brought to the attention of the International Civil Aviation Organization (ICAO) Working Group of the Dangerous Goods Panel (DGP) at a meeting in October of 2006. As you are aware, the ICAO Technical Instructions taking effect on January 1, 2007 require compliance with IEC PAS 62282-6-1 as a prerequisite to allowing fuel cells for carry-on use by passengers onboard passenger airliners. The ICAO Working Group of the DGP subsequently requested that the pending Corrigendum to IEC PAS 62282-6-1 be modified to conform the Type Testing in the Specification to the requirements of the ICAO Technical Instructions for other similar articles to prevent such leakage. The attached Corrigendum adds these requirements to the Corrigendum already approved for publication.

If these changes are not made to PAS 62282-6-1 the ICAO DGP may exercise its authority to remove butane fuel cells from the passenger exceptions list in the ICAO Technical Instructions and thereby not allow butane fuel cells to be carried onboard passenger aircraft in accordance with those Technical Instructions.

It is in the best interests of both the fuel cell industry and the International Electrotechnical Commission to make these changes to resolve this safety issue.

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(TC 105 WG 8 convenor)

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## Annex

Date 2007-02-23	Document SPAIN/105/137/DC
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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Edi torial)	COMMENTS	Proposed change	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
ES			General	The Spanish National Committee abstains with the proposal.		
FR			General	The French National Committee agrees to the publication of the additional corrigendum to IEC PAS 62282-6-1/Ed.1		
GB				The British National committee agrees to the correction		
GB	F.7			Text after Table 8 shall be replaced with Table F.1.  The paragraph below this text is a little confusing. Suggesting that no leakage or deformation may occur unless the case is plastic and softens. Perhaps keeping the pass criteria to simply no leakage would be less confusing.  Reword for clarity		
IT 1			General	The Italian NC agrees on the proposal of document 105/137/DC; therefore, the answers to the questions are the following: <ul style="list-style-type: none"> <li>• Question 1: YES</li> <li>• Question 2: YES</li> </ul>		

COMMENTS RECEIVED FROM IEC COUNTRIES

APPENDIX B

**IEC/TC 105 WG8 Comment Form  
(Country Comment)**

<b>Comment Due Date</b> February 23, 2007	<b>DC Issued Date</b> December 22, 2006	<b>Document</b> IEC TC 105 WG#8 105/137/DC
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<b>National Committee</b>	<b>Clause/ Subclause/ Figure/ Table</b>	<b>Type Of Comment (General/ Technical/Editorial)</b>	<b>COMMENTS</b>	<b>Proposed change</b>	<b>Resolution</b>
<b>Japan</b>		General	We agree to the Action No.1		
<b>Japan</b>		General	We agree to the Action No.2		

Date February 21, 2007	Document 105/137/DC
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<b>National Committee</b>	<b>Clause/ Subclause</b>	<b>Paragraph Figure/ Table</b>	<b>Type of comment (General/ Technical/Editorial)</b>	<b>COMMENTS</b>	<b>Proposed change</b>	<b>OBSERVATIONS OF THE SECRETARIAT on each comment submitted</b>
US	IEC PAS 62282-6-1, Proposed Additional Corrigendum (2006-12)		Ge	As proposed in 105/137/DC, the U.S. agrees that the additional corrigendum should be merged with the original corrigendum covered in 105/128/DC, and a single technical corrigendum should be published.		



National Committee	Clause/Subclause	Paragraph Figure/Table	Type of comment (General/Technical/Editorial)	COMMENTS	Proposed change	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
US	IEC PAS 62282-6-1, Proposed Additional Corrigendum (2006-12)		Ge	<p>Members of the UN ICAO panel have identified a significant issue with the IEC/PAS 62281-6-1 that could lead to items conforming to this safety specification creating hazardous situations under routine circumstances, such as when stored in an aircraft overhead bin. The proposed additional corrigendum resolves this issue by applying routine requirements described in the ICAO Technical Instructions, the UN manual for the Transport of Dangerous Goods, and other similar publications. Resolving this safety issue is critical to industry and regulatory acceptance of IEC/PAS 62281-6-1 as an authoritative specification for micro fuel cell safety.</p> <p>1) We support the publication of the additional corrigendum.</p> <p>2) We find that the circumstances for publication of this additional corrigendum (so as to correct technical errors that could lead to unsafe application of this specification) are met.</p>		



## APPENDIX C

**INTERNATIONAL ELECTROTECHNICAL COMMISSION**      **105/xxx/INF, 2007-03**  
**TECHNICAL COMMITTEE 105: FUEL CELL TECHNOLOGIES**

**Compilation of comments on documents 105/128/DC and 105/137/DC: Request to issue a corrigendum to IEC PAS 62282-6-1**

### **Background**

Documents 105/128/DC and 105/137/DC were circulated with the proposal to issue a corrigendum to IEC PAS 62282-6-1 Ed. 1.

The national comments received on the two documents are attached. They reflect that the P-members approve the contents of the proposed corrigenda and that their publication is in agreement with the rules laid down in IEC directives.

### **Action**

In response to the comments received and in agreement with the TC 105 secretary and chairman, the corrigenda proposed in 105/128/DC and 105/137/DC will be merged and published as a single technical corrigendum. Any additional national comments received will be submitted to the project leader for consideration in the development of project 62282-6-1 (currently at the ACDV stage).

**Annex:** reports of comments on documents 105/128/DC and 105/137/DC

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