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The 27th INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION.

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Evolution in electric vehicle safety legislation and global harmonisation activities

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Overview

1. Why safety legislation is necessary
2. Harmonisation mechanisms
3. UN Global Technical Regulation No. 13 (HFCV)
4. Draft UN Global Technical Regulation No. XX (EV)
5. Conclusions

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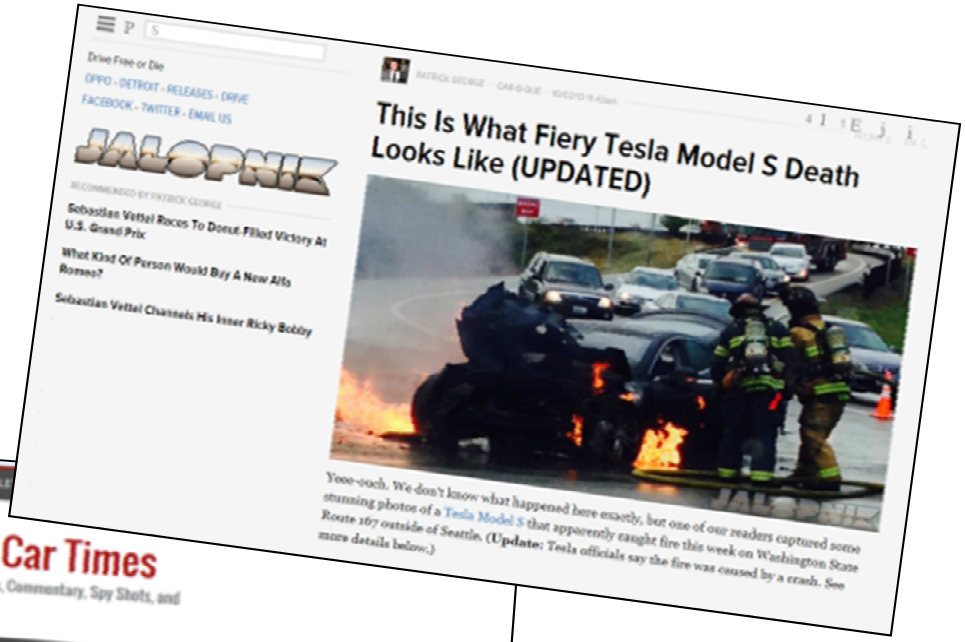
Bad press



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The role of legislation

- Reduce risks to users
- Maintain public confidence
- Establish uniform technical requirements

- Harmonisation reduces burden to industry

Harmonisation of vehicle regulations

- World Forum for Harmonisation of Vehicle Regulations (WP.29)
  - United Nations Economic Commission for Europe
- Harmonised requirements and tests
  - UN Regulations
  - UN Global Technical Regulations

UN Regulations

- Type-approval and mutual recognition
- “1958 Agreement”
- Systems and components
  - Whole vehicle approval mechanism under development
- Not compatible with self-certification

UN Global Technical Regulations (GTRs)

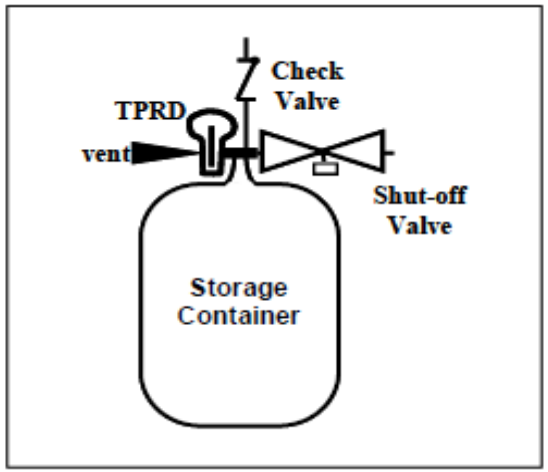
- Not a legal document
  - Requirements are transposed into local legislation
- “1998 Global Agreement”
- Compatible with type-approval and self-certification
  - Data-driven
  - Performance based

UN GTR No. 13 on hydrogen-fuelled vehicles

- Proposal to develop GTR adopted 2007
  - Co-sponsors: Germany; Japan; United States
- Phase 1 of GTR adopted in June 2013
  - Developed by subgroup on safety
- Phase 2 expected to start in 2014
  - To take account of latest research
  - Harmonise crash test specifications

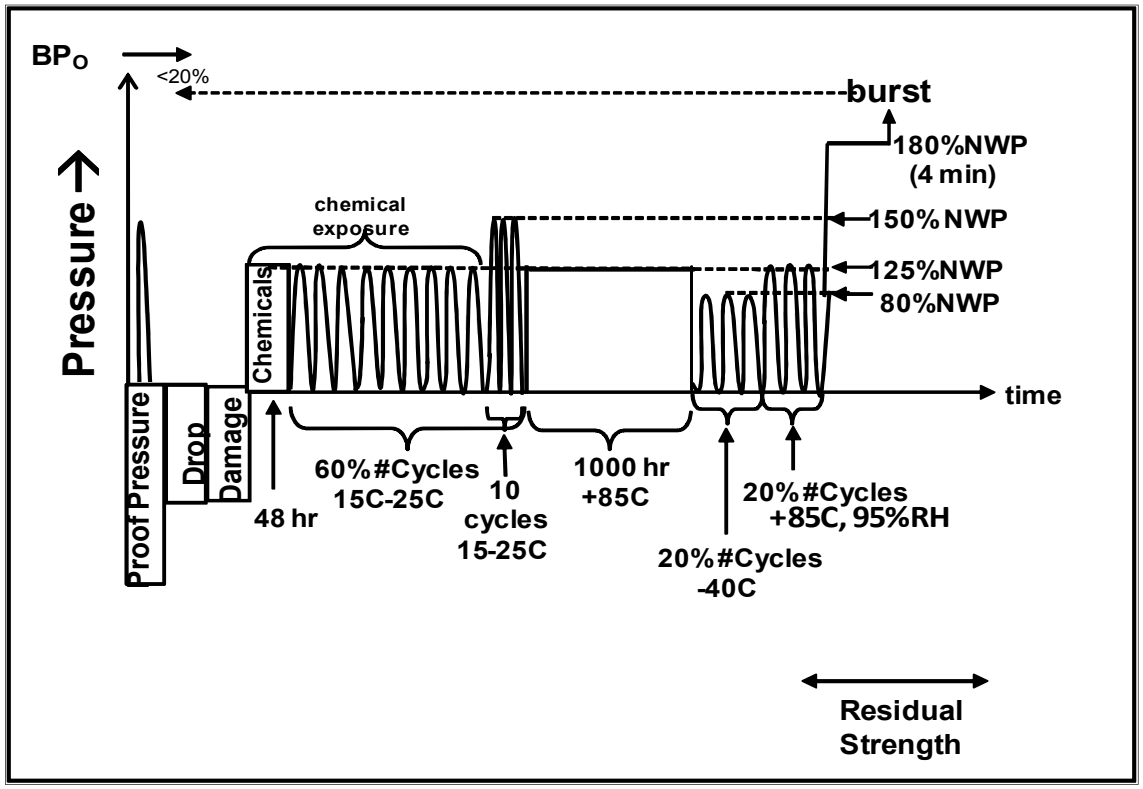
Main elements

- Compressed hydrogen storage system
- Vehicle fuel system
  - In use
  - Post crash
- Electrical safety
  - In use
  - Post-crash



Compressed hydrogen storage system

- Verification test for performance durability

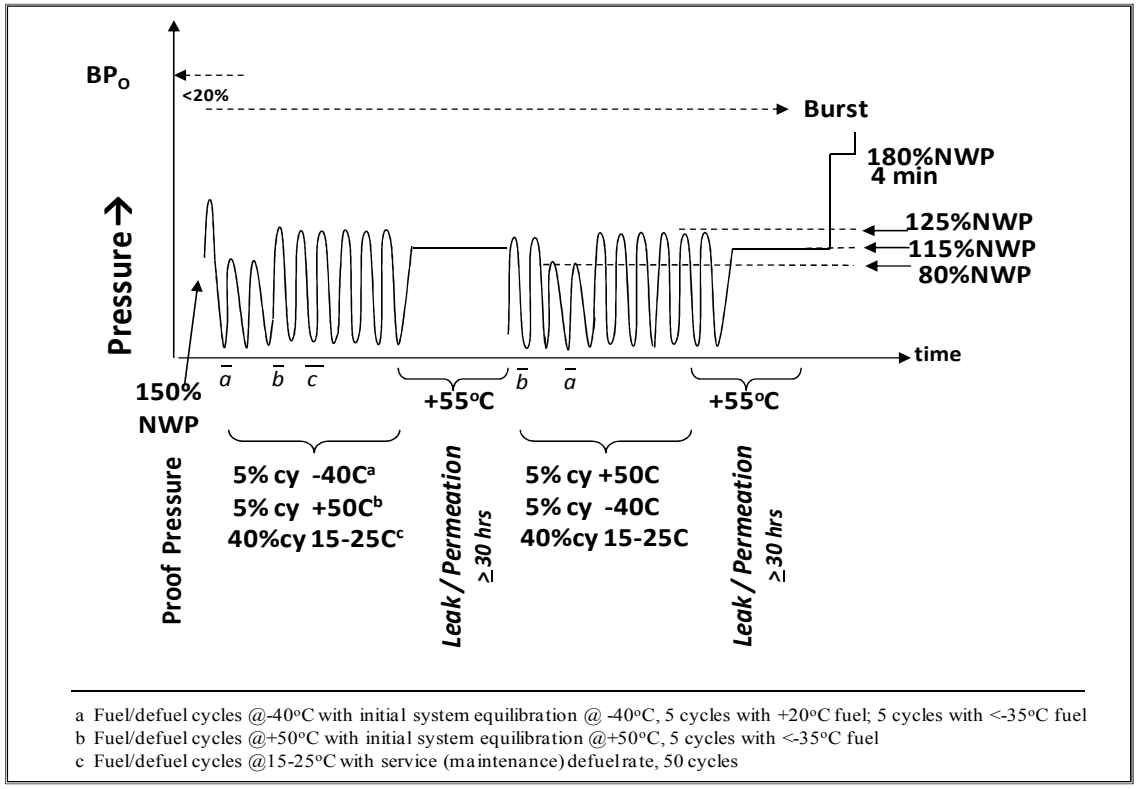


Structural resistance to rupture:

Sequential hydraulic cycling
(fluid is liquid)

Compressed hydrogen storage system

- Verification test for on-road performance



a Fuel/defuel cycles @-40°C with initial system equilibration @ -40°C, 5 cycles with +20°C fuel; 5 cycles with <-35°C fuel
b Fuel/defuel cycles @+50°C with initial system equilibration @+50°C, 5 cycles with <-35°C fuel
c Fuel/defuel cycles @15-25°C with service (maintenance) defuel rate, 50 cycles

Expected worst-case conditions (including fuel):

Sequential pneumatic cycling (fluid is H_2 gas)

UN GTR No. XX on electric vehicles

- Proposal to establish two new informal groups adopted 2012
  - Co-sponsors: China; EU, Japan; United States
- Work started on safety GTR
  - Four meetings to date
  - Completion 2014

Main elements

- Electrical safety in-use
- Electrical safety post-crash
- Safety of rechargeable energy storage system

- First draft draws from UN Regulation 100

Rechargeable energy storage system

- Vibration
- Thermal shock and cycling
- Mechanical shock
- Mechanical integrity
- Fire resistance
- External short circuit
- Overcharge
- Over-discharge
- Over-temperature

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No evidence of: electrolyte leakage, rupture, fire, explosion

Conclusions

- High levels of cooperation achieved
- Political challenges
  - Political will to transpose requirements
  - Time-consuming
- Technical challenges
  - Technology is evolving

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Expect the unexpected…

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