OUTSTANDING ISSUES – COMPILATION OF COMMENTS THAT COULD HAVE AN EFFECT ON THE GRPE/ISO HARMONIZATION – Discussed at the GRPE/ISO group of experts meeting on 22 January 2003 in Munich, Germany		GRPE/ISO **N 038** 2003-01-22
GRPE Draft regulations: Uniform Provisions Concerning the Approval of: I Specific Components of Motor Vehicles Using Compressed Gaseous Hydrogen; II. Vehicles with Regard to the Installation of Specific Components for the Use of Compressed Gaseous Hydrogen. Version 10 Dated 06.11.02	ISO/CD 15869-1 to ISO/CD 15869-5 (2002-06) Gaseous hydrogen and hydrogen blends – Land vehicle fuel tanks	Replaces: Document GRPE/ISO **N 035**

Note: “Final Modification” Column - Red text: EIHP2 comments/proposals

Table 1 — Main Outstanding GRPE/ISO harmonization issue

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
General	ISO 15869-2	-	ISO 15869-2 refers to ISO 9809-1, ISO 9809-2 and ISO 7866 in their entirety for type 1 containers and specifies additional type approval tests for vehicle applications (fire protection and exterior environmental protection). GRPE draft regulation refers only to the testing requirements of ISO 9809-1, ISO 9809-2 and ISO 7866 NOTE: ISO 9809 and ISO 7866 are prescriptive standards and not performance standards. Solution 1: Both ISO and GRPE are to use the ISO 15869-2 approach. Solution 2: The GRPE draft regulations could refer to the applicable parts of ISO 9809-1, ISO 9809-2 and ISO 7866 instead of referencing the document in their entirety. Craig Webster identified the changes that would be required in the GRPE draft regulations to achieve this (see the proposed changes below). Solution 3: Retain performance based requirements for Type 1 containers based on GRPE draft regulation Rev.10		It was decided after a long discussion that is reported at the end of Table 1 that the GRPE draft regulations would keep the performance-based approach only. The ISO draft standard would have two options for tank design: - the first option would be to keep the existing requirements in ISO 15869-2 (mainly based on ISO 9809 and ISO 7866 plus the additional tests already included in ISO 15869-2) - the second option would be to design the fuel tank as per the performance based approach included in the GRPE draft regulation. GRPE did not want to accept to have two options for the design, one of which being design based with specific type 1 requirements (similar to the existing

Table 1 — Main Outstanding GRPE/ISO harmonization issue

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			NOTE: Agreement at Koln meeting of the GRPE Ad-hoc Working Group on the Type 1 issue: "*The group agrees on the 1st option (i.e. retaining existing ECE revision 10) with future alignment for GTR development through revised performance-based ISO standard. The WG recommends ISO to consider incorporating the performance approach as per the draft GRPE."*		requirements (similar to the existing ISO 15869-2). This was considered as not in line with the philosophy of the rest of the draft regulations which aim toward performance-based requirements. ISO cannot live with only the performance approach. There was a resolution in ISO/TC58/SC3 stating that references to ISO 9809 and ISO 7866 were to be included.
Ann.7: A3.3		Faber	Retain Type 1 Burst Pressure Ratio stated in GRPE draft regulation Rev.10	-	The burst pressure ratio in Rev. 10 is not to be changed.

CRAIG WEBSTER'S PROPOSAL

PROPOSED CHANGES TO THE GRPE DRAFT REGULATION TO ACCOMMODATE USING ISO 9809-1, ISO 9809-2 AND ISO 7866 FOR TYPE 1 CONTAINERS

Note – I found that ISO 7866 and 9809-1 & 9809-2 contain instructions on how to obtain type approval – these requirements would likely conflict with the EIHP draft regulation, so it is better for EIHP that one does not reference the ISO standards in their entirety, but only refer to sections that are relevant.

ANNEX 7: PART A

A2.4 MATERIAL SPECIFICATIONS AND TEST DATA

This section is to be changed as follows:

Table 1 — Main Outstanding GRPE/ISO harmonization issue

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
"A detailed description of all principal material properties and tolerances used in the Container design shall be provided according to Table 7A.3. The material specifications shall be verified by appropriate materials tests. In the case of steel Containers of Type 1, the materials tests shall include the material tests specified in paragraph 9.2 of ISO 9809-1 or ISO 9809-2, as applicable and the additional tests specified in Table 7A.3. In the case of aluminium Containers of Type 1, the materials tests shall include the material tests specified in paragraph 9.2 of ISO 7866 and the additional tests specified in Table 7A.3. For Containers of Type 2, 3 and 4, the material tests shall include the tests specified in Table 7A.3. The results from the tests shall be provided. If more samples than required are tested, all results shall be documented" In Table 7A.3, the footnotes 1 and 2 should no longer refer to metallic containers. The reference should be kept for metallic liners only. **A2.5 CONTAINER SPECIFICATIONS AND TEST DATA** After the first sentence, add the following paragraph: Modify the second paragraph as follows: "The Container design specifications for each test that is required shall be provided. The design specifications shall be verified by appropriate Container tests. In the case of steel Containers of Type 1, the tests shall include the prototype tests specified in paragraph 9.2 of ISO 9809-1 or ISO 9809-2, as applicable and the additional tests specified in Table 7A.4. In the case of aluminium Containers of Type 1, the tests shall include the Container tests specified in paragraph 9.2 of ISO 7866 and the additional tests specified in Table 7A.3. For Containers of Type 2, 3 and 4, the container tests shall include the tests specified in Table 7A.4." In Table 7A.4, the following "X" shall be removed from the Type 1 Container column: LBB performance test, burst test, ambient temperature cycling test, penetration test. Only the bonfire test is to be kept. Table 7A.8 would also have to be modified accordingly.				

Table 1 — Main Outstanding GRPE/ISO harmonization issue

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
A3 CONTAINER DESIGN REQUIREMENTS A3.1.2 - delete reference to Type 1 containers in the first sentence, and add the following statement at the end of the paragraph: "For Type 1 aluminium containers, the maximum defect size shall be established in accordance with the requirements in 8.4 of ISO 7866. For Type 1 steel containers, the maximum defect size shall be established in accordance with the requirements in Annex B of ISO 9809-1, or ISO 9809-2." Add a new paragraph under A3.1. It could be identified as follows: A3.1.6 **Specific requirements for Container Type 1** Steel Containers of Type 1 shall meet the design requirements specified in clause 7 of ISO 9809-1 or ISO 9809-2, as applicable. Aluminium Containers of Type 1 shall meet the design requirements specified in clauses 7 of ISO 7866. **A3.3 BURST PRESSURE RATIOS** After the first sentence, add the following; "For Type 1 aluminium containers, the minimum burst pressure ratio shall be established in accordance with the requirements of paragraph 7.2 in ISO 7866. For Type 1 steel containers, the minimum burst pressure ratio shall be established in accordance with the requirements of paragraph 7.3 in ISO 9809-1 or ISO 9809-2, as applicable." **Table 7A.5** Delete the column labelled "Type 1" and the row labelled "All metal".					

Table 1 — Main Outstanding GRPE/ISO harmonization issue

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection

A4.1 METAL CONTAINERS AND LINERS

Add the following sentences at the beginning of this section:

“For Type 1 aluminium containers, the container manufacturing requirements shall be performed in accordance with the requirements in clause 8 of ISO 7866. For Type 1 steel containers, the container manufacturing requirements shall be performed in accordance with the requirements in clause 8 of ISO 9809-1 or ISO 9809-2, as applicable. ”

A5.1 BATCH TEST

A5.1.1 General

Under the first paragraph of A5.1.1, add the following paragraph:

“For Type 1 aluminium containers, the batch test requirements shall be performed in accordance with the requirements in 10 of ISO 7866. For Type 1 steel containers, the batch test requirements shall be performed in accordance with the requirements in 10 of ISO 9809-1 or ISO 9809-2, as applicable. ”

Change the first sentence of the next paragraph (second paragraph of A5.1.1) as follows:

"Containers of Type 2, 3 and 4, the following batch tests shall be required (see Table 7A.6):"

Table 7A.6 – Batch Tests

Delete the column labelled “1” under “Applicable to Container Type”.

Table 1 — Main Outstanding GRPE/ISO harmonization issue

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
A6 PRODUCTION EXAMINATION AND TEST REQUIREMENTS At the very start of this section, begin with the sentence: "For Type 1 aluminium containers, the production examination and test requirements shall be performed in accordance with the requirements in 11 of ISO 7866. For Type 1 steel containers, the production examination and test requirements shall be performed in accordance with the requirements in 11 of ISO 9809-1 or ISO 9809-2, as applicable." Make the following changes to the rest of A6: "Production examination and tests shall be carried out on Containers of Type 2, 3 and 4 ….." "iii) For metallic ~~Container(s) and~~ Liner(s), NDE in accordance……." "iv) Brinell hardness test for metallic ~~Container(s) and~~ Liner(s) in accordance……." "A summary of the required production and tests for ~~each~~ *Type 2, 3 and 4* Containers is provided…." **Table 7A.7 – Production Examination and Tests** Delete the column referring to Type 1 containers. I think this covers it. The 7866 and 9809 standards do not have a provision for "Minor Change of Design", so I think we will leave the ones in the GRPE draft regulation to include Type 1 containers.					

Summary of the discussion regarding the main outstanding GRPE/ISO harmonization issue – Type 1 Container

The differences between ISO/WI 15869-2 and the GRPE draft regulations were reviewed. Basically, ISO 15869-2 refers to ISO 9809-1, ISO 9809-2 and ISO 7866 in their entirety and specifies additional type approval tests for vehicle applications (fire protection and exterior environmental protection). On the other hand, the GRPE draft regulation:

- refers only to the material testing requirements of ISO 9809-1, ISO 9809-2 and ISO 7866 for type 1 containers;
- does not specify formula for minimum thickness but requires that a number of additional tests be performed to approve the design.

Mr. Hervé Barthélémy explained that it had been decided at the time of development of the ISO 9809 and 7866 standards to use a prescriptive approach, which provides a formula for the calculation of the minimum wall thickness. He indicated that containers meeting these requirements had proven to be safe over the years in many industrial applications. He did not see why the car manufacturer industry could not take advantage of these known standards by adopting the same approach as the ISO 15869-2. .

Mr. Rainer Bauer explained that all the ECE regulations in the field of road vehicles were performance based. He said that it was important for the car manufacturers that the ECE regulations do not specify how a component is to be designed but specify the minimum performance requirements.

Mr. Dyre Rolstad presented EIHP2's comments regarding Craig Webster' s proposal (see GRPE/ISO N039). One of the main issues that he pointed out was the differences in the scope of the ISO 9809/7866 and the draft ECE regulations. He pointed out that the temperature range was not the same and that ISO 9809 had a limit in size (150 litres). Mr. Barthélémy explained that he did not see any technical reasons that would prevent the use of the ISO 9809/7866 containers in the temperature range specified in the regulations. Mr. Ken Feith explained that liability issues had to be considered. He recommended that the GRPE group of experts should not take an exemption to an ISO standard that has been approved by the international community. He recommended that the changes should first be submitted to the approval of the international community. Ms. Gingras explained that a request to expand the temperature range could indeed be submitted to ISO/TC 58/SC 3 to revise the ISO 9809 and 7866. She also mentioned that, once the ISO 15869-2 is published, the use of the ISO 9809/7866 in the temperature range for vehicle use (-40 °C to 85 °C), would have received the approval of the international community. Mr. Barthélémy explained that ISO 11120 covered the containers that were larger in size than 150 litres.

An attempt was then made to reconcile the specific differences between the ISO 9809/7866 standards and the GRPE draft regulations. The following differences were identified:

- Pressure cycling
- Burst pressure ratio
- Formula for wall thickness
- Aluminium tanks (ISO 7866) does not require ultrasonic inspection
- Elongation for aluminium containers
- Pressure level for the proof pressure test/volumetric expansion test
- Temperature and size limits

However, this attempt was abandoned when it became apparent that the changes required to reconcile the differences would have an effect on the other types of containers (Type 2 to Type 4). In addition, it would require importing a prescriptive design formula for wall thickness into the GRPE documents – contrary to the GRPE philosophy.

In order to resolve this impasse, Mr. Barthélémy suggested that both ISO and the GRPE documents should have two options regarding the design:

- Containers could be designed as per the current version of ISO/WI 15869 and be subjected to a limited number of testing;
- Containers could also be designed as per the current GRPE requirements with an extended number of testing.

There was a general consensus among the ISO members that this compromise solution should be adopted by ISO and GRPE. Certain ISO members explained that they could not live with only the performance approach. There was a previous resolution in ISO/TC58/SC3 stating that references to ISO 9809 and ISO 7866 were to be included in ISO/WI 15869-2.

The GRPE members rejected the ISO proposal. The GRPE members did not want to accept to have two options for the design, one of which being design based with specific type 1 requirements. This was considered as not in line with the philosophy of the rest of the GRPE regulations which aim toward performance based requirements. The Chairman of the meeting finally concluded that the agreement made at the Koln meeting of the GRPE Ad-hoc WG should be supported, i.e. retain existing ECE revision 10 type 1 requirements with future alignment for GTR development through a performance-based ISO standard. ISO was sympathetic to this approach and it will proceed with both options.

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 Table 7A.3 Tensile test Footnote 1 Annex 7 Table 7A.6 Tensile test Footnote 1	ISO 15869-2, ISO 15869-3, clause 8.1.1 and 8.1.2 ISO 15869-4, clause 8.1.1 and 8.1.2	ISO/TC 197 Secretariat	Tensile test: As ISO 9809 has two parts, it is not sufficient to refer only to ISO 9809. In addition, in order to avoid confusion, the applicable paragraphs of ISO 9809-1 and ISO 9809-2, ISO 7866 should be referred to. Proposed change in footnote 1: For non-metallic *Liners* refer to Paragraph B1 of this Annex, and for metallic *Containers* or *Liners* refer to paragraph 10.2 of ISO 9809-1, ISO 9809-2 or ISO 7866 as appropriate. The same comment apply to Annex 7, Table 7A.6.	Y	

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7, Table 7A.3	ISO 15569-3 clause 8.2.1	Dynetek	ISO 15869-3 requires aluminium alloys to have an elongation of at least 12%. EIHP Annex 7 requires that tensile test results be within manufacturers specifications. To be consistent, ISO should be changed to be in line with EIHP.	N	ISO 15869-3 applies only to type 2 (hoop-wrapped) designs. Since the ends of the hoop-wrapped designs are exposed (i.e. aluminium liners are not protected by composite reinforcement), then the aluminium materials properties must have minimum elongation to ensure there will not be brittle behaviour in the event of through-wall cracking in the exposed ends. It is for this reason the elongation was left at minimum 12% for type 2 designs in ISO. The GRPE draft regulation refers to ISO 7866, which requires a minimum of 12 %. No change is required.

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			For type 3 containers, ISO requires that the manufacturer specification be met. The GRPE draft regulations refer to ISO 7866, which requires a minimum of 12 %.		For type 3 containers, ISO will modify the steel requirement so that, as for aluminium, the manufacturer specification for elongation are to be met. In order to remove the requirements regarding the elongation for type 3 containers, both ISO and GRPE are to indicate that the burst test acceptance criteria of the entire cylinder shall state that there shall not be more than 3 metallic parts. The test is to be performed as a hydraulic test. GRPE is to harmonize with ISO (aluminium and steel).

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 Table 7A.3 Charpy impact test Footnote 2 Annex 7 Table 7A.6 Charpy impact test Footnote 2	ISO 15869-2, ISO 15869-3, clause 8.1.1 ISO 15869-4, clause 8.1.1	ISO/TC 197 Secretariat	A "√ " should be added to indicate that steels are to be subjected to a Charpy impact test. As aluminium does not require that this test be performed, the reference to ISO 7866 should be removed from footnote 2. Charpy impact test: As ISO 9809 has two parts, it is not sufficient to refer only to ISO 9809. In addition, in order to avoid confusion, the applicable paragraphs of ISO 9809-1 and ISO 9809-2 should be referred to. Proposed change in footnote 2: For metallic *Containers* or *Liners* refer to paragraph 10.4 of ISO 9809-1 or ISO 9809-2 as appropriate. The same comment apply to Annex 7, Table 7A.6.	P	For Table 7A.3 & 7A.6 footnote 2 should be changed to: For steel *Containers* or *Liners* refer to paragraph 10.4 of ISO 9809-1 or ISO 9809-2 as appropriate.

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 Table 7A.3 Corrosion test Footnote 3	ISO 15869-2, ISO 15869-3, clause 8.1.2 ISO 15869-4, clause 8.1.2	ISO/TC 197 Secretariat	Corrosion test: In order to avoid confusion, the applicable paragraphs of ISO 7866 should be referred to. Proposed change: Add a footnote 3 applicable to the corrosion test: *[3] – For metallic *Containers* or *Liners* refer to Annex A of ISO 7866.	P	*[3] – For aluminium *Containers* or *Liners* refer to Annex A of ISO 7866.
Annex 7 Table 7A.3 Footnote 4	ISO 15869-2, ISO 15869-3, clause 8.1.2 ISO 15869-4, clause 8.1.2	ISO/TC 197 Secretariat	Sustained load cracking test: In order to avoid confusion, the applicable paragraphs of ISO 7866 should be referred to. Proposed change: Add a footnote 4 applicable to the Sustained load cracking test: *4 – For metallic *Containers* or *Liners* refer to Annex B of ISO 7866.	P	Proposed change: Add a footnote 4 applicable to the Sustained load cracking test: *4 – For Aluminium *Containers* or *Liners* refer to Annex B of ISO 7866 but excluding the second paragraph of Section B.2 General.

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 Table 7A.3	ISO 15869-2, ISO 15869-3, clause 8.1.1 and 8.1.2 ISO 15869-4, clause 8.1.1 and 8.1.2	ISO/TC 197 Secretariat	The ISO 15869-2, ISO 15869-3 and ISO 15869-4 all require that a bend test and a flattening test be performed as part of type approval: Test as per 10.3 of ISO 9809-1, ISO 9809-2 or ISO 7866, as appropriate. The GRPE draft regulation does not require that these tests be performed.	N	Not included in CNG standard ISO 11439. This test does not provide anything that is not already covered by the other material/performance tests. ISO is to harmonize with GRPE.
Annex 7 A3.2.2	ISO 15869-2, ISO 15869-3, clause 5.2 ISO 15869-4, clause 5.2	ISO/TC 197 Secretariat	As ISO 9809 has two parts, it is not sufficient to refer only to ISO 9809. In addition, in order to avoid confusion, the applicable paragraphs of ISO 9809-1 and ISO 9809-2 should be referred to. Proposed change: Steels for containers and liners shall conform to the material requirements of ISO 9809-1, paragraph 6.1 to 6.4 or ISO 9809-2, paragraphs 6.1 to 6.3.	Y	

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 A3.2.3	ISO 15869-2, ISO 15869-3, clause 5.3 ISO 15869-4, clause 5.3	ISO/TC 197 Secretariat	To avoid confusion, the applicable paragraphs of ISO 7866 should be referred to. Proposed change: Aluminium alloys for containers and liners shall conform to the material requirements of ISO 7866, paragraph 6.1 and 6.2.	Y	

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7: A3.3 Table 7A.5 Note 2	ISO 15869-3, clauses 6.3 ISO 15869-4, clauses 6.3 ISO 15869-5, clauses 6.3	ISO/TC 197 Secretariat	It was agreed that the wording needed to be adjusted in note 2 of Table 7A.5 to reflect that only the "structural" fibre needs to meet the stress ratio requirements if the "structural" fibre can meet the burst requirements with the "non-structural" fibres are removed. To meet the intent, should the text be written as follows: For *Container* designs using hybrid reinforcement, i.e. two or more different structural fibre types, consideration shall be given to the load share between the different structural fibres based on the different elastic modulii of the fibres. The calculated stress ratios for each individual structural fibre type shall conform to the un-bracketed values. Verification of the stress ratios may also be performed using strain gauges. The minimum *Burst Pressure* Ratio shall be chosen such that the calculated stress in the structural fibres at the minimum *Burst Pressure* Ratio times *Working Pressure* divided by the calculated stress in the structural fibre at *Working Pressure* meets the stress ratio requirements for the fibres used.	Y	

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7: A5.1.2 iii) and vi)		Dynetek	The context/logic of the proposed change is not obvious. Batch testing is consistently required for each batch, I would have thought? If this is the case, why should the manufacturer "demonstrate that containers produced since the last batch tests meet all batch test requirements"?	-	No change is required. Powertech Comment - Batch Testing - Regarding the added wording to the batch test requirement, I believe the intent was to have some way of ensuring that all batches of tanks produced under a reduced frequency of batch testing were subjected to batch testing should a tank fail reduced frequency batch testing. Clauses A5.1.2 ii) and A5.1.2 iii) specify that reduced frequency batch testing must be performed on a tank from the FIRST batch - so if it fails then I think the added wording was intended to ensure the manufacturer performed batch testing on any other batch that may have been produced during the time that testing was being performed on the first batch (this is more for the mass production of small type 1 tanks).

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7: A5.1.2 iii) and vi)		ISO/TC 197 Secretariat	It was agreed that to add at the end of Paragraph .5.1.2 vi): "The *Manufacturer* shall demonstrate that *Containers* produced since the last *Batch* test meet all *Batch* test requirements." in reply to the following comment: "The concept of batch testing of multiple batches is always difficult and open to uncertainty. Is the test conducted to approve multiple batches in the future or does it approve the previous batches that have already been shipped? If a fault is found what happens to the multiple batches covered by the test? Paragraph 5.1.2 vi) indicates that only one batch is rejected." Even though the above change was introduced in the GRPE draft regulation, the intent is not clear.	P	"The *Manufacturer* shall demonstrate that *Containers* produced since the last successful *Batch* test meet all *Batch* test requirements." It is up to the manufacturer to propose how this shall be demonstrated for the batches between the successful and unsuccessful tests.
Annex 7 B7.2		ISO/TC 197 Secretariat	B7.2 should be changed to clarify that only steels and aluminium complying with the material requirements of ISO 9809-1 and ISO 7866 are exempted from the hydrogen compatibility test. Proposed change: Use the same wording as in Annex 8, B1.2.	P	Only aluminium complying with ISO 7866, CrMo (Q & T) steels below 950 MPa tensile strength, and CMn (Q & T) below 880 MPa tensile strength are to be exempted from the hydrogen compatibility test. Other materials are to be tested in accordance with B7.

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7, B8.1		DC	Why shall the Brinell hardness test be conducted to every container? DC sees no rational for this.	N	This test is required to check that the heat treatment is done properly.
Annex 7, B8.3		DC	This is no requirement. In our opinion, the whole test should be a material test and therefore deleted at this place.	N	See above
Annex 7 B9.3			The acceptance criteria is not clear. It is to be corrected as follows: The containers tested shall either fail by leakage or shall exceed 3,0 times the number of filling cycles in accordance with paragraph 2.4.6 of this Regulation without failure.	Y	
Annex 7, B10.2 iv)		DC	How long?	Y	Change sentence to “Condition the *Container* and test fluid TO…….”

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 B12	ISO/CD 15869-3, clauses 10 ISO/CD 15869-4, clauses 10 ISO/CD 15869-5, clauses 10	ISO/TC 197 Secretariat	ISO allows that type 1 container be verified using option 2 (proof pressure test). Indeed, ISO 15869-2 refer to ISO 9809-1, ISO 9809-2 and ISO 7866. All of these standards allow that the hydrostatic test be performed using option 2. In order to ensure the harmonization, option 2 that was included in version 9 of the GRPE draft regulation could have been brought back to revision 11. However, while making these verifications, we found that no acceptance criteria had been defined for Type 1 container for the volumetric expansion test. It could have been added as well, but after another verification, we found that the acceptance criteria varies depending on the type of containers (5% for ISO 9809-1 and 10 % for ISO 9809-2 and ISO 7866). Based on this, it was deemed easier to make a reference to the appropriate paragraphs of these standards. The proposed change is as follows: Separate B12.2 in two sections Containers of Type 1 Aluminium containers shall be subjected to the test specified in paragraph 11.2 of ISO 7866. Steel containers shall be subjected to the test specified in paragraph 11.2 of ISO 9809-1 or ISO 9809-2, as applicable. Containers of Types 2, 3, 4 Use the existing text I) to v)	N	ISO is to harmonize with GRPE. 5 % is to be used for types 1 to 3 in both GRPE and ISO. A definition of permanent expansion is to be added to the GRPE (i.e. volumetric expansion after the pressure has been released) A definition of elastic expansion is to be added to the GRPE (i.e. total expansion less permanent expansion)

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 B13		VTEC	Type 2 Liners- clarification needed: Do complete Type 2 containers have to be burst tested or only the liners?	Y	Change “Number of liners to be tested: 1(Container Type 2 only)” to “Number of liners to be tested: 1(Additional test for Container Type 2 only)” Note: for type approval only B13.3 The requirement is to be changed to 1,25 times working pressure for type 2 liners.

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 B14	ISO 15869-1, clause D.2	ISO/TC 197 Secretariat	The ISO test requires that the test be carried out to failure or a minimum of 45 000 cycles. It also requires that a tank that exceeds the minimum of 15000 cycles fail by leakage and not rupture. The GRPE draft regulation test requires that *Containers* that do not fail within 3.0 times the number of *Filling Cycles* specified in Paragraph 2.4.6 of this Regulation be destroyed either by continuing the cycling until failure occurs, or by hydrostatically pressurizing to burst. It also requires that *Containers* exceeding 3.0 times the number of *Filling Cycles* specified in Paragraph 2.4.6 of this Regulation shall fail by leakage and not by rupture. However, as it is allowed that the tank be destroyed by bursting, this requirement cannot be checked. Suggestion: The GRPE draft regulation should harmonize with ISO for the type approval test. To support this suggestion, it is mentioned in the GRPE draft regulation in Annex 7B, B9.1 that the LBB test does not need to be performed if the container is proven to exceed 9 times the number of filling cycles when tested as per B.14. NOTE: The ISO and GRPE batch tests are the same	P	14.2 change final two paragraphs to: For batch testing, *Containers* that do not fail within 3.0 times the number of *Filling Cycles* in accordance with Paragraph 2.4.6 of this Regulation shall be destroyed either by continuing the cycling until failure occurs, or by performing the burst test of paragraph B.13. For type approval, containers shall be cycled until failure occurs or up to 9 times the number of filling cycles. Reword B14.3: "The Containers shall not fail before reaching 3.0 times the number of Filling Cycles in accordance with Paragraph 2.4.6 of this Regulation. If the Containers are not subsequently being hydraulically pressurized to burst, they shall either reach 9.0 times the number of Filling Cycles without failure, in which case the LBB test in Paragraph B9 of this Annex is not required, or they shall fail by leakage and not by rupture."

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Ann.7: B15.3		RA	It says, "The Container shall achieve a Burst Pressure of ≥ 1.8 times Working Pressure." This is based on the wording in ISO 15869. The former acid environment test said 85% of WP times burst pressure ratio. Change to" 0.85 times WP times burst pressure ratio"	N	
Annex 7 B18.3	ISO 15869-1 D.8	ISO/TC 197 Secretariat	The acceptance requirement in EIHP is different from ISO. Proposed change: The acceptance requirement could be modified as follows: The container shall not leak or rupture within 0,6 times the number of filling cycles specified in Paragraph 2.4.6 of this regulation, but may fail by leakage during the remaining test cycles. NOTE: This also correspond to the wording used in B20.3 for the impact damage test.	Y	

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7, B20.2 iv)		DC	What is the meaning of this paragraph? We don't understand it	-	Change "…secondary impact…" to "…bouncing…"
Annex 7: B21	ISO 15869-1 D.19	ISO/TC 197 Secretariat	A note should be added to explain that "N" refer to standard conditions. In addition, a definition of standard conditions should be added. Example: standard conditions: conditions to which the volume or other properties of a gas are referred and which are represented by a temperature of 15 °C and an atmospheric pressure of 101,3 kPa Before introducing this definition, a verification should be made to make sure that the specified value of 1 cm^3 per hour of hydrogen per litre internal volume of the container corresponds to the standard conditions defined above. If the temperature is different, the definition would have to be modified accordingly.	-	Included in Rev.10 – see 2.1.32

Table 2 —Other outstanding GRPE/ISO harmonization issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7 B22.3	ISO 15869-1 D4	ISO/TC 197 Secretariat	The GRPE draft regulation requires that both a leak test and burst test be performed after the boss torque test as part of the type approval. ISO 15869-1 only requires that a leak test be performed.	N	ISO to harmonize with EIHP for type approval testing by changing the sequence of testing. Perform the boss torque test first and then the burst and leak tests. For batch testing add: “The Container shall meet the leak test requirements.” Remove yellow highlighting from “For Type Approval”

****

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
	General	Air Liquide	Please find below my position for the ISO CD standards for H2 vehicles. I believe that in the last draft, two important concerns remain. One of them is the fact that fusible plug shall systematically be used on every cylinder type (see comments and proposal below) ISO/CD 15869-1 requires the use of thermally activated pressure relief devices (fusible plug) on every gas cylinders. 1) We know that this type of PRD is the only one which allow to evacuate the gas pressure in case of fire, even in case of low pressure in the cylinder, providing that the heat is applied onto the cylinder, not far from the PRD (that means that they are not always efficient in case of local fire). 2) We also know that some fully wrapped composite cylinders behave very badly during "standard" bonfire tests when they are not equipped with PRD. They may fragment with projection of pieces. 3) We strongly disagree however to require systematically fusible plugs on all cylinders for hydrogen vehicles, and the rational is the following :	N	After a discussion that is reported at the end of this Table, it was recognized that the principle of thermally activated PRDs is widely accepted for automotive applications. It was agreed that it would be easier to reduce the probability of leakage of PRD than the risk of fire. With the increased number of vehicles on the road, the fire risk will increase. Statistical data is required to justify removing the use of PRD. Known studies on CNG vehicles indicates that the use of PRD are preferable. _____ Under B16.2, the final paragraph is to be deleted because a PRD has to be installed (thermally activated ref. 14.4.1).

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			3.1. In Europe, several millions of industrial cylinders (single, in bundles/packs or on trailers), are used to store and to transport hydrogen. None of them are equipped with PRD. Such cylinders are sometimes taken in a fire, but we don't know a single case where this situation led to injury or fatality. The reason for not using PRD is to limit the risk of leak due to improper functioning of the PRD. It was indeed shown that unfortunately, a lot of fire or explosion were initiated by leaks of flammable gases and PRD are considered as not reliable to prevent unexpected release of gases (see attached the paper I presented in Ottawa). 3.2. In North America, it is mandatory by regulation to use PRD on every gas cylinders (except very toxic gases) but for hydrogen, the Industry decided to use only CG4 types (CGA) that is PRD consisting in bursting disk back up with a fusible plug. This is done in order to avoid the risk of unexpected release of gases in case of failure of the bursting disk (the fusible plug being normally protected by the upstream disk). 3.3. We do not believe that reliable fusible plugs for pressure as high as 350 or even 700 bar that could work, between 100 – 140 °C, for 15 years without any inspection, exist today.		

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			Consequently, it is better to limit their use to the case where they are really beneficial and to prevent an expected release of hydrogen in big cities knowing the subsequent risk of fire or explosion. 3.4. We know that PRD are also required for CNG vehicles as per the ISO standard, but the vast majority of CNG vehicles in the World uses steel cylinders without PRD. The ISO standard is very new, the number of vehicles following this standard is very limited and the flammability range of natural gases smaller than the one of hydrogen. 4) Our proposal is the following : a) "Full metal" cylinders (Type 1) and hoop wrapped cylinders (Type 2) are known to have a "good behaviour" in a fire (without PRD, they will fail but after a long enough time to allow to evacuate the zone around the fire, which is itself a big hazard). They do not need to be equipped with PRD. b) Some fully wrapped cylinders are the most critical and can fail in a fire after a short time. We are proposing to require for such cylinders the use of a fusible plug integrated in the cylinder design if it cannot be demonstrated that they are able to resist more than 5 min. in a fire without PRD. In addition, the		

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			state of the PRD should be checked at least every 3 years. For every type of gas cylinders, it should be left to the car manufacturer the possibility of using PRD of the type he wants to protect the full system and the car. The choice of the PRD (if any) should depend on the type of car, overall fire protection used for the cylinder and pressure system,…		
	General	Air Liquide	Please find attached my position for the ISO CD standards for H2 vehicles. I believe that in the last draft , two important concerns remain. One of them is the stress ratio for carbon cylinders . The value of 2.35 is really too low . DOT specification requires 3.4 and EN standards require 3.0 . I know that the ISO standard for CNG vehicle and the NGV standards require only 2.35 but the number of cylinders manufactured to these standard is limited and the experience very short (few years) and not always satisfactory (some cylinders being subject to recall) . In addition several manufacturers manufacturing cylinders to the CNG standard actually make cylinders with much higher stress ratio than require to be able to pass the other test requirements (cycle test , etc.) ; In order to not block the progress in this field , I am proposing to leave the 2.35 ratio , but to verify during the	Y	It was agreed that the burst pressure during the batch test should be in the same range as the burst pressure that was measured during the type approval test. It was agreed that a percentage of variation should be allowed. All cylinder manufacturers are invited to forward a proposal to the group of experts by 31 January 2003. The ISO/TC 197 Secretariat is to forward this invitation. The proposals will be compiled and a proposal is to be circulated to all the members of the GRPE/ISO experts for their consideration.

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			batch tests that the burst pressure is not only greater than 2.35 time the service pressure , but also greater (or the same order) than the actual burst pressure value found during the approval tests .		
Ann 7: A3.1.3		VTEC	Why does A3.1.3 refer to the appropriate type approval test, while A3.1.1 does not refer to B9?	Y	Delete "…specified in Paragraph B16 of this Annex"
Ann 7: A3.2&3		VTEC	Why are A3.2 & A3.3 in the "general" design requirements and not in A2 as they are requirements that would have to be fulfilled for type approval?	Y	Also make the following changes to A3.1: i) Delete 1st sentence in opening paragraph. ii) Delete A3.1.1 as it is only an informative statement iii) Transfer text from A3.1.2 to A6 iii) iv) A3.1.3 delete "…be designed …" v) A3.1.5 delete "…be designed to…"

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7, A3.3		DC	In our opinion, it must be possible to have a reduced burst pressure requirement under special conditions.	N	Reduced BPR deleted at Vancouver. meeting.
Ann.7: A4.2.1.vii		RA	Write “Container Types 3 and 4 only” to clarify that it is not fibre type that is meant.	Y	
Annex 7, A5.1.1 iii)		DC	Delete “the other tests” and write instead which tests are to be subjected.	P	Change to “…subjected to the other tests specified in Table 7A.6.”
Ann.7: B9-23		VTEC	B9-23 Is there any logic to the numerical order of the tests(does there need to be?): i) In terms of the tests that should be carried out to ensure basic integrity before the service simulation tests - see order of ISO tests that seems more logical (see proposed renumbering at the end of these comments). Should we	-	No test order is imposed. May be reorder for editorial purposes.

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			impose a test order for the main tests? ii) In terms of the e.g. B15 & B19 calling up a preceding test (B13). iii) It may not be necessary to undertake B9 if B14 fulfills certain requirements, so why not put B9 after B14 Proposed renumbering of B9 to B23: Old New B9 B11 B10 B17 B11 B19 B12 B23 B13 B9 B14 B10 B15 B14 B16 B12 B17 B13 B18 B15 B19 B16 B20 B18 B21 B20 B22 B21 B23 B22		

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			Or in other words the new order is: New B9 Burst B10 Ambient temperature pressure cycling B11 LBB B12 Bonfire B13 Penetration B14 Environment B15 Composite flaw tolerance B16 Accelerated stress rupture B17 Extreme temperature pressure cycling B18 Impact damage B19 Leak B20 Permeation B21 Boss torque B22 Hydrogen gas cycling B23 Hydrostatic		
Annex 7B B10.3		JASIC	"All *Containers* shall not burst at less than 85% of the *Working Pressure* times the *Burst Pressure* ratio given in Paragraph A3.3 of this Annex." As wording defining requirements after various endurance tests of Finished Containers, one that might be taken as	N	The extreme temperature pressure cycling is an extreme test that exceeds service condition requirements. It is therefore expected that the performance of the container will deteriorate somewhat during the test.

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			tolerating the deterioration of the Container is not appropriate. We propose to specify instead a safety factor for the working pressure. From this viewpoint, the wording (including figures) should be modified based on NGV1998 or NGV 2000.		
Annex 7 B13		JASIC	"The *Container Burst Pressure* shall exceed the *Working Pressure* times the *Burst Pressure* ratio given in Paragraph A3.3 of this Annex." The "Burst Pressure ratio given in Paragraph A3.3 of this Annex" is nothing but the actual performance of existing containers. Not to hamper the progress of technology, we propose to add the term and definition of "Minimum required burst pressure (2.25 times working pressure) as in NGV 2000 or 2001 US FMVSS.The wording (including figures) in the provision on burst pressure should be harmonized based on 2001 US FMVSS related to compressed natural gas, which has been already put into force, or NGV 2000, the document based on which US FMVSS was made.	N	At the request of regulatory authorities, the use of the stress ratios as burst pressure ratios was required to allow for the performance-based assessment of design.
			The following is an excerpt of 2001 US FMVSS.		

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			S7.2 *Hydrostatic burst test.* S7.2.1 Each Type 1 CNG fuel container shall not leak when subjected to burst pressure and tested in accordance with S8.2. Burst pressure shall not be less than 2.25 times the service pressure for non-welded containers and shall not be less than 3.5 times the service pressure for welded containers. S7.2.2 Each Type 2, Type 3, or Type 4 CNG fuel container shall not leak when subjected to burst pressure and tested in accordance with S8.2. Burst pressure shall be not less than 2.25 times the service pressure.		
			(Reference) Description of burst pressure in 1999 US FMVSS		

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			S7.2 *Hydrostatic burst test.* S7.2.1 Each Type 1 CNG fuel container shall not leak when subjected to burst pressure and tested in accordance with S8.2. Burst pressure shall not be less than 2.25 times the service pressure for non-welded containers and shall not be less than 3.5 times the service pressure for welded containers. S7.2.2 Each Type 2, Type 3, or Type 4 CNG fuel container shall not leak when subjected to burst pressure and tested in accordance with S8.2. Burst pressure shall not be less than the value specified in Table 1 times the service pressure, as follows: TABLE 1.—STRESS RATIOS Material / Type 2 / Type 3 / Type 4 E–Glass ..... 2.65 / 3.5 / 3.5 S–Glass ..... 2.65 / 3.5 / 3.5 Aramid ..... 2.25 / 3.0 / 3.0 Carbon ..... 2.25 / 2.25 / 2.25		

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Ann.7: B15		VTEC	B15 Environment test requires a burst test in accordance with B13, then we have a conflict between the requirements of B15 and B13, suggest that the reference to B13 in B15 is clarified to "Paragraph 13.2 of this Annex".	Y	
Ann.7: B19		VTEC	B19 Accelerated stress rupture test requires a burst test in accordance with B13, then we have a conflict between the requirements of B19 and B13, suggest that the reference to B13 in B19 is clarified to "Paragraph 13.2 of this Annex". Also applies to B10 Extreme Temperature Pressure Cycling Test	Y	
Ann.7: B15		RA	Is it an environment or an environmental test?	P	Reword to “Chemical Exposure Test” and change all references

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Ann.7: B15.2 iii) a)		Opel	Change to “19% solution by volume in water” and delete reference to specific gravity to harmonize with ISO.	Y	
Ann.7: B19.3		VTEC	Reword requirement from "85%" to "0.85 times"	Y	
Annex 7B B19.3		JASIC	“The *Container* shall achieve a *Burst Pressure* of ≥ 85% of the *Working Pressure* times the *Burst Pressure* ratio given in Paragraph A3.3 of this Annex.” The same proposal as the one related to Annex 7, B10.3 for the same reason.	N	The accelerated stress rupture is an extreme test that exceeds service condition requirements. It is therefore expected that the performance of the container will deteriorate somewhat during the test.
Ann.7: B22		VTEC	i) B22 Boss torque test requires a burst test in accordance with B13, suggest that the reference to B13 in B22 is clarified to "Paragraphs 13.2 & 13.3 of this Annex". ii) B22.2 Where is the test sequence given in Table 7A.6, does it mean Para. A5.1.1?	i) Y ii) P	ii) Change reference to footnote 4 of Table 7A.6

Table 3 – Comments on the GRPE draft regulations or the ISO draft standards that could have an effect on the GRPE/ISO harmonization

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Ann.7: B22		VTEC	i) Remove unwanted yellow highlighting	Y	

Summary of the discussion related to the use of pressure relief devices (PRD)

Mr. Hervé Barthélémy made a presentation regarding the risks associated with the use of PRD (see GRPE/ISO N040). He explained that the failure of PRD may result in leaks that have a high flammability range due to the nature of hydrogen. His point of view is that the use of PRD may introduce higher risks than the risks associated with the absence of PRD in case of fire, which can result in the rupture of the cylinders.

He suggested that the use of PRD should not be made mandatory on all types of containers. Basically, his proposal was as follows:

- Option 1:
    - Type 1 and type 2 containers: These containers have a good behaviour in fire. Therefore the use of PRD shall not be mandatory. There is no need to have a PRD installed on the cylinders.
    - Fully wrapped cylinders: Thermally activated PRD is required, if cylinders cannot resist 5 minutes in a standard fire (note: ISO 11119 requires only 2 minutes)
- Option 2: For every type, the car manufacturer should decide if the use of PRD is required and which type of PRD will protect the full system.

Mr. Livio Gambone explained that Powertech had done a risk analysis concerning the chances of premature failures in PRDs for CNG vehicles. The analysis showed that the risk was less than many other industry PRD applications.

Mr. Bauer explained that the tank systems installed on cars are highly sophisticated systems that are not the simple systems shown in Hervé's presentation. He explained that the vehicle manufacturers take into account all the factors and make sure that these cars are safe.

Mr. Hervé Barthélémy indicated that he wanted to get this message across to the members for their considerations. In his opinion, each car manufacturer should be allowed to decide what is best for their specific situation.

The general opinion was that the principle of thermally activated PRDs is widely accepted for automotive applications. It was agreed that it would be easier to reduce the probability of leakage of PRD than the risk of fire. With the increased number of vehicles on the road, the fire risk will increase.

It was recognized that statistical data would be required to justify removing the use of PRD. Known studies on CNG vehicles indicate that the use of PRD are preferable.

****

Table 4 — Editorial Issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Annex 7: A1 References		EIHP2	Change reference to ISO 9809-2:1999 to ISO 9809-2:2000	Y	
Ann 7: A2/3		VTEC	Why does A3 Container Design Requirements follow A2 Container Type Approval Requirements? Switch them around.	Y	Change “Container Type Approval Requirements” to “Approval Requirements” and “Container Design Requirements” to “General Requirements” Change texts as appropriate.
Ann 7: Table 7A.4		VTEC	Delete blank line from Table 7A.4	Y	

Table 4 — Editorial Issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
Ann 7: A3.2.5		VTEC	Insert line at end of A3.2.5	Y	
Ann. 7: A4.3.viii		RA	Write “Paragraph” instead of “Section”.	Y	
Annex 7 B10.1			Only types 2, 3 and 4 should be referred to. Type 1 should not be referenced.		
Ann.7: B1-B23		VTEC	In the sampling section of each test, why not make a clear statement regarding which type of test it is, i.e. type approval, batch or production: B10.1 Sampling The test applies to all Container Types.	Y	

Table 4 — Editorial Issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			Type approval testing: Number of Finished Containers to be tested: 1		
Annex 7 B7.2		EIHP2	Paragraph alignment	Y	
Annex 7 B9.3		ISO/TC 197 Secretariat	Editorial change. Remove one "fail" from the sentence.	Y	
Ann.7: B10		VTEC	B10.2 "Applies to Container Type 4 only"..Change to.."Applies to Type 4 Containers only"	Y	

Table 4 — Editorial Issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection
			B10.3 "Containers of Type 4".. Change to.."Type 4 Containers")		
Annex 7B B10.3		EIHP2	Change “All Containers…” to “The Container…”	Y	
Annex 7 B12		EIHP2	i) Change title from “Hydrostatic Test” to “Hydraulic Test” ii) Change “…containers of Type x…” to “….Type x container …”	Y	
Ann.7: B16.2		RA	Change to “(…) of 5.0 MPa at 15 °C.”	Y	
Ann.7: B22		VTEC	ii) Remove unwanted yellow highlighting	Y	

Table 4 — Editorial Issues

Paragraph/ Annex	Related clause in ISO drafts	Organisation	Comments/Proposed Modification	Agreed	Final Modification Or Reason For Rejection

****