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Pedestrian protection and compliance with UN R127 head form tests on vehicles

Glass for Europe takes note of the 03 series of amendments to UN Regulation No. 127 (R127) which now includes head form testing on vehicles' areas to which the windscreens belong. Head Impact Criteria (HIC) are set for different impact points and must respect thresholds that are defined according to R127's methodology.

As suppliers of windscreens, the automotive glass manufacturers regrouped in Glass for Europe stand ready to cooperate with their clients to investigate the parameters of glass components which may influence windscreen's HIC test results when vehicles are tested.

1. R127 HIC tests performed on vehicles, not on individual glass pieces

Meeting the requirements of the 03 series of amendments to R127 is the car manufacturers' responsibility. The evaluation and subsequent tests required by R127 are made on complete vehicles and not only considering individual glass pieces. This means that (automotive) glass manufacturers cannot perform the test themselves, as defined in R127. They, and their test laboratory suppliers, do not have access to the final vehicle prior to its launch.

Variations in the HIC test result are influenced by numerous non-glass-related factors. The design of vehicles and their glass pieces, the assembly mechanism, the windscreens mounting on the vehicle, properties of the glueing and the body to which it is mounted, may all impact HIC results. These parameters are also the responsibility of car manufacturers and automotive glass manufacturers cannot deviate from car manufacturers' specifications, including the specified preparation for assembly.

Although to date, automotive glass manufacturers have not identified possible sources of variation in R127 HIC tests of identical glass products that would be inherent and specific to automotive glazing, automotive glass manufacturers stand ready to study any suspected contributing factors linked to glass in partnership with car manufacturers.

2. Glass breakage behaviours in automotive glass

Regarding the question of variation of the behaviour of windscreens during R127 head impact tests, it shall be noted that float glass, which is used to make automotive glass parts, is a brittle material and underlies a natural variation of its strength. This characteristic is inherent to all types of glass and cannot be controlled by production parameters. Data for this kind of behaviour can be found in scientific and technical literature[1] and this physical reality leads to what is sometimes described as 'atypical breakage behaviours'.

[1] Richard C. Bradt , "The Fractography and Crack Patterns of Broken Glass", Journal of Failure Analysis and Prevention, April 2011, Volume 11, Issue 2, pp 79–96

Overall, windscreen breakage results in HIC that are well within the threshold defined in R127. Atypical breakage behaviours can statistically occur on any type of windscreen and generate various HIC results. Indeed, atypical breakage of glass does not necessarily lead to what R127 defines as "Atypical windscreen fracture behaviour" leading to HIC values outside the limits. Based on current knowledge, atypical breakage behaviours are not correlated to clear and unique HIC test result patterns. They do not produce a well-defined acceleration profile of the impactor during a head form test on a vehicle's windscreen, and thus cannot be strictly correlated to non-compliant HIC according to R127.

As for the origin of these breaking behaviours, there is no known and established causal link, e.g., between (micro)mechanical parameters of windshields and breaking behaviours. Whenever data suggesting that such causal links between unusual HIC results, or "Atypical windscreen fracture behaviour" as defined in R127, and any glazing-specific properties becomes available, automotive glass manufacturers are ready to do glass component testing to evaluate the impact of this property and to address this impact if relevant and possible.

3. Background on the safety of automotive glass pieces

Today, the legal obligation of automotive glass makers is to meet the safety requirements of GTR6 and R43. To ensure the safety of all glass pieces mounted in vehicles, automotive glass manufacturers are responsible for the conformity of their products with the provisions of GTR6 and R43 while meeting the specifications of their clients, the vehicle manufacturers. Glazing must pass several tests, including on mechanical strength, e.g., to protect vehicles' occupants from external objects penetrating inside the vehicle (i.e., 227g ball drop test), and to protect occupants during an accident by well-defined breakage behaviour of the glazing (i.e., 2260g ball test, head form test, HIC during head impact of occupant from inside the vehicle). Tests are performed for type approval as well as during production.

All GTR6 and R43 tests are conducted on individual glass pieces, rather than on the glass piece mounted on a vehicle. This approach ensures that automotive glass manufacturers can operate the test without needing to know and consider other design parameters of the vehicle. This also ensures that it is the property of glass, independently of other vehicle parameters, that is tested. This approach allows automotive glass makers to have very strict production control protocols to ensure the conformity of their products and guarantee the stable and uniform performance of products put on the market.

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Notwithstanding the elements addressed above, the windscreen manufacturers that are members of Glass for Europe want to stress again their readiness to support their customers in investigating glass components' characteristics that may influence the results of the vehicle tests depicted in R127.

Glass for Europe is the trade association for Europe's flat glass sector. Flat glass is the material that goes into a variety of end products, primarily in windows and facades for buildings, windscreens and windows for automotive and transport as well as solar energy equipment, furniture and appliances. Glass for Europe brings together multinational firms and thousands of SMEs across Europe, to represent the entire flat glass value-chain. It is composed of flat glass manufacturers, AGC Glass Europe, Guardian, NSG-Group and Saint-Gobain Glass Industry, and works in association with national partners gathering glass processors and transformers. European automotive glass producers supply advanced glazing systems to both Original Equipment Manufacturers and for the replacement market all over the world.