12th IWG GTR 13
Status of TF 1

Annett Schuessling, OICA

HE Yuntang, CATARC

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ITEM	STATUS	Contents	
TPRD Direction	Revision of OICA Proposal	Proposal: no angles, requirement of spaces not to vent towards	✓
Crash requirements / Sled Test	Revision of EC proposal	Proposal: Acceleration pulses from UN-R 134 Tendency: CP option	Open
Service life	Revision of OICA Proposal	Proposal: No change needed Tendency: CP option	Open
Vehicle Class	Reached agreement, editorial revision of scope needed	Categories 1 and 2	✓
Installation requirement of container	Reached agreement	No need	✓
Hydrogen Leakage Criteria(in-use)	Reached agreement	After Crash, 118NL/min/1hr	✓
Permeation Criteria	Reached agreement	(LDV, HDV) 55℃, After 30hrs Less 46mL/h/L	✓

TPRD direction

5.2.1.3.1. Pressure relief systems (para. 6.1.6. test procedure)

(a) Storage system TPRDs.

The outlet of the vent line, if present, for hydrogen gas discharge from TPRD(s) of the CHSS storage system shall be protected from ingress of dirt and water (e.g. by a cap);

(b) Storage system TPRDs.

The hydrogen gas discharge from TPRD(s) of the CHSS storage system shall be directed such that the hydrogen exhaust does not impinge upon:

(i) enclosed or semi-enclosed spaces;

(ii) any vehicle wheel housing;

(iii) hydrogen gas containers;

(iv) the vehicle's REESS.

Rationale for TPRD direction

a. Rationale for paragraph 5.2.1.3.1. pressure relief systems

78. The vent line of storage system discharge systems (TPRDs and PRDs) should be protected by a cap to prevent blockage by intrusion of objects such as dirt, stones, and freezing water. Horizontal discharge, i.e., parallel to the road surface, should be avoided in order to protect first responders, and other road users and adjoining buildings from potentially harmful ignited discharge directly. Vertical discharge direction should consider potential releases in tunnel and underground car parking garages. In addition, it is recommended to not direct the TPRD towards any exits of buses to avoid hindering passengers from leaving the vehicle in case of a breakdown or accident.

Summary TPRD direction at TF 1

CP	Agree	Comment
US	✓	
China	✓	
EU	✓	
Korea	✓	
Japan	✓	
Canada	✓	

Service life – proposal

5.1.1.2. Baseline initial pressure cycle life

Three (3) new containers randomly selected from the design qualification batch are hydraulically pressure cycled ~~at 20(±5)°C to 125 per cent NWP without rupture for 22,000 cycles or until a leak occurs (para.~~ **in accordance with paragraph** 6.2.2.2. ~~test procedure).~~ **The container attachments, if any, shall also be included in this test, unless the manufacturer can demonstrate that the container attachments do not affect the test results and are not affected by the test procedure**. Leakage shall not occur within a number of **cycles** ~~Cycles~~, where the number of **cycles** ~~Cycles~~ is set individually by each Contracting Party [~~at 5,500, 7,500 or 11,000 cycles for a 15-year service life.~~ **at 5,500 or 7,500 cycles** ~~for a service life of 15 years~~ or less, or at 11,000 **cycles** ~~for a service life or 25 years~~ for a maximum service life of up to 25 years.

6.2.2.2. Pressure cycling test (hydraulic)

The test is performed in accordance with the following procedure:

(a) The container is filled with a **hydraulic** ~~non-corrosive~~ fluid;

(b) The container and fluid are stabilized at **the ambient temperature of 20 ± 15 °C** ~~the specified temperature~~ and relative humidity at the start of testing; the environment, fuelling fluid and **the surface of the test article** ~~container skin~~ are maintained at the specified temperature for the duration of the testing. The container temperature may vary from the environmental temperature during testing;

(c) The container is pressure cycled between ≤ **2** ~~2 (±1)~~ MPa and ~~the~~ ≥ **125 per cent NWP** ~~target pressure~~ at a rate not exceeding 10 cycles per minute for ~~the specified number of~~ **[two times the number of** cycles **as specified in para. 5.1.1.2. or until a leak occurs]**;

(d) The temperature of the hydraulic fluid within the container is maintained and monitored at **20 ± 15 °C** ~~the specified temperature~~.

(e) The container manufacturer may specify a hydraulic pressure cycle profile that will prevent premature failure of the container due to test conditions outside of the container design envelope.

Service life – JAMA (rationale)

Extension of the service life of the container to 25 years
– Determination of the number of the pressure test cycles

JAMA

The maximum lifetime miles traveled within the category of LDV/T and HDV/T were estimated to determine the number of the pressure test cycles. The study is based on the vehicles in Japan.

1. Japanese (JAMA) study

(1) **Summary**

The estimated maximum lifetime miles traveled and lifetime number of pressure cycles are shown in Table 1. It is considered that the 1,1000 cycles in the pressure cycle test of current GTR13 can be applied to both heavy duty and light duty vehicles for 25 years.

The analyzed data were Japanese legal inspection records in July 2017. The number of record was about 6,000 for LDV/T and 21,000 for HDV/T.

The maximum lifetime miles traveled was calculated by summing the estimated maximum VMT (Vehicle Mileage Traveled) in each vehicle age. Number of pressure cycles were calculated by applying a fill per traveled mileage of 320 km for light duty and 400 km for heavy duty.

Table 1. Results of Japanese study

Vehicle Type	Max svc. life	Max lifetime miles traveled	Lifetime N of fills (=pressure test cycles)
HD Commercial	20 yrs 25 yrs	3,500,000 km 4,000,000 km	8,500 9,800 (fill / 400km)
LD Commercial	20 yrs 25 yrs	2,100,000 km 2,400,000 km	6,600 7,400 (fill/320km)

(2) Points of the study

① Analyzed data

The major items of the inspection records are shown in Table 2. They were obtained in the legal inspection in July 2017 from about 400 thousands on-road vehicles.

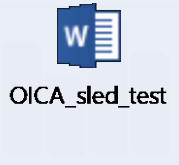
Special note is;

- HDV/T are defined as below:
  Number of seats>10 (according to Japanese categorization)
  Loading capacity>1250kg (assuming the vehicle weight more than 3,500kg)

Summary Service life at TF 1

CP	Agree	Comment
US		- No service life limit - Prefer a test of minimum performance representing a service life of 25 years - Prefer CP option
China		- CP option ok - Range for hybrid HDV could be more than 1,000 km - Cycles could be too high - Would like to consider different power sources (e.g. hybrid)
EU		- CP option is ok - Will opt for 11,000 cycles
Korea		- CP option is ok - Regardless of the service life number of cycles should be 11,000 cycles
Japan		- CP option is ok - Will opt for 11,000 cycles
Canada		- Agrees with US - Test of minimum performance representing sevice life of 25 years preferred - CP option preferred

Sled test – proposals

EU proposal	OICA proposal (revised EU proposal)
• Pulses originally from UN regulation no. 134 to be amended according to a study conducted by TRL • decision at GRSP level • EU to provide a rationale for this test	• Amended to reflect the status of UN regulation no. 134
	

Summary Sled test at TF 1

CP	Agree	Comment
US		- Prefer CP option
China		- CP option is ok
EU		- CP option is ok
Korea		- CP option is ok
Japan		- CP option is ok
Canada		- CP option is ok

Thank you!