JRC questions to SIGTP-02-11

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Stockholm, Sweden

A. Eddarir, N. Lebedeva

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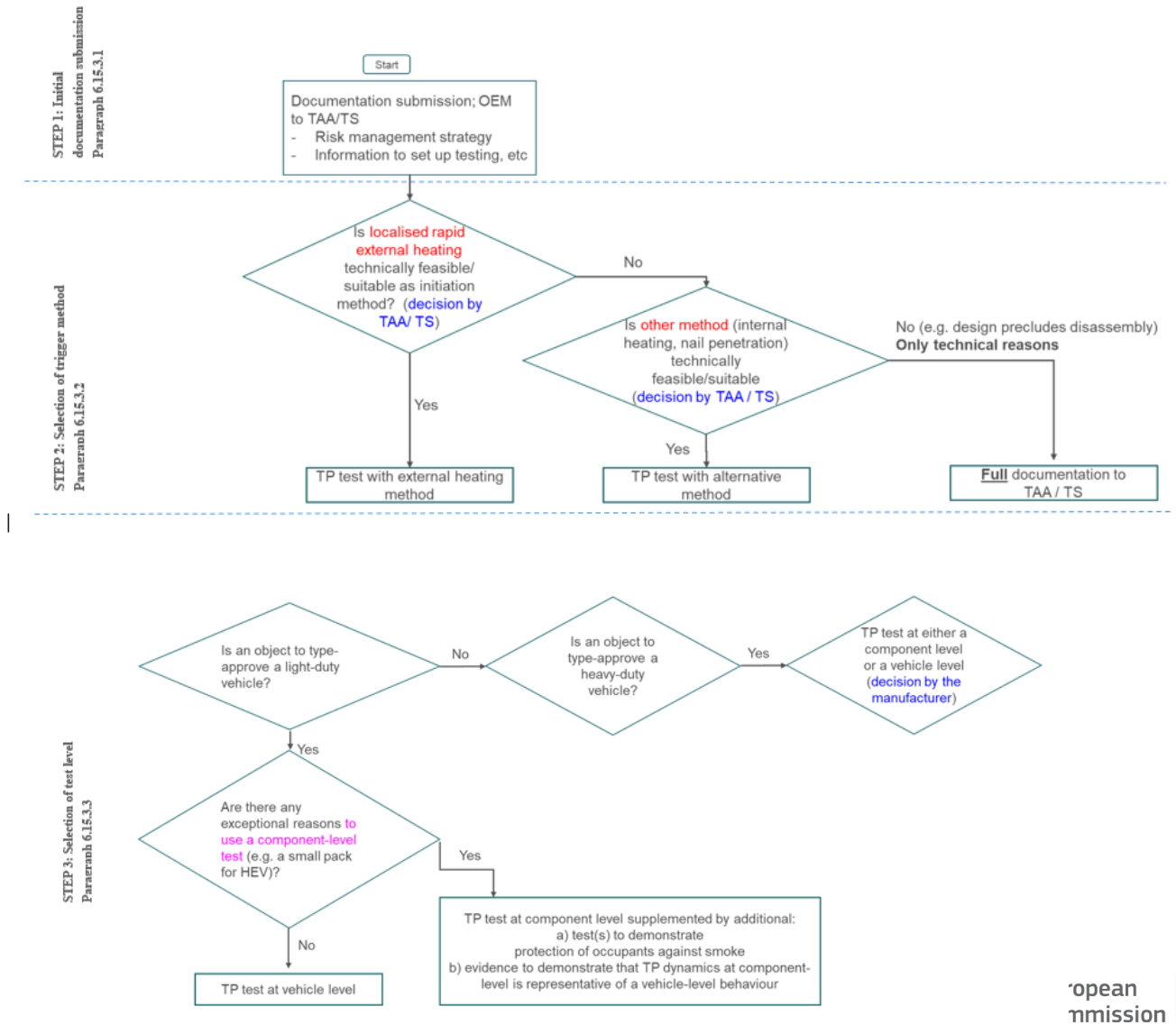
- The flow chart for the verification of thermal propagation safety compliance has been agreed among CN, EU and JP supported by KR and industry at 27th GTR EVS meeting and further refined at the 1st SIG TP meeting.
- For light duty vehicles, vehicle-level test is a default method.

Figure 3
Flow-chart for the verification of thermal propagation safety compliance



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Overview of thermal propagation test

1. Pre-tests on cell/module to determine the initiation method and the test parameters
2. Instrumentation of initiation device and measuring sensors within the battery pack
3. SOC adjustment and system functionality check
4. Placement at the test site, either indoor or outdoor
5. Confirmation of test conditions (e.g. REESS temperature, wind, humidity, etc.)
6. Start initiation device and measurements
7. On-site observations, stop initiation device at appropriate timing
8. Analysis of measured data and video
9. Post-test inspection (if necessary) and post test treatment

Pass/fail criteria:
During the egress or 5 minutes after the activation of warning signal, no evidence of:
(a) Fire
(b) Explosion
(c) Smoke inside the passenger compartment

⇦ Visual inspection without disassembly (i.e. no numerical threshold)

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These parts are not in the proposed test description

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- More realistic behavior of thermal propagation
  - Influence of vehicle structure to the thermal propagation behaviour
    → The magnitude of the influence has not sufficiently been examined
  - Direct analysis of vehicle response (e.g. warning indication, cooling, etc.)

JRC result have shown that TP can occur faster in a car than in the REESS possibly due to less heat dissipation and better gas tightness of a pack installed in a vehicle, underlining the role of hot vented gases in the overall heat transfer during the TP.

[EVS25-E1TP-0500]

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- Assessment of smoke inside the passenger compartment
  → There is no reported field incident with any occupant casualty caused by the smoke from REESS

Field accident with occupant casualty caused by smoke from REESS failure

‘’The last moments of Awan's life were gruesome and excruciating. After the crash, the Tesla's lithium ion battery caught fire. Smoke - and then flames - filled the car, suffocating Awan and burning him from his feet up. Outside, a crowd gathered, but couldn't help.

The Broward County autopsy report, obtained by The Washington Post, lists Awan's cause of death as "inhalation of products of combustion with a contributory cause of death of thermal injuries.“’

https://www.ndtv.com/world-news/us-doctor-omar-awan-dies-in-burning-tesla-as-futuristic-doors-didnt-open-after-crash-in-florida-alle-2121767

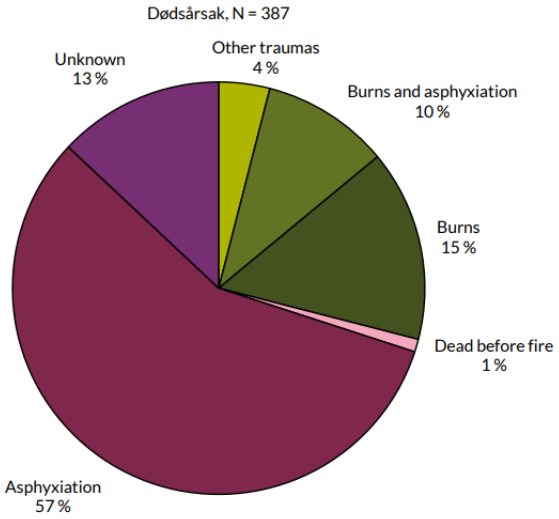
Smoke is an important hazard

Smoke is the main death cause in fires

National SAFE KIDS Campaign and the United States Fire Administration

Most people who die in fires die from the toxic gases, thick smoke and lack of oxygen.
The majority of fire-related deaths are caused by smoke inhalation of the toxic gases produced by fires. **Actual flames and burns only account for about 30 percent of fire-related deaths and injuries.**

https://www.stanfordchildrens.org/en/topic/default?id=fire-safety-and-burns--injury-statistics-and-incidence-rates-90-P02978#:~:text=The%20majority%20of%20fire%2Drelated,fire%2Drelated%20deaths%20and%20injuries.



Analysis of fatal fires in Norway in the 2005 – 2014 period (RISE fire research)

Asphyxiation is the chief cause (57 %), followed by burns (15 %). In addition to that a combination of asphyxiation and burns was concluded in 10 % of cases. In 13 % of cases the cause of death is unknown, which may be attributed to the fact that the victim was so heavily burnt that it was difficult to carry out an examination or draw some conclusions.

https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1184709&dswid=-6573

European Commission

Figure 4-18 **Cause of death for fatalities in fatal fires during the 2005-2014 period.**

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- REESS Suppliers will not be able to obtain REESS type approval independently from vehicle manufacturer
  - Restrictions for suppliers' business that may hamper technological evolutions

  - REESS family concept
  - Vehicle family concept
  - After market REESS supply

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- Higher cost and longer time required for test vehicle preparation
  - Need to obtain vehicle with final-level quality at a higher cost
    → only available at the late stage of product development
  - Need to dismantle and re-install REESS
  - Pre-instrumentation of REESS will anyway be the most realistic way
    → Need at least 1 complete vehicle on the top of pre-installed REESS
- Large scale test site will be required
  - Limited number of indoor facilities capable to conduct vehicle-level test
  - Limited availability of outdoor sites and temporary wind/rain proof needed

The same applies to vehicle level crash tests

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- Difficulty in visual observation
  - REESS may not be observed directly
  - Inside the passenger compartment can only be observed through camera installed in the vest vehicle → The camera may be burned out after the test

From our experience, even HD video cameras are not expensive and can be used for the test.
REESS does not need to be observed as the smoke in the cabin is being monitored.

- Post-test treatment
  - Need to de-energize REESS before moving the vehicle
  - May need to wait until the vehicle is fully burned out → more time required to burn out
  - Higher amount of waste management

The same applies to vehicle level crash tests
No need to wait for vehicle to fully burn out, due to data recording time of 5 minutes
Vehicle chassis recycling cost is a small part of that for REESS

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- Allow manufacturer's choice of vehicle level test or REESS/REESS subsystem level test as the principle

JRC do not support manufacturer's choice option which is also not in line with verification of thermal propagation safety compliance process.

- Consider pragmatic and reasonable way to assess the hazard from smoke inside the passenger compartment

JRC consider visual observation as pragmatic and reasonable way to verify the occurrence of smoke in the passenger compartment

Thank you

European Commission