UNECE EVS-IWG

OICA proposal:

Thermal propagation regulatory text ”Documented approach” and ”Test approach”

27th IWG EVS

Tokyo 27-29 June 2023

General understanding

- “Documentation” approach will remain in parallel to the “test” approach
  - OEM option to chose “documentation” or “test” approach
    - Detailed technical knowledge of the REESS necessary to determine which approach is feasible
  - Necessary to future-proof the GTR
    - New cell chemistries
    - New REESS designs
- “No thermal runaway” and “no thermal propagation” will not create a “hazardous environment/condition” and therefore such situations will be considered to satisfy the thermal propagation requirements
  - Criteria to determine “no thermal runaway” needed
  - Avoid excessive and non-representative forced TR of thermally stable battery chemistries and designs
- REESS level test should be allowed to assure the efficiency of the test
  - practical and will be beneficial to accelerate the development.
  - Necessary for HDV

General understanding

- Tests shall be performed with the system operational since vehicle occupant will typically be present in such mode
- Boundaries of the requirements; i.e. “protection of vehicle occupants” and “a single cell thermal runaway due to an internal short circuit” are carried over from current GTR20
- Different initiation methods should be allowed, provided sufficient level of thermal runaway of the initiation cell is achieved
  - Determined by criteria of thermal runaway
  - Should be aligned with the new criteria in ISO 6469-1 AMD1:2022
- Definition of “hazardous condition” is essential
  - A common understanding is needed to harmonize interpretations among Contracting Parties and Technical Services

[A hazardous situation is a circumstance that exposes the occupants to one or more hazards (for example smoke, fire, explosion) and shall be evaluated based on realistic exposure conditions, considering e.g. exposure time.] Inspired by ISO 26262

General understanding

- Warning indication to allow egress or 5 minutes needs clarification

  New text proposed

a) To allow egress. This requirement is deemed to be satisfied if the vehicle occupants will not be exposed to any hazardous environment caused by thermal propagation (following an accordant performance and documentation of a risk assessment and risk reduction analysis by the vehicle manufacturer in accordance with paragraph 5.4.12.2.)

or

b) 5 minutes prior to the presence of a hazardous situation inside the passenger compartment. This requirement is deemed to be satisfied if the thermal propagation does not lead to a hazardous situation for the vehicle occupants or if the single cell thermal runaway does not lead to thermal propagation in the REESS.

- Welcome the scenario-based discussion (table) proposed by TP-TF leadership
- Recommend to split the “hazardous conditions” related to “fire”, “explosion” and “emissions” and specify the conditions separately for each one.

Updated draft regulatory text

- REESS and vehicle family concept (see separate presentation)
  - LDV and passenger cars
  - HDV
- Updated draft rationale text
  - Family concepts
  - *Revised rationale for ”Documentation” and ”test” approach pending IWG EVS discussion*

Please refer to the OICA draft thermal propagation regulatory text proposal (word file) for the complete text (submitted separately).

”Documentation approach”

- Content and report structure agreed by subgroup TP-documentation approach
- 4 parts:
  - System analysis
  - Risk identification and mitigation
  - Risk mitigation effectiveness – validation & verification
  - Conclusions

Part 1 – System analysis

a) A system diagram of all relevant physical systems and components

b) Description of systems/components relevant to single-cell thermal runaway and thermal propagation du to internal short circuit and their interoperability

c) Description of advanced warning indication and operating logic

d) Functional analyses identifying the conditions leading to single cell thermal runaway, i.e. internal short circuit of the cell, and allocating them to the corresponding components or functional units or subsystems

Part 2 – Risk identification and mitigation

- A risk reduction analysis using appropriate industry standard methodology
  - (for guidance, see for example, IEC 61508, MIL-STD 882E, ISO 26262, AIAG DFMEA, fault analysis as in SAE J2929, or similar)
- The risk identification and mitigation analysis shall include:
  - Risk mitigation by design
  - Risk mitigation by manufacturing control
  - Risk mitigation by other means
- Assumptions made about system performance characteristics and properties

Part 3 – Risk mitigation effectiveness

- Tests and verification methods
  - Recognized industry standard tests, for example ISO, IEC, SAE or equivalent
  - In the absence of appropriate industry standard tests, test methods and verification techniques designed by manufacturer
- Data sources and quality requirements
  - Consistency check
  - Completeness check
  - Sensitivity check

Part 4 – Conclusions

- Brief summary of main results
- Statement that the requirements are satisfied, including:
  - The methods used are scientifically and technically valid for the scope of the risk reduction analysis
  - The data used are appropriate and reasonable in relation to the intention of the risk reduction analysis
  - The interpretations are relevant and reflect the assumptions made and the limitations identified for the study
- May be in the form of a critical review report, if available

”Test approach” – main points

- Category 1-1 and vehicles of Categories 1-2 and 2 with GVM of 4,536 kg or less
  - Vehicle level test or with the complete REESS or with REESS subsystem(s)
- Category 1-2 and Category 2 with GVM exceeding 3,500 kg
  - Complete REESS or with REESS subsystem(s)
  - Vehicle level testing is not practicable for HDV
- Test method - The test shall be performed using an appropriate industry standard methodology
  - ISO 6469-1:2019/Amd 1:2022 should be used
  - An equivalent industry standard, e.g. UL2580, and SAE J2464, may be used at the choice of the manufacturer, and when justified by the system design
- Detection of thermal runaway updated based on new criteria in ISO 6469-1:2019/Amd 1:2022
- Pre-testing is not part of homologation process – appropriate test parameters and settings should be supplied by the OEM in agreement with Technical Services
- Post-test disassembly analysis is not part of homologation process