GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW3220

Laminate Bond Strength

1 Introduction

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 test procedure is used to determine the average force required to physically separate one (1) of two (2) or more flat pliable layers from a laminate assembly.

1.2 Applicability. This procedure applies to laminated soft trim materials.

1.3 Remarks. This standard determines the strength required to separate two (2) soft laminated piles using a constant rate of extension at each required exposure treatment. The resulting graph, representing the strength as a function of jaw separation, is then evaluated to approximate the average laminate bond strength.

2 References

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

2.1 External Standards/Specifications.

ASTM D76 ISO 7500-1 ISO 9513

2.2 GM Standards/Specifications.

GMW3221

3 Resources

3.1 Facilities.

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 Apparatus for conditioning to the appropriate requirements as described in GMW3221 Code A, unless otherwise specified in the relevant materials specification.

3.2.2 Tensile Test Machine. An electronic constant rate-of-extension (CRE) tensile testing machine is required. A CRE type tensile testing machine is defined as an apparatus in which the pulling clamp moves at a uniform rate, and the force-measuring mechanism (load cell) moves a negligible distance with increasing force, less than 0.13 mm. The machine shall include a force indicating mechanism which will indicate (or record) continuously the force applied to the specimen and the accompanying elongation, when needed. It shall be equipped with a load cell whose capacity allows the indicated force to fall between 15% and 85% of its total capacity. This mechanism shall be capable of measuring force and elongation to the tolerances specified in this test method, as well as the following. The force-measuring system, including the recording mechanism, shall have a full-scale pen response time less than 2 s in either direction. The maximum allowable error in force indication shall be ± 0.5% of the reading. The maximum allowable error in recorded grip displacement shall be ± 1% of the recorded values. The maximum allowable variation in nominal gage length on repeated return of the clamps to their starting position shall be less than 0.25 mm. The maximum allowable variation of the crosshead speed of the tester from the required testing speed shall be less than 4%.

3.2.3 Local requirements for calibration and accuracy shall be satisfied (such as ASTM D76, ISO 7500-1, or ISO 9513).

3.2.4 The clamping device of the tensile testing machine shall be able to securely hold the test specimen over its width, without damage.

3.2.5 When testing specimens, which could be damaged by the clamps (e.g., fibers), the test specimens shall be protected at the clamps.

3.2.6 The jaw dimensions shall be a 25 mm × 50 mm minimum with the smaller dimension parallel to the direction of traverse.

3.2.7 Cutting dies or shears for preparation of test specimens.

3.3 Test Vehicle/Test Piece. Three (3) test specimens shall be tested for each direction. The dimension of the test specimen shall be (50 mm ± 5 mm) × 200 mm minimum.

3.4 Test Time.

Calendar time:	1 day
Test hours:	1 hour
Coordination hours:	1 hour

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Personnel trained in accordance with the laboratory accreditation and Standard Operating Procedure requirements.

4 Procedure

4.1 Preparation.

4.1.1 For each test exposure (as required), three (3) test specimens minimum shall be taken from two (2) directions, perpendicular to each other. (If there is a machine direction, in machine direction and perpendicular to machine direction. If there is no machine direction, a chosen direction and a direction perpendicular to the chosen direction.)

4.1.2 The size of the test specimens shall be (50 mm ± 5 mm) × 200 mm minimum.

4.1.3 Beginning at one (1) end of the 200 mm length, separate the initial 50 mm of the bond between two (2) layers, by hand. If two (2) layers cannot be manually separated without tearing one (1) of them, the results of this test shall be reported as (Substrate) Tear. The word Substrate shall be replaced with a term identifying the layer which tore.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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.

4.2.3 Standard Conditions (GMW3221-A). All test specimens shall be conditioned to GMW3221 Code A for a minimum of 24 h, unless the test method indicates that standard conditioning is not required or that other conditions apply.

4.3 Instructions.

4.3.1 Test Procedure.

4.3.1.1 Set the distance between the upper and lower jaws at 50 mm ± 5 mm.

4.3.1.2 Set the autographic recorder so that the peaks and valleys of the resulting curve are recorded between 15% and 85% of the chart width.

4.3.1.3 Clamp 25 mm ± 3 mm of one (1) of the separated plies centrally in one (1) of the jaws, and the other plies centrally in the other jaw.

4.3.1.4 Peel the plies apart at a rate of 100 mm/minute ± 5 mm/minute until the crosshead has traveled 100 mm minimum.

5 Data

5.1 Calculations.

5.1.1 Exclude the first 25% of the resulting graph. Also exclude all irregular peaks.

5.1.2 Identify the ten (10) highest and ten (10) lowest peaks in the remaining 75% of the graph, and their associated bond strengths.

5.1.3 Calculate the average of the ten (10) highest and ten (10) lowest bond strengths to the nearest 0.1 N.

5.1.4 Calculate the average of all test specimens taken in the same direction, for each exposure treatment.

5.2 Interpretation of Results. Not applicable.

5.2.1 Summary of Test Method. This standard determines the strength required to separate two (2) soft laminated plies using a constant rate of extension at each required exposure treatment. The resulting graph, representing the strength as a function of jaw separation, is then evaluated to approximate the average laminate bond strength.

5.3 Test Documentation.

5.3.1 Report the laminate bond strength for each test specimen (all directions and exposure treatments), in N/50 mm width.

5.3.2 Report the average of the three (3) specimens for each direction, at each exposure treatment, in N/50 mm width.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

CRE Constant Rate-of-Extension

GSSLT Global Subsystem Leadership Team

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW3220

9 Release and Revisions

This standard was originated in February 1999. It was first approved by in June 2000. It was first published in June 2000.

Issue	Publication Date	Description (Organization)
1	JUN 2000	Initial publication.
2	OCT 2000	Editorial Change (GMNA)
3	APR 2001	Add exposure condition coding.
4	MAY 2005	Test equipment addition, delete exposure treatment.
5	SEP 2005	References updated
6	FEB 2011	5 Year Refresh (Textile GSSLT.)
7	AUG 2016	5 Year Refresh. Publication history for Issue 3 is documented in Issue 4. (Materials Textiles/Trim Global Subsystem Leadership Team (GSSLT))