

Fast Filling of High Pressure Cylinder Storage Systems

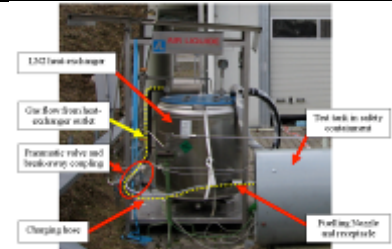
Objectives

- ❖ Evaluate the feasibility, interests and limitations of both “warm” and “cold” filling processes.
- ❖ Develop a suitable filling procedure for a safe, quick (< 4 min.) and reliable refuelling of vehicles with 700 bar hydrogen storage vessels.

Achievements

Cold filling (filling gas temperature below -40°C):

- ❖ Cold filling process: optimum from energy consumption point of view calculated around -40 to -70°C
- ❖ Tests at -85°C: cylinder materials were not exposed to low temperature (minimum of -20°C measured)
- ❖ 100% filling achieved within 2 min.
- ❖ Limitations: filling line material exposure



ET filling test bench including ALD heat exchanger (LN₂ bath), WEH filling components and Dynetek cylinder

Warm filling (filling gas temperature from -40°C to ambient):

- ❖ Filling tests with both Type III and Type IV cylinders up to -30°C
 - Type III: 100 % filling achieved within 3-4 min. for filling gas temperature below 0°C, 90% filling achieved for ambient filling temperature
 - Type IV: 90 % filling achieved for ambient filling in 10 min.; complete filling achievable with moderate cooling within 3-4 min.



AL 700 bar filling station

Filling procedures

- ❖ Complete filling within 3 min. demonstrated with a filling gas temperature of -40°C (final gas temperature was 65°C)
- ❖ 700 bar simulation tools validated
- ❖ Simulation tools able to define adapted procedures depending on specific parameters (ambient conditions, storage cylinder, etc.)



Daimler F-Cell vehicle with a 700 bar hydrogen storage system in a filling test

Future Perspectives

- ❖ Safe and optimized filling was demonstrated for 700 bar storage systems for both Type III and Type IV vessels.
- ❖ Procedures can be implemented into commercial fueling stations.
- ❖ Generic procedures still need to be defined.

<p>Partners</p>	<ul style="list-style-type: none"> ❖ Air Liquide (AL) and Air Liquide Deutschland (ALD) ❖ Energie Technologie (ET) ❖ Dynetek ❖ WEH ❖ Daimler ❖ Ford ❖ (CEA and Faber) 	
------------------------	--	---

<p>Website</p>	<p>www.storhy.net</p>
-----------------------	---

 The project partners wish to thank the European Commission for financial support of the Integrated Project StorHy– Hydrogen Storage Systems for Automotive Application (Contract No.: SES6-CT-2004-502667) within the 6th RTD Framework Programme.