

[DRAFT Meeting Notes]

4th Meeting of the Informal Working Group on Hydrogen and Fuel Cell Vehicles

Global Technical Regulation No. 13 (Phase 2)

16-18 October, 2018 – Brussels, Belgium

	Agenda Items	Presenters	Documents
0	Welcome and practical arrangements	P. Broertjes	--
1	Organization <ul style="list-style-type: none"> • Co-chairmanship: N. Nguyen (US/NHTSA); H. Ito (JPN/METI) • Co-vice chairmanship: H. Seo (Korea); Y. He (China) • Secretary: Y. Fujimoto (JPN/OICA) • Attendees: See list of attendees in appendix 	N. Nguyen	--
2	Approval of the agenda <ul style="list-style-type: none"> • Requesting presentations to be submitted to Secretary at least 2 weeks before the meeting so IWG members can review 	N. Nguyen	GTR13-4-01
3	Approval of the meeting minutes of the 3rd meeting <ul style="list-style-type: none"> • No comments from IWG members; Agenda approved 	N. Nguyen	GTR13-3-25
4	Review of Terms of Reference <ul style="list-style-type: none"> • Focus is on main technical topics of Phase 1 • Mandate to conclude by Dec 2020 → finalize text by mid-2020 	N. Nguyen	GTR13-2-15
5	Update on ongoing and planned research and rulemaking activities <ol style="list-style-type: none"> <u>Canada (Hendershot)</u> – Not much change since last update. Still planning on performing crash test of Mirai (timing tbd). Will present test plan at next IWG meeting. <u>EC (Broertjes)</u> – Commission has published the revised GSR, part of the 3rd Mobility Package. EC79 will be repealed, refer to UNR134. ECE to be working on finalizing technical proposals (previously annexes). EU will add material provisions on national level and will be included or linked to the revision of the GSR. <u>China (He)</u> – New and ongoing work on standards (GB/T) continues. FCV standardization to be included in EV. <u>China (Bei-Sun)</u> – Update on hydrogen vehicle and infrastructure progress in China. Type 4 cylinders are allowed for 35 MPa use, but not for high pressure application (no timeline for Type 4 standards). <u>Japan (Ito)</u> – Announcement that there will be a Hydrogen Energy Ministerial Meeting in Japan on 23rd Oct in Tokyo, hosted by METI. The purpose is to discuss cooperation on hydrogen technology, formulating a global initiative on hydrogen <u>Korea (Seo)</u> – Korea developing safety standards for HDV. Also KGS investigating material compatibility (metals and polymers). Progress to be informed at future IWG meetings USA (Nha) – NHTSA Rulemaking is in process of preparing NPRM to adopt GTR13 after completing series of tests on containers. NHTSA management to decide whether adopting phase1 now or wait until the completion of phase 2 prior to adopting. 	Contracting Parties	GTR13-4-16 GTR13-4-18 GTR13-4-05
6	ISO TC197 Update <ol style="list-style-type: none"> Provided program update. Most items in DIS or FDIS status. Plenary , WG24 mtg to be held 12/6-7 in Vancouver. 	A. Tchouvelev	GTR13-4-04

Draft Notes - GTR13 Informal Working Group Meeting (October, 2018)

7	SAE Update	G. Scheffler (SAE)	--
	a. Continued discussions on material compatibility, stress rupture and fire test. Details in the corresponding sections below.		
8	CSA CHMC2 Update	B. Hobein for CSA	GTR13-4-13
	a. Draft being circulated for industry review before public review in November. Goal is to ballot in early 2019.		
9	Schedule of the project	Y. Fujimoto	GTR13-4-02
	a. Mid-2019: Provide first draft of GTR13 Phase 2 at June IWG. b. Oct 2019: Complete TF work c. Early 2020: As needed, request for extensions of mandate can be made to GRSP/WP29 d. End 2020: Submit informal draft to GRSP		
10	Industry presentation: Nikola	J. Schneider	GTR13-4-20
	a. Nikola presented company background, current activity and plans for production of heavy duty trucks and fueling stations.		
11	Taskforce #1 (Heavy Duty Vehicle) Update	M. Kwon (KATRI)	GTR13-4-14
	a. TF leader presented list of current proposed items from TF members. b. Submitted topics include: (1) vehicle categorization; (2) post-crash fuel system integrity; (3) TPRD discharge direction; (4) permeation and garage size.		
12	GTR13 Permeation Rate for HDV	A. Ruiz (Nikola)	GTR13-4-19
	a. Presented review of permeation requirements currently in GTR13 and how permeation rate would need to change based on larger tank capacity. b. SAE stated the current permissible permeation is based on a very conservative scenario and independent of garage size. c. IWG agree to review more closely to see if changes are required.		
13	Taskforce #2 (Receptacle)	L. Gambone (Nikola)	--
	a. Taskforce continues discussion on language of receptacle in GTR13. Aim to finalize by next IWG.		
14	Report-out from Taskforce #1 (HDV) Meeting	M. Kwon (KATRI)	GTR13-4-21
	a. TF leader (Kwon) reported that he will set up monthly Webex meetings on the 3 rd Thur starting in November (1:00 pm GMT). b. CP advised TF to focus on identifying and discussing a list of possible requirements including those in current GTR13 for HDV		
15	Material Compatibility	G. Scheffler (SAE)	GTR13-4-07
	a. Many issues have been resolved among CP (SSRT pressure reduction to 1.25 NWP, gas quality purge every 12 month, acceptance of generic language for welding, acceptance of notched and smooth specimens for FLT) b. Unresolved issues: HG-SCC test method (see item 17 below) and evaluation metrics for SSRT (relative vs absolute properties). Goal is to come to final agreement to test methods, review lab results and conclude by March IWG. c. China and Korea expressed interest in conducting the material test. Japan will provide test samples to China and Korea. d. Discussion points: How to include “good” materials in GTR, perhaps in appendix. List exists in SAE J2579, but not all CP find it acceptable.		
16	Humid Gas - Stress Corrosion Cracking (HG-SCC) for Aluminum Alloys	H. Tamura (JARI)	GTR13-4-06
	a. Presented test plan and rationale for test conditions. Plan is to test 6061-T6 and 7075-T6 in humid vs. dry hydrogen at -30°C. SSRT test to be performed in Oct. b. Japan presented its test results and the data showed the test is not conclusive as 7075 failed at 1mm thickness but 5mm thickness passed. Japan will conduct more testing. c. IWG is not convinced that this requirement is needed at this time and the test procedure still requires more research		

17	Material Compatibility for Aluminum: Wrap-up	N. Nguyen	--
	<ul style="list-style-type: none"> a. US: Difference between reliability and design issues. If manufacturers decide to use certain materials, they are responsible for its design. Material requirements are suitable as recommended practice in industry standards. The US at this point would not consider to adopt HG-SCC. b. Canada: Same as US. View HG-SCC as a reliability issue, intention is not to influence design. Would not adopt HG-SCC at this point. c. EU: Need more research to be done. The proposed test is considering only 2 types of aluminum, which may not be enough. d. Korea: Would like to get data from own research and production companies. Prefer to leave as standard and not regulation. e. Japan: Propose to continue to discuss at next IWG. 		
18	Initial Burst Pressure Requirement	H. Tamura (JARI)	--
	<ul style="list-style-type: none"> a. New 200 NWP requirement is now included in SAE J2579: 2018. b. Self-certification CP may not be able to select vessels in the same batch. As a result, the $\pm 10\%$ may not be applicable. Language has been discussed in TF3 and proposed. See #19 below. c. Brief comment from CEA: Reductions in the burst pressure should be considered carefully. Referenced pre-normative study HyCOMP study where damage can occur when laminate is over loaded. d. CN: 200NWP is acceptable for Type 3 or Type 4 tanks for 70MPa only. Not for 35 MPa due to the absolute differences in pressure between initial and 200% NWP. e. EU, JPN, KOR: OK with 200%NWP for 35MPa and 70MPa f. US, CAN: Need time to review, but support JARI's rationale. 		
19	Taskforce #3 (Test Procedure Improvements) Update	L. Gambone (Nikola)	GTR13-4-22 GTR13-4-23
	<ul style="list-style-type: none"> a. TF #3 met on Monday, 15 October. TF leader provided update of status of proposals to date. b. 4 main issues: (1) WG24 presented tank over-temp scenarios; (2) permeation steady state; (3) storage systems with repeating elements – how to perform gas cycling tests; (4) fire test procedure g. For initial burst pressure, added the following to Section 5.1.1.1. “For the purpose of market surveillance or compliance validation testing, the containers do not need to be sourced from the same manufacturing batch. In this case, the tested containers do not need to have a burst pressure within +/- 10% of BPO.” h. The TF will continue to discuss remainder of the table of comments. i. In person meeting will be the day before the next IWG meeting. 		
20	Taskforce #4 (Fire Test) Update	G. Scheffler (SAE)	GTR13-4-08
	<ul style="list-style-type: none"> a. Objectives of Phase 2: (1) Address variability (fire width, height and uniformity) in fire test results (especially to better define wind barrier); (2) Expand to HDV: JARI provided data for original fire test, but no HDV data is available. Will use CNG as basis; (3) Other situations and alternatives: Canada suggested that batteries as fire source has already been addressed in EVS GTR, and there are measures to prevent it from being a fire threat. May not need to be addressed here. 		
21	Leak No Burst (LNB) Safety Technology for Type IV Tanks	V. Molkov (Ulster)	GTR13-4-12
	<ul style="list-style-type: none"> a. Introduced LNB safety technology consisting of a RFP layer, an outer thermal protection layer (could be load bearing), and a liner that melts to leak gas through walls of tank before rupture b. Prototype numerical testing results demonstrates no rupture in fire, to confirm with larger volume tank c. IWG comment: This is still in research phaseshould be discussed at industry standard level first. 		
22	Taskforce #5 (ISO TC197) Update	A. Tchouvelev	GTR13-4-03 GTR13-4-15
	<ul style="list-style-type: none"> a. Taskforce leader reviewed proposals that have been resolved by TF in Korea, provided to Secretary. b. TF leader proposed additional items to infrastructure. c. IWG comment: Contracting Parties agreed that infrastructure items are not appropriate to include in the regulatory text of the GTR. However, IWG were not able to come to a consensus on how it should be expressed in the document. One option is to draft a section describing fueling interface and other fueling-related items for rationale section as background. This should include any relevant standards (ISO, SAE, etc.). However, JAMA was not in favor and requested to continue the discussion at the next IWG. 		

Draft Notes - GTR13 Informal Working Group Meeting (October, 2018)

23	Long-term Stress Rupture	G. Scheffler (SAE)	GTR13-4-09 GTR13-4-10																																								
	<ul style="list-style-type: none"> a. Presented follow-up to proposed change to high temperature static pressure test (increase to 1.5NWP for 105 hrs) b. Purpose of test is to provide ability to verify a new fiber, new wrap and see if stress ratios have been violated. c. Addressed suitability for Type 3 COPVs. FEA of Type 3 carbon and glass COPVs at 1.5NWP and 85°C are required to understand stresses and can establish the effectiveness of the proposed test. d. Next steps: Perform FEA and then verification testing. 																																										
24	Liquid Organic Hydrogen Carrier (LOHC)Technology	Y. He (China)	GTR13-4-17																																								
	<ul style="list-style-type: none"> a. Presented LOHC technology – a type of “hydrogen oil” that is stable, reversible, and has high storage capacity. b. Already being demonstrated at a fueling station (600kg of H2 in 10m3 tank). Currently only usable for HDV (buses, trucks) 																																										
25	Action Items	A. Ryan	GTR13-4-24																																								
	<ul style="list-style-type: none"> • See last page or GTR13-4-24. 																																										
26	Review of Schedule	Y. Fujimoto	GTR13-4-02																																								
	<ul style="list-style-type: none"> • Review of schedule based on discussions in the past 3 days 																																										
27	Next IWG meetings																																										
	<p>2019 March 5-7: North America (Specific location TBD) 2019 June 18-20: China (CATARC/Tianjin) 2019 Nov 5-7: EU</p>																																										
28	APPENDIX: Attendees List																																										
	<table border="0"> <tr> <td>Air Liquide</td> <td>ITM Power</td> <td>MLIT/Korea</td> <td>Plastic Omnium</td> </tr> <tr> <td>CATARC</td> <td>ISO TC197</td> <td>OICA/Audi</td> <td>Powertech Labs</td> </tr> <tr> <td>CEA</td> <td>JASIC</td> <td>OICA/BMW</td> <td>Shanghai Re-fire Technology</td> </tr> <tr> <td>DOE (US)</td> <td>JARI Japan</td> <td>OICA/Ford</td> <td>SAE</td> </tr> <tr> <td>Bosch</td> <td>KATRI</td> <td>OICA/GM</td> <td>Shell Hydrogen</td> </tr> <tr> <td>European Commission</td> <td>KHK/Japan</td> <td>OICA/ Honda R&D</td> <td>Transport Canada</td> </tr> <tr> <td>Faurecia</td> <td>Kiwa Nederland</td> <td>OICA/Hyundai Europe</td> <td>US/NHTSA</td> </tr> <tr> <td>Great Wall Motors</td> <td>KPIT Technologies</td> <td>OICA/Hyundai R&D Korea</td> <td>Ulster Univ.</td> </tr> <tr> <td>Hexagon Lincoln</td> <td>Nikola Motors</td> <td>OICA/Toyota</td> <td>Zhejiang Univ</td> </tr> <tr> <td>Hexagon Composites</td> <td>METI/ Japan</td> <td>OICA/VW</td> <td></td> </tr> </table>	Air Liquide	ITM Power	MLIT/Korea	Plastic Omnium	CATARC	ISO TC197	OICA/Audi	Powertech Labs	CEA	JASIC	OICA/BMW	Shanghai Re-fire Technology	DOE (US)	JARI Japan	OICA/Ford	SAE	Bosch	KATRI	OICA/GM	Shell Hydrogen	European Commission	KHK/Japan	OICA/ Honda R&D	Transport Canada	Faurecia	Kiwa Nederland	OICA/Hyundai Europe	US/NHTSA	Great Wall Motors	KPIT Technologies	OICA/Hyundai R&D Korea	Ulster Univ.	Hexagon Lincoln	Nikola Motors	OICA/Toyota	Zhejiang Univ	Hexagon Composites	METI/ Japan	OICA/VW			
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Action Items 4th IWG Meeting

	Topic	Discussion at 4 th IWG Meeting	Action	Responsible Person	Due Date
1	Vehicle Class (TF#1)	<ul style="list-style-type: none"> • TF leader provided schedule of meetings and proposed topics • TF members met to discuss schedule and next steps • Team provided timeline of meetings (webex mtgs starting in Nov), if in-person needed then inform cosponsors. 	<ul style="list-style-type: none"> • TF leader to provide update at next IWG • Create a list of “gaps” for HDV in current regulation 	TF1 leader	Next IWG (MAR)
2	Receptacle (TF#2)	<ul style="list-style-type: none"> • TF leader provided update (ongoing discussion) 	<ul style="list-style-type: none"> • TF leader to present proposed text at next IWG meeting 	TF2 leader	Next IWG (MAR)
3	Recommendations for test procedures (TF#3)	<ul style="list-style-type: none"> • TF leader reviewed progress of submitted comments. Majority are dispensed. 	<ul style="list-style-type: none"> • TF to meet again in-person at next IWG, day before 	TF3 leader	Next IWG (MAR)
4	Fire test reproducibility (TF#4)	<ul style="list-style-type: none"> • TF leader identified areas to be investigated for reproducibility and HDV and other cargo burning. • Width, height and uniformity of fire were discussed 	<ul style="list-style-type: none"> • TF to continue discussion • Next steps: Next SAE is Feb 5-6 is in Torrance, CA • Will decide if separate TF4 mtg or join with SAE 	TF4 leader	Next IWG (MAR)
5	Recommendations from ISO TC 197 (TF#5)	<ul style="list-style-type: none"> • TF5 leader provided proposed changes agreed to by TF in ISO format • Interface topics discussed as well 	<ul style="list-style-type: none"> • Draft language from table • TF to draft fueling interface and other related fueling items for consideration in rationale section 	Secretary TF5 leader	Next IWG (MAR)
6	Initial burst pressure (225 → 200 NWP) for carbon fiber	<ul style="list-style-type: none"> • EC, JPN, Korea agree to 200% NWP • China: 200% NWP is OK for 70MPa but not for 35 MPa • Canada supports rationale but needs to review • General agreement but reservations from US, Canada 	<ul style="list-style-type: none"> • US, Canada to review proposal • Need to better understand China rationale for not including 35MPa 	US, Canada Request China to provide more detailed rationale	Next IWG (MAR)

Draft Notes - GTR13 Informal Working Group Meeting (October, 2018)

7	Material compatibility	<ul style="list-style-type: none"> • Update of status of open items from last IWG • All items initially agreed to except 2 outstanding issues: • Relative comparison for SSRT • HG-SCC 	<ul style="list-style-type: none"> • Rationale text needed • Next steps: provide available test results • CP to continue discussion • Next steps: Material experts to meet at next SAE meeting in Feb 5-6 	C. San Marchi / SAE	Next IWG (MAR)
8	HG-SCC (Aluminum)	<ul style="list-style-type: none"> • JARI provided plan to test in humid H2 conditions • Canada, US: This is reliability issue, not safety. Does not seem like it should be in regulation, but in standard. • JRC: More research required (only 2 types being considered) • China: Agree with US • Korea: Need time to review test methods with experts. Should be standard not regulation. 	<ul style="list-style-type: none"> • Continue discussion, provide any updates on verification of test method and data • Provide update at next IWG 	JARI	Next IWG (MAR)
9	Long-term stress rupture	<ul style="list-style-type: none"> • Addressed the applicability of the performance test to Type 3 	<ul style="list-style-type: none"> • Provide update on test verification • Next steps: analysis and tests 	SAE	Next IWG (MAR)
10	Materials compatibility (polymers)	<ul style="list-style-type: none"> • Update regarding progress of CHMC2 • Draft available 	<ul style="list-style-type: none"> • Review document if interested 	IWG	
11	Static roll-over test	<ul style="list-style-type: none"> • To be included in TF1 	<ul style="list-style-type: none"> • See TF1 → 	→	→
12	Post-crash safety	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • N/A 	TBD	TBD
13	High voltage safety	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • N/A 	TBD	TBD
14	Liquid hydrogen	<ul style="list-style-type: none"> • Not discussed 	<ul style="list-style-type: none"> • N/A 	N/A	N/A
15	Editorial improvement	<ul style="list-style-type: none"> • Not discussed 	<ul style="list-style-type: none"> • N/A 	N/A	N/A
16	International standards and regulations	<ul style="list-style-type: none"> • Not discussed 	<ul style="list-style-type: none"> • All members to review and update 	All CP	As necessary
17	Research Items	<ul style="list-style-type: none"> • Presentation only 	<ul style="list-style-type: none"> • N/A 	N/A	N/A