

How to Define ‘Hazardous Situation’

China
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Background

- In the TP-TF meeting on June 8th, discussions were held on 6 issues, among which **the Definition of 'Hazardous Situation'** will affect the Test level and the pass/fail criteria (including whether warning signal is necessary) of TP test.
- Therefore, clarifying the definition of 'Hazardous Condition' or proposing a directional solution is urgently needed. we hope to propose a suggested direction for further discussion in order to form the final definition.

Hazardous Situation

- It can be considered that Hazardous Situation mainly includes fire, explosion, and smoke inside the passenger compartment.
- **Fire** is easy to judge by observation, but are fires both outside and inside the passenger compartment Hazardous Situation?
- **Explosion** is not easy to determine through observation, so how to determine an explosion? Are both outside and inside the passenger compartment dangerous?
- **Smoke** is easy to determine by observation, but whether it is Hazardous Situation or not depends on the content and time of both the smoke and gas. How to conduct testing and provide boundaries based on content and time?

5.4.12.1.

paragraphs 5.4.12.1. and 5.4.12.2. shall be satisfied.-

The vehicle shall provide an advance warning indication to allow egress or 5 minutes prior to the presence of a hazardous situation inside the passenger compartment caused by thermal propagation which is triggered by an internal short circuit leading to a single cell thermal runaway such as fire, explosion or smoke. This requirement is deemed to be satisfied if the thermal propagation does not lead to a hazardous situation for the vehicle occupants. This warning shall have characteristics in accordance with paragraph 5.3.3.2. The vehicle manufacturer shall make available, at the request of the regulatory or testing entity as applicable with its necessity, the following documentation explaining safety performance of the system level or sub-system level of the vehicle:

Fire

- **Fire** is easy to judge by observation, but are fires both outside and inside the passenger compartment Hazardous Situation?
- We believe that as long as a fire occurs, both inside and outside the passenger compartment, it is a potential danger to passenger. Therefore, it is recommended to visually inspect whether a fire has occurred as a criteria for determining the Hazardous Situation.

Explosion

- **Explosion** is not easy to determine through observation, so how to determine an explosion? Are both outside and inside the passenger compartment dangerous?
- We believe that as long as an explosion occurs, both inside and outside the passenger compartment, it is a potential danger to passengers.
- For the detection of explosions,
 - The method of UL2580 can be referred to determine whether an explosion has occurred outside the vehicle.
 - and obvious object splashing by visually inspected can be used as a basis for determining whether an explosion has occurred inside the vehicle.

30.5 The complete assembly is to be covered with an aluminum mesh octagonal test cage with mesh flat cover located a maximum of 25.4 mm (1 in) from the exterior of the DUT sides and top surfaces. The mesh used to build the cage is to be constructed of 0.25-mm (0.01-in) aluminum wire with 16-18 wires/25.4 mm (1 in). The support structures used to support the wire mesh of the octagonal cage are to be sized to secure the mesh in place during the test without affecting the results. The test cage is to be secured to the supporting surface to prevent inadvertent movement during testing. The DUT is to be centered within the test cage.

30.6 As a result of this test, there shall be no **explosion** of the DUT that results in projectiles penetrating the mesh test cage of 30.5.

Smoke

- **Smoke** is easy to determine by observation, but whether it is Hazardous Situation or not depends on the content and time of both the smoke and gas. How to conduct testing and provide boundaries based on content and time?
 - Firstly, we believe that both Smoke and Gas need to be tested.
 - Since the gas composition in the process of TP is very complex, it is necessary to find representative gases first (Characteristics required: All kinds of batteries will release, high concentrations, easy to test, and have certain hazards). Can CO (carbon monoxide) be used as a representative gas?
 - Then, a matrix of concentration and exposure time need to be set up to depict the boundaries of hazards. However, due to the continuous variation of flue gas concentration (considering that the cabin has a certain degree of sealing, the gas concentration generally increases continuously), from the perspective of enforceability, some concentration gradients can be set and the time boundary after exceeding the corresponding concentration can be specified. This provides operability. Due to differences in tolerance among different populations, some compromises in determining conditions should also be acceptable.
 - Finally, it is necessary to propose suitable instruments and sensors, etc. for the test, as well as the number and location of sensors arrangements.

Smoke

- Although we believe that the research on limits and testing methods is meaningful, considering the limited time of Phase 2, we think that it is acceptable to continue to maintain a simple visual inspection before obtaining sufficient and effective research results.

I. The Tested Objects

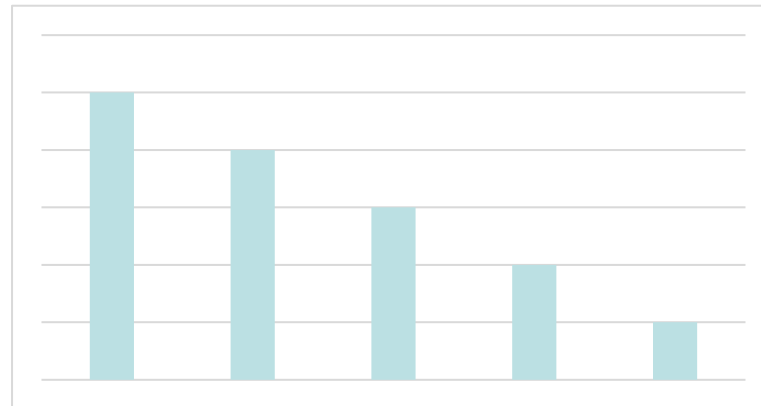
Smoke

Typical measured
gas

Is CO OK?

II. The determine conditions

tolerance time



concentration of smoke/gas

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III. The Test Methods

- ① Instruments and sensors
- ② Number and location of sensors

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Thank You