



1 Background

The ad hoc group on Hydrogen Vehicle Fuel System (HVFS) was created after the 16th plenary meeting of ISO/TC 197 with the objective of developing a path forward for the standardization of HVFS. More specifically, the ad hoc group was asked to look into the scope of the HVFS and the safety issues associated with hydrogen storage and use on board.

2 Work done

As a first step, a survey and a proposed schematic of the HVFS (see page 4) were prepared. Members of the ISO/TC 197 HVFS ad hoc group as well as relevant stakeholders including automotive OEM and tank manufacturers were consulted. Only the aggregated results of this survey are included in this report. It is important to note that this work is considered to be only a preliminary look at the HVFS system.

The consultation clearly shows that the HVFS is quite complex and that a number of safety considerations have to be taken into account to ensure its integrity. Most of the components can lead to safety concerns in case of failure. The results show that some components such as the fuel tank, the thermally activated pressure relief device protecting the fuel tank and the high pressure lines and fittings are critical to the integrity of the HVFS.

It would be useful to take a further look at the following:

Scope

- The options to be considered such as the use of multiple tanks.

Critical components

- Identify the critical components of the HVFS that need to be separately tested and certified.

Other safety aspects

- Identify the other safety aspects that need to be put in place, for example: overpressure protection of the low pressure system.

Integrity

- Define how the assembly of the HVFS should be tested to ensure its integrity.

It would be useful to address how best to proceed with the standardization work. One of the options would be to work with ISO/TC 22 to revise ISO 23273-2 *Fuel cell road vehicles — Safety specifications — Part 2: Protection against hydrogen hazards for vehicles fuelled with compressed hydrogen*, which is broader in scope than the HVFS. Another option would be to have a standard that only covers the requirements of the HVFS.

3 Next steps

The HVFS ad hoc group will continue its work to develop a better understanding of the HVFS scope, options, safety aspects and a path forward for the standardization work..

Aggregated results

Survey questions	Percentage of replies
A. Identification Please indicate which group of stakeholders are you representing: Automotive OEM Vehicle integrator Onboard fuel tank/fuel system Onboard component Regulator	45 10 25 10 10
B. Scope - Please indicate which components on the <u>high pressure side</u> could lead to safety concerns in case of failure: 1. Fuelling connector 2. Fill check valve 3. Solenoid shut-off valve 4. Fuel tank 5. Manual shut-off valve 6. Filter 7. Thermally activated PRD prot.... 8. Excess flow device 9. High pressure gauge 10. High pressure regulator 11. High pressure lines and fittings (seals)	 70 90 70 90 30 30 90 30 30 50 80
C. Scope - Please indicate which components on the <u>medium pressure side</u> could lead to safety concerns in case of failure: 1. Medium pressure relief valve 2. Maintenance shut-off valve 3. Low pressure regulator 4. Medium pressure lines and fittings (seals)	 60 50 60 70
D. Scope - Please indicate which components on the <u>low pressure side</u> could lead to safety concerns in case of failure: 1. Low Pressure relief valve 2. Low pressure fuel gauge 3. Fuel cell system & asso. components 4. Low pressure lines & fittings (seals)	 70 20 60 80
E. Options to be considered Please indicate which options should be considered for the HVFS: 1. Use of multiple fuel tanks 2. Use of removable fuel tanks(for small & off-road vehicl) 3. Use of integrated (electronic) gas handling unit 4. Use of electronic regulators for low pressure regulation	 80 20 40 40
F. System Control Please indicate if the following safety requirements should be considered in the HVFS: 1. Shut down of fuel cell system when fuelling?Yes <input type="checkbox"/> No <input type="checkbox"/> 2. Other (please specify)	 Yes 70 No 10

G. Additional Safety concerns Please indicate what are the additional safety requirements that should be considered to ensure the safety of the HVFS:	Whole system	HP	MP	LP
1. Overpressure protection	60	20	10	0
2. Leakage	70	22	0	10
3. Shock and vibration	50	10	10	0
4. Hydrogen compatibility	70	10	0	0
5. Electromagnetic interference	40	20	20	0
6. Mounting requirements of certain components	30	20	10	0
7. Residual hydrogen leak at start	60	10	0	10
H. Specific considerations for multiple tanks Please indicate the additional safety concerns that should be addressed when multiple fuel tanks are used:				Percentage
1. Permeation level of multiple tanks				30
2. Use of a single shut-off valve for the series of fuel tanks				80
3. Use of a single thermally activated PRD for the series of fuel tanks				50
4. Use of a single overflow protection valve for the series of fuel tanks				50

HVFS – Schematic (Proposed)

