



Procedures for Test of Cellular and Related Materials Determination of Indentation Load Deflection and Hardness Number

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 method shall be used to determine the hardness number of cellular and related materials used in soft automotive trim applications.

1.2 Applicability. The applications of this test procedure include open cell foam and soft trim applications.

1.3 Remarks. Hardness number, as determined by this test procedure, shall be a dimensionless number that is numerically equal to the force in newtons (N) (total force minus preload) required to produce, under specified conditions, a specified compression of the test piece.

2 References

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

2.1 External Standards/Specifications.

None

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 GMW3221, Code A.

3.2.2 Testing machine for determination of Indentation Load Deflection (ILD) and hardness number.

3.2.2.1. The testing machine shall be capable of indenting the test piece between a supporting surface and an indenter, which shall have a uniform relative motion in the vertical direction of $100 \text{ mm} \pm 20 \text{ mm/minute}$ (multizone foam to Code 7 and Code 8 of Table 1, $50 \text{ mm} \pm 10 \text{ mm/minute}$).

Table 1: Test Conditions

Coding		1	2	3	4	5	6	7	8
Typical Parts Tested: Examples		Head Restraints	Center Arm Rests	Pads Front Seats	Pads Front and Rear Seats	Pads Front Seat Back Note 1	Pads Front Seat Back Note 1	Pads Multi-Zone Foam	Pads Multi-Zone Foam
Dimensions of Indenter Edge	Diameter (millimeters (mm))	100 ± 1	100 ± 1	152 ± 1	200 + 3	200 + 3	152 ± 1	25 ± 0.1	20 ± 0.1
	Radius (mm)	8 ± 1	8 ± 1	11 ± 1	1 + 0.5	1 + 0.5	11 ± 1	Chamfer 0.5 x 45 degrees	Hemisphere 10 ± 1
Preload (N)		5	6	20	20	20	20	5	1
Precompression	Number of Times	2	3	3	3	-	-	-	-
	Compressed Thickness in percent of t ₁ or t ₅ Note 3	70	70	70	70	-	-	-	-
Recovery Time after Final Precompression (seconds)		600 ± 300	< 10	< 10	< 10	-	-	-	-
Measuring Compression	t ₂ or t ₇ Note 3 (percent)	50	40	40	40	40	40	-	-
	(mm)	-	-	-	-	-	-	20	14 Note 2
Dwell Time after which Hardness is Read (seconds)		60 ± 1	Immediately (i.e., Maximum Force)	Immediately (i.e., Maximum Force)	Immediately (i.e., Maximum Force)	60 ± 1	60 ± 1	Immediately (i.e., Maximum Force)	Immediately (i.e., Maximum Force)

Note 1: Only rubber hair or rubber coco fiber.

Note 2: Per GM Engineering, measuring compression may be called out at 20 mm on Drawing.

Note 3: t₁ thru t₇ = See 4.3.3 and 4.3.4

3.2.2.2 The testing machine shall have a means of measuring the force required to produce the specified indentation (see 4.3.2) with a precision of ± 1% or ± 1 N, whichever is greater.

3.2.2.3 Means of measuring the test piece thickness under load to an accuracy of ± 0.5 mm for the specified period shall be provided.

3.2.2.4 The support surface of the test machine shall be smooth, flat, horizontal, rigid, larger than the test piece and suitably vented with holes 6 mm ± 0.1 mm in diameter and 20 mm ± 0.1 mm in pitch.

3.2.2.5 Indenters. The indenters used for testing parts to Codes 1 thru 6 of Table 1 shall be flat, circular and mounted in the testing machine by means of a ball joint free from vertical movement. A stationary indenter shall be used for testing parts to Code 7 and Code 8 of Table 1. The diameters and corner radii at the lower edge of the indenters used are shown in Table 1.

3.2.2.6 Support Blocks (for Test to Procedure B Only, see 4.3.4). The size, shape, etc., of the support block will be shown on the relevant engineering drawing, material procedure, etc.

3.2.2.6.1 Blocks shall be made of wood, epoxy resin or other suitable material and shall not be ventilated (i.e., the supporting area shall be continuous).

3.2.2.6.2 Side supports (Procedure B only, see Figure 2) shall be incorporated into the support block to reduce horizontal splay of foam during compression (i.e., Code 7 or Code 8 seat bolster compression).

3.2.2.7 Spirit level.

3.2.2.8 Cutting dies or saws for preparation of the test piece where necessary.