

GTR #13 (Phase 2)

Task Force #4

FIRE TEST DEFINITION

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GTR #13 PHASE 2 OBJECTIVES

- Address Variability in Fire Test Results
- Expand to Larger Vehicles

VARIABILITY OF TEST RESULTS

The issue was pointed out at the SAE meeting in June 2017 based on back-to-back testing at four labs.

A Lab.



B Lab.



C Lab.



D Lab.



Surface temperature around the tank, internal pressure, flame scale, flame type differ.

SOURCES OF VARIABILITY OF TEST RESULTS

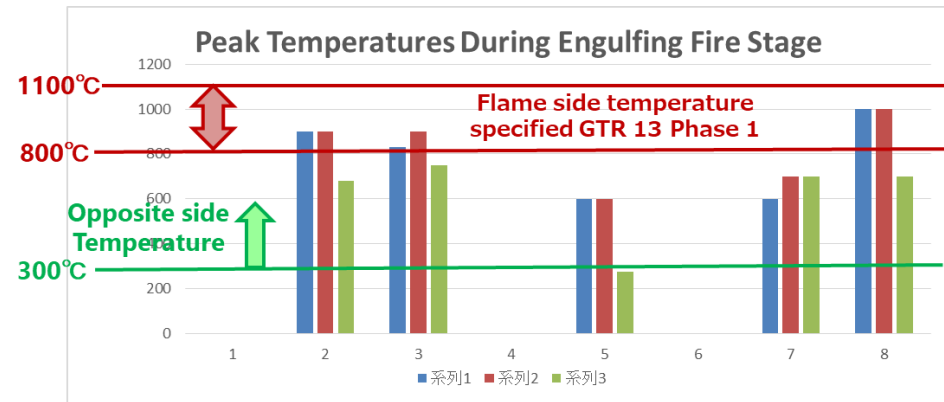
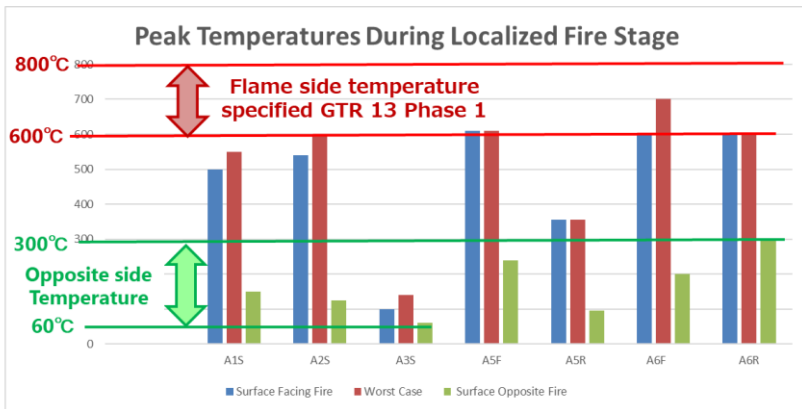
- 1) Height of flame (relative to top of container)
- 2) Width of fire (relative to container diameter)
- 3) Type of burning (diffusion or pre-mix)
- 4) Uniformity of fire within the targeted test area
- 5) Wind

STATUS

- Data from JARI automobile fire testing in Phase 1 was reviewed to confirm required container temperatures on the side facing the fire during the fire test.
 - 600-800C for localized fire phase
 - 800-1000C for engulfing phase

- Container temperature on the side opposing the fire could also be determined from the JARI automobile fire test.
 - 60-300C for localized fire phase
 - 300-800C for engulfing phase

This data can be used to set the allowable range of flame height for the fire test method.



STATUS

- JARI has provided parametric fire test data to guide decision-making:
 - Introduced concept of “reference test vessel” based on the size container used in automobile fire testing to qualify burners and test facilities and establish fuel flow (HRR/A) settings prior to conduct actual container fire tests.
 - Demonstrated the ability to meet the desired container temperature ranges on both the bottom of the container (side facing the fire) and top of the container (side opposing the fire).
 - Investigated use of fixed fire widths to simplify burner design and facilitate testing of containers with different diameters.
 - Demonstrated ability to detect effect of wind by monitoring temperature data.



Wind speed =0.0 m/s



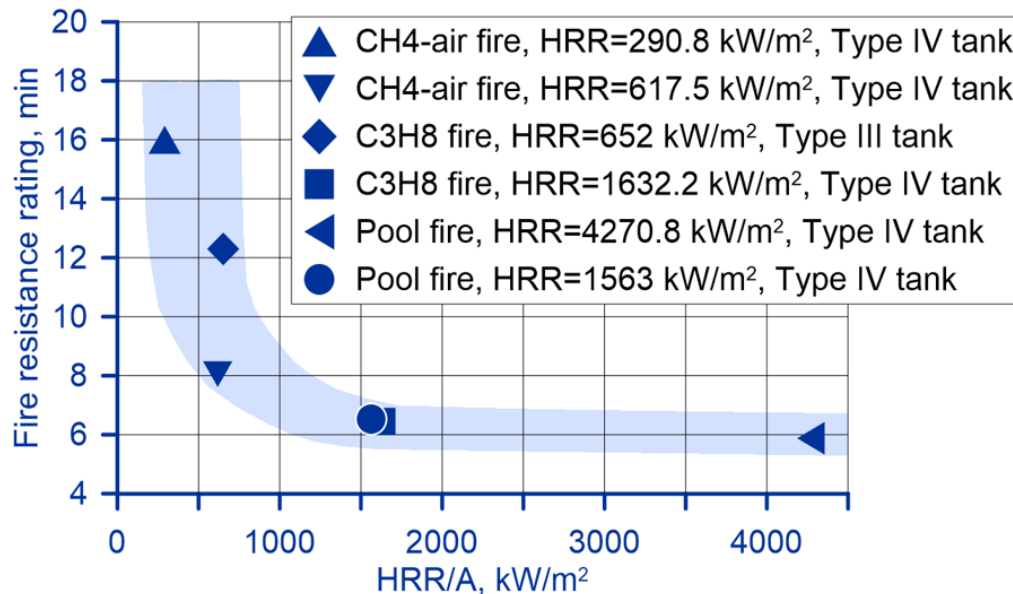
Wind speed =0.8m/s

PLANS

- Additional testing and analysis by JARI is necessary to define a preliminary proposal:
 - Improve (expand) the allowable operating window for fuel flow (HHR/A) with diffusion burners during the engulfing fire phase of the test.
 - Determine what type of burner specification is necessary to achieve acceptable burner uniformity.
 - Define approaches for shielding fire tests from wind.
- Draft the preliminary proposal for eliminating variability of test results.
 - Do we include a pre-test with a “reference test vessel” to qualify test facilities prior to actual tests. If so, what is the frequency for repeating the pre-test?
 - Do we restrict testing to a specific burner configuration or do we allow alternative configurations that demonstrate meet pre-test requirements?
- Perform round robin tests to verify that the proposal is successful and make necessary changes.

ISSUE

While the majority of TF#4 experts favor improving the localized/engulfing fire test approach from GTR Phase 1 to demonstrate the ability of TPRDs to protect the containers under representative automobile fire conditions, there is one expert that favors a fire resistance test of the container.



Proposed container fire resistance test:

- Container tested at HHR/As greater than automobile fire data.
- TPRD eliminated to allow test to continue until container rupture.
- Vehicle protection against container rupture not tested.

Is the proposed test appropriate as part of vehicle regulations?

Extension of Fire Test to Larger Vehicles

- Current CNG vehicles are verified to an engulfing test similar to 6.2.5.2 of the GTR.
- Since the localized/engulfing fire test method in 6.2.5.1 of the GTR was based on adding a localized fire interval to the engulfing fire in 6.2.5.2, this localized/engulfing fire test method should also serve as a starting point for heavy-duty vehicles.
- From the standpoint of expanding the GTR to heavy-duty vehicles, the test methods in 6.2.5.1 and 6.2.5.2 are sufficient; however, the following precautions are being considered for inclusion:
 - The vehicle design shall ensure that no shielding, barriers, or structural supports prevent the fire to reach the TPRD.
 - The design shall prevent the possibility of long lasting localized fire on tanks or represent such additions as part of the localized fire test.