



Procedure for Crowbar Testing Structurally Bonded Plastic Assemblies

1 Scope

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This qualitative test procedure is used to evaluate structurally bonded plastic assemblies.

1.2 Foreword. Plastics may include, but are not limited to, fiber reinforced plastic (FRP), sheet molding compound (SMC), and engineering thermoplastics or thermoplastic alloys such as Xenoy. Also included as a substrate would be primed metal for applications where plastic is bonded to metal.

1.3 Applicability. Typical assemblies include bonded inner panel to outer panel and reinforcements to inner and/or outer panel. Parts include doors, hoods, headlamp covers, body panels, spoilers, instrument panels, etc.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 10356

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities. Not applicable.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Crowbars or equivalent that can be used to separate the bonded assembly.

3.2.2 Optional: Vise or other device to assist in holding the part stationary during disassembly.

3.2.3 Optional: Band saw or equivalent.

3.3 Test Vehicle/Test Piece.

3.3.1 Sample parts are made by production intent unless otherwise specified. Include details with incoming parts.

3.3.2 Parts are tested in the "as-received" condition. Additional post-cure (e.g., to simulate assembly plant paint ovens) must be indicated.

3.3.3 When possible, tests should be conducted on whole parts.

3.3.4 When whole parts cannot be tested (due to the size of the part, limitations on environmental chambers, and in the interests of minimizing costs), they may be cut into smaller sections.

3.3.4.1 Use a band saw or equivalent to cut parts. Take care to avoid initiating any cracks or fracture in adhesive or substrate during cutting. This may also involve cutting sections very slowly to avoid heating.

3.3.4.2 A minimum of 300 mm of continuous bondline must be present in each test sample to minimize the effect of damage incurred by the cutting process.

3.3.5 Label the parts.

3.3.5.1 Labeling of the cut samples should indicate the original position in the uncut part.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation.

4.2 Conditions.

4.2.1 Environmental Conditions. Typical environmental exposures for this test are:

- a. Ambient: 23 °C, 50% relative humidity (RH).
- b. Water soak, immediate: 168 h, 55 °C, test wet @ 23 °C.
- c. Water soak, recovery: 168 h, 55 °C, test after 24 h @ 23 °C.
- d. Hot: 82 °C (condition test samples at temperature a minimum of 4 h prior to testing - test at temperature).
- e. Cold: -30 °C (condition test samples at temperature a minimum of 4 h prior to testing - test at temperature).
- f. Humidity: 168 h, 38 °C, 100% relative humidity (RH), test wet @ 23 °C.

Note: Actual environmental exposures will be specified on the drawing or within performance requirement.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions. Test a minimum of three parts to demonstrate consistency from part to part.

4.3.1 Place in the appropriate environment for the specified length of time.

Note: If test samples are cut from parts, do not load one environment with all samples from the same part. Distribute the cut sections evenly between environments.

4.3.2 Test under specified environmental conditions (see 4.2.1).

4.3.3 Using crowbars or equivalent, force the bonded assembly apart (this will often entail a hammer and chisel at an edge to start the failure), along with a vise or equivalent to keep the part from moving.

4.3.4 Once the failure is started, care must be taken to not cut into either the adhesive or the substrate with the tip of the prying tool.

4.3.5 If there is a recovery time required, the samples are pried apart after the designated recovery time period.

4.3.6 Force the failure across the width of the bead path as opposed to parallel to the length. This concentrates the cleavage loading on one small area at a time.

Note: It is not recommended that an air chisel be used to separate the panels.

5 Data

5.1 Calculations.

5.1.1 Record the failure mode along the bondline. Also note skips or other features of the bondline.

5.1.1.1 Calculate percentage of each failure mode based on the estimate of actual bond area.

5.1.1.2 Calculate percentage of each failure mode based on the design intent bond area.

5.2 Interpretation of Results. Reference ISO 10365 "Adhesives - Designation of Main Failure Patterns".

5.2.1 Identify and report the test part and the parts materials (substrates, adhesives, and processing).

5.2.2 Report additional post-cure, if any.

5.2.3 Report the environmental exposure used prior to prying the sections apart.

5.2.4 Report the environmental conditions when the sections were pried apart (temperature, humidity, etc.)