

Hydrogen Research Priority Workshop

Hydrogen & Fuel Cell Vehicles Global Technical Regulation

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Background

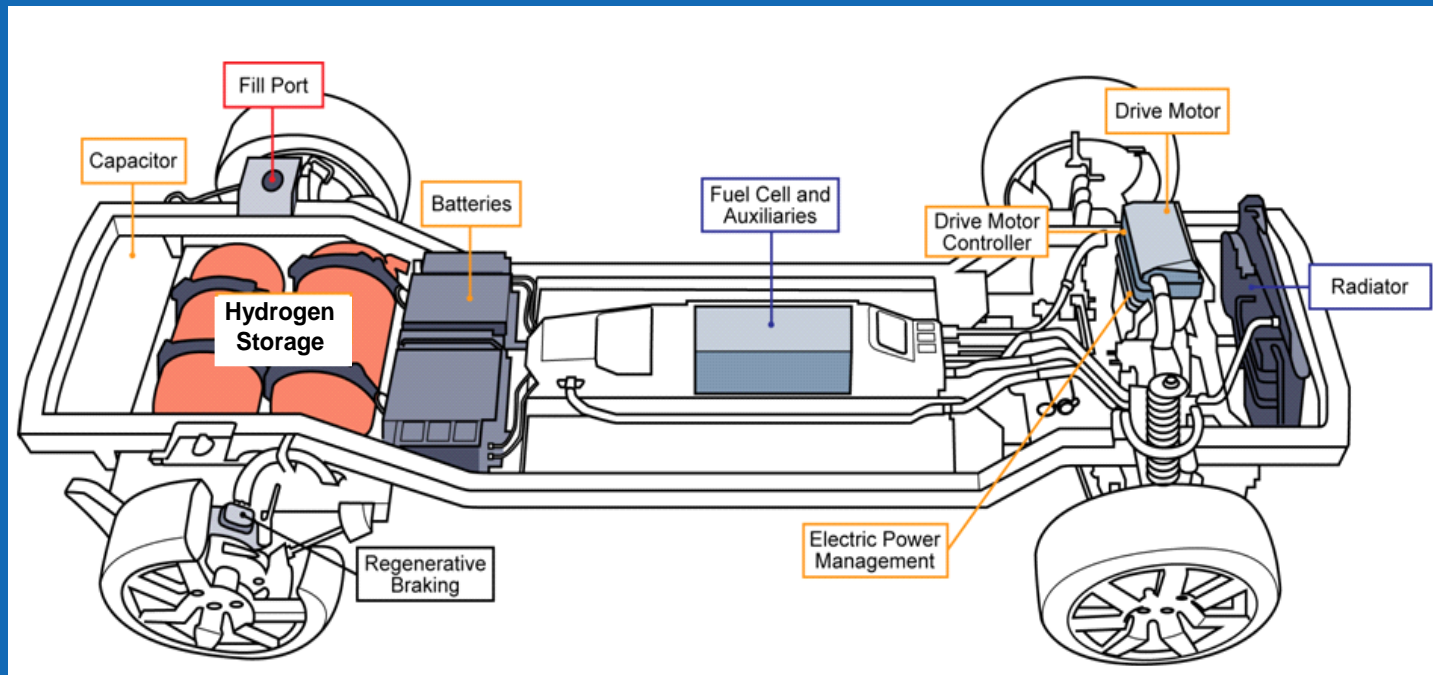
- In 2009, The U.S., Japan and Germany co-sponsored a working group to develop a Global Technical Regulation (GTR) Under the United Nations 1998 Agreement.
- The working group consisted of governments participants from China, European Union, Korea, Canada and India; and industry participants from standard organizations, automobile and component manufacturers
- In June 2013, Phase 1 was completed, establishing GTR No. 13: Contracting Parties under the 1998 Agreement are obligated to start an adoption process of GTR No.13 into their national regulations

http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.html



Compresses Hydrogen Fuel Cell Vehicle

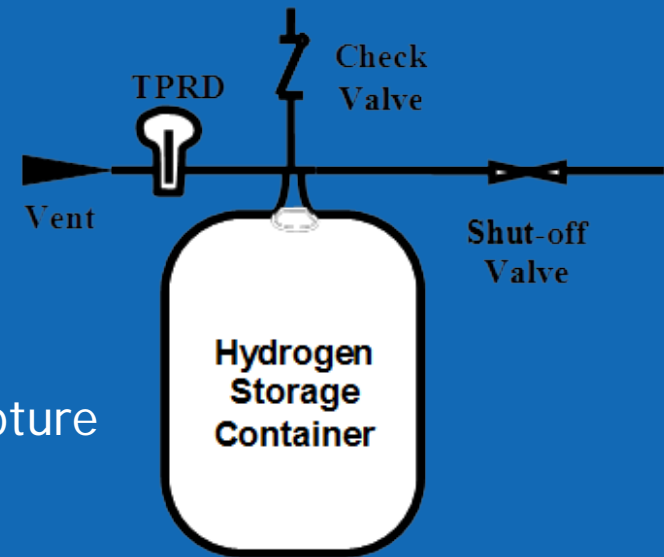
1. High pressure fuel container system
2. Fuel system at vehicle level: in-use and post-crash hydrogen leakage limits
3. Electrical integrity of high voltage system: in-use and post-crash





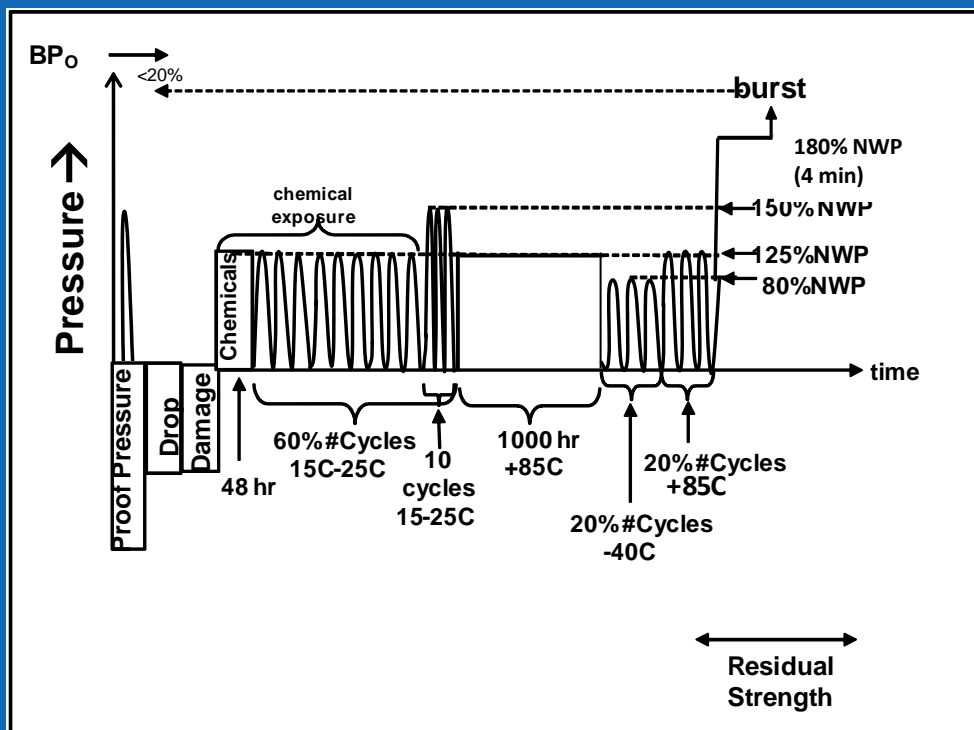
Verification test for Baseline Metrics

- Baseline Initial Burst Pressure Test
 - Burst pressure within $\pm 10\%$ of BP0
 - Burst pressure \geq BPmin of 225% NWP
- Baseline Initial Pressure Cycling Test
 - Pressure cycle for 22,000 cycles without rupture





Verification Test for Performance Durability (Sequential hydraulic cycling tests)

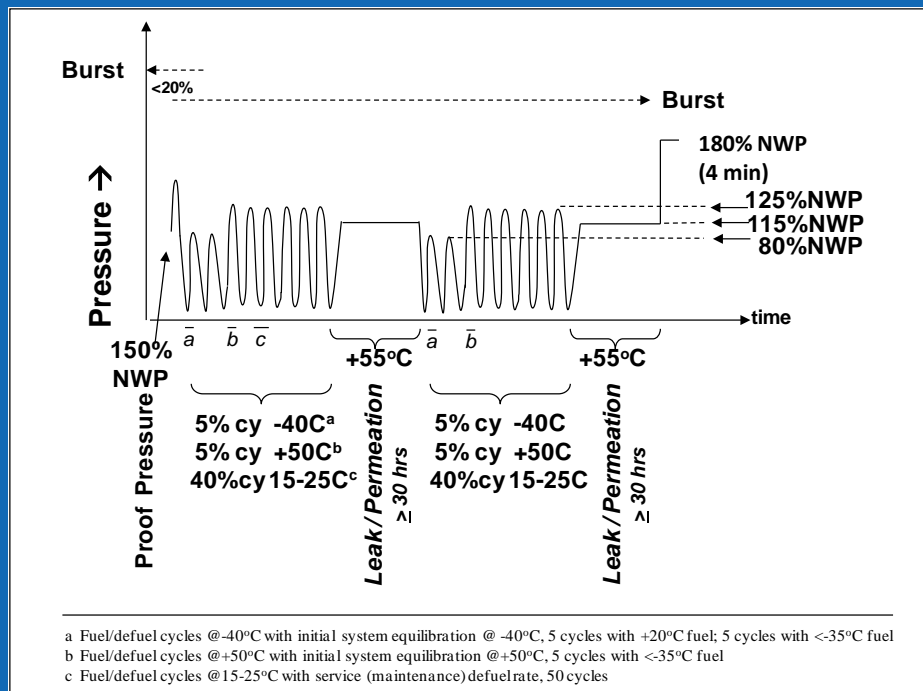


Number of cycles is specified by individual contracting party (5,500, 7,500 and 11,000)

1. Proof pressure test
2. Drop (impact) test
3. Surface damage
4. Chemical exposure
5. ambient temperature pressure cycling tests
6. High temperature static pressure test
7. Extreme temperature pressure cycling
8. Residual proof pressure test (180% NWP for 4 mins)
9. Residual strength burst test (within 20% of BPo)



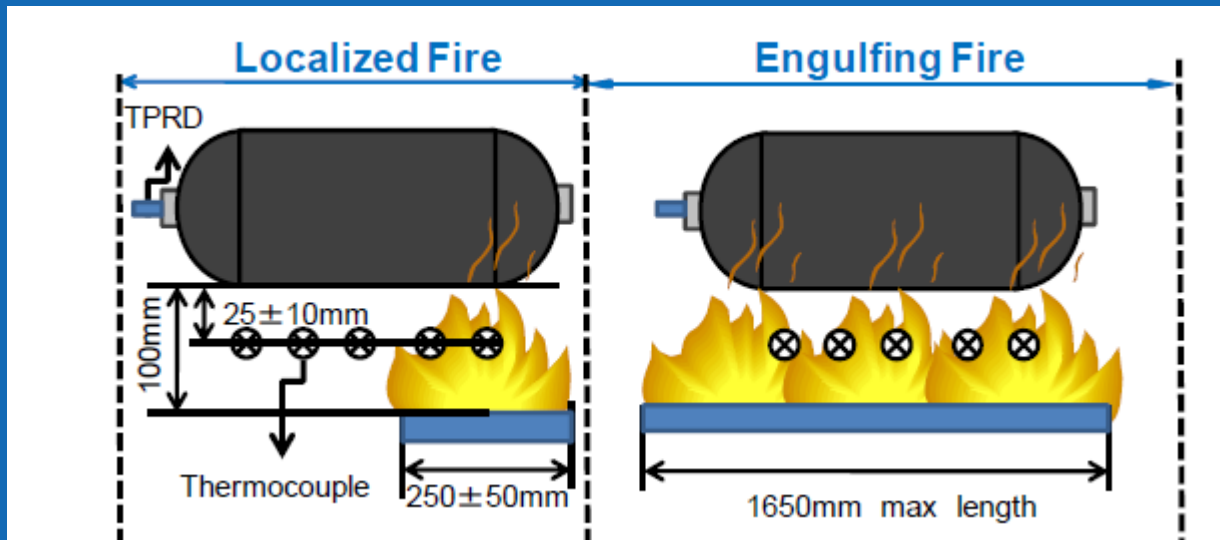
Verification Test for On-Road Performance (Sequential pneumatic/hydraulic cycling tests)



Number of cycles: 500

1. Proof pressure test
2. Ambient and extreme temperature gas pressure cycling test (pneumatic)
3. Extreme temperature static gas pressure leak/permeation test (pneumatic)
4. Residual proof test (180% NWP for 4 mins)
5. Residual strength burst test (hydraulic) -
Within 20% of BPo

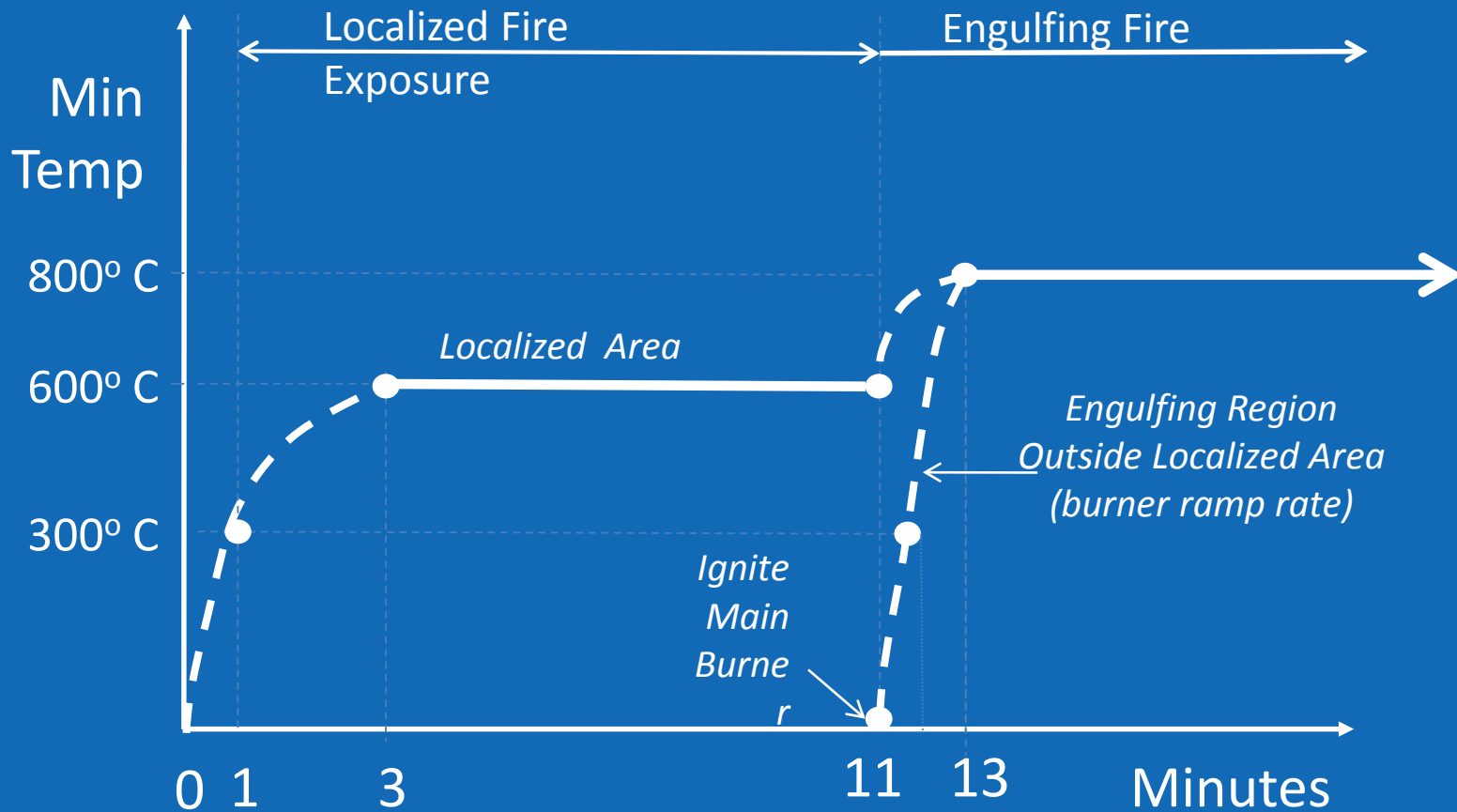
Combining Localized and Engulfing Fire



A hydrogen storage system is pressurized to NWP and exposed to fire. A temperature-activated pressure relief device shall release the contained gases in a controlled manner without rupture.



Fire Test Profile





Fuel System Requirements

- Fuel System Integrity:
 - Fuel Receptacle and Label requirements
 - PRD requirements
 - Exhaust requirements
- In-use fuel leakage:
 - Warning tell-tale at $2\pm 1\%$ of Hydrogen concentration in enclosed spaces
- Post-crash leakage:
 - Less than $3\pm 1\%$ of Hydrogen concentration in enclosed spaces



Electrical Safety

- In-Use requirements:
 - Protection from high voltage shock
 - Absence of high voltage
 - Isolation resistance
 - Barrier
 - label
 - Isolation resistance monitoring system
 - Functional safety
- Post-crash requirements:
 - Protection from high voltage shock
 - Battery leakage and retention



Status of GTR Adoption

- Adopted:
 - EU transposed GTR into UN-ECE
 - Japan
 - Korea
- The U.S. is currently preparing a notice of proposed rulemaking (NPRM):
 - Completed a series of fuel tank tests to validate the test procedures
 - NPRM is expected in 2017



GTR Phase 2

- Phase 2 GTR is expected to start early 2017
 - Material compatibility
 - Stress rupture
 - Electric safety
 - Improve current test procedures
 - Potential scope revision to include other vehicle classes



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Questions



NHTSA



HFCV GTR NO. 13

**HYDROGEN RESEARCH
PRIORITY WORKSHOP**