



ENGINEERING ACCEPTANCE - TECHNICAL NOTE

Subject: Testing of windscreens

Advice to: CCBs and VABs

Reference: Standard: GM/RT2456 Issue: 2 Clauses C1.2, 2.1

Applies when: Carrying out design scrutiny of windscreens.

Note's Purpose: To clarify the requirements in the interests of consistency.

Background: Concern has been expressed that the requirements of GM/RT2456 Issue 2 are not being consistently interpreted, resulting in a wide variety of performances being accepted.

Requirements: The responsibility of the Design Conformance signatory is to ensure that:

- 1) Conformance with clause C1.2 is demonstrated by tests which truly represent the windscreen being subjected to a stabilised temperature of -17°C on the outer face and a stabilised temperature of $21 \pm 5^\circ\text{C}$ on the inner surface. The temperature of non-glass laminates is likely to be critical and full justification should be obtained in demonstration that the test installation equates to the stabilised conditions specified. See also Appendix 1 of this TN. (CCB)
- 2) Clause C2.1 requires that the penetration requirements are to be met EVERYWHERE over the windscreen. Verification of conformance should therefore demonstrate that the weakest point, wherever it may be on the windscreen, meets the requirement. Nevertheless, the default for this test is normally the geometric centre of the windscreen. However, where the edge is deemed to be the weakest point in, for example, the cold temperature, the point of impact for the test may be close to the edge but should not be closer to the edge than 150mm. (CCB)
- 3) Photographic confirmation of the impact zone should be obtained as evidence that the missile hit the windscreen point-first. This can be seen by the formation of a star of three equal length impact lines on the glass. (CCB).
- 4) The impact tests are carried out on a full sized windscreen. (CCB)

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TN-035 APPENDIX: GUIDANCE ON METHODS OF TESTING

DEMONSTRATION OF CONFORMANCE

Test Temperature

The impact tests demonstrating conformance have to be carried out within the temperature range specified in clause C1.2. Whilst there are a number of ways of demonstrating conformance, the method selected must be truly representative of the extreme conditions. For guidance purposes, several methods are indicated below as an indication of acceptable testing methods, not as a comprehensive list of the acceptable methods.

Method 1. The glass to be tested is inserted between two chambers. The chamber on the outside of the windscreen is maintained at -17°C for the cold temperature test, whilst the chamber on the inside of the windscreen (representing cab interior conditions) is within the range of $21^{\circ}\text{C} \pm 5^{\circ}\text{C}$. The windscreen must remain within these conditions for at least 3 hours to ensure that the temperatures are stabilised through the complete thickness of the windscreen. The impact test is then conducted with the temperatures in this stabilised condition. The ambient temperature chamber may be the test room itself provided that the temperature lies within the range indicated above.

Method 2. The glass to be tested is soaked in a chiller cabinet at a temperature of -17°C for a minimum of 12 hours. The temperature of the interlayer in stabilised conditions for an outside temperature of -17°C and an interior temperature of 21°C is determined by calculation. At the end of the 12 hour soak period, the windscreen is inserted in a test rig with the interior face exposed to ambient conditions within the test area and the temperature of the interior face monitored until it rises to a predetermined level at which the interlayer temperature would be equivalent to the calculated stabilised temperature. The impact test is then conducted in the simulated stabilised conditions.

For the high temperature tests methods 1 and 2 equally apply, except that the temperature of 35°C is substituted for the temperature of -17°C and the chiller cabinet is replaced by an oven or heating cabinet.

Point of Impact

Evidence of correct orientation of the impact will be indicated by indent on the windscreen being of form similar to the diagram below. Each leg of the star should be of equal length when the impact orientation is correct.

