



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 procedure shall be used to determine the indentation hardness of flexible, and semi-flexible, foam, foam components and related materials.

1.2 Applicability. Seats, instrument panel, head restraints, armrest, soft integral-skin foam, etc.

1.3 Remarks. Not applicable.

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

2.3 Additional References. None.

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. Testing machine for determination of Hardness Number and Indentation Load Deflection (ILD).

3.2.2.1 The testing machine shall have capacity to compress the test piece between a supporting surface and an indenter, which shall have a uniform relative motion in the vertical direction from (50 mm/minute to 100 mm/minute).

3.2.2.2 The testing machine shall have a means of measuring the force required to produce the specified indentation with a precision of $\pm 1\%$, or ± 1 N (or ± 0.01 mm, as appropriate), 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 $6 \text{ mm} \pm 0.1 \text{ mm}$ in diameter and $20 \text{ mm} \pm 0.1 \text{ mm}$ in pitch.

3.2.3 Indenters.

3.2.3.1 The indenters for Codes 1, 4, 5, 7 and 8 shall be mounted stationary to the testing machine.

3.2.3.2 The indentors for Code 2 and Code 3 shall be mounted to the test machine by means of a ball-joint, free of vertical movement.

3.2.3.3 The shapes, diameters and corner radii at the lower edge of the indentors used (see Table 1).

3.2.3.4 Indenter shall be made of steel or aluminum, or equivalent.

Table 1: Test Conditions

Coding		1	2	3	4	5	7	8
Typical Parts Tested		Head Restraints Note 1	Center Arm Rests	Pads Seats-Insert	Pads Multi-Zone Foam	Thin Head Restraints ≤ 25 mm; Armrest; Instrument Panels; Door Panels in Thin Foam	Pads Multi-Zone Foam	Pads Seats-Bolster
Indenter Shape (see Figure 1)		Hemisphere or Sphere	Flat Round Plate	Flat Round Plate	Hemisphere or Sphere	Flat Round Plate	Chamfered Rounded Plate	Hemisphere or Sphere
Dimensions of Indenter Edge	Diameter (mm)	50 ± 1.0	100 ± 1	152 ± 1	12.5 ± 0.1	25 ± 0.5	25 ± 0.1	20 ± 0.1
	Radius (mm)	25 ± 1.0	8 ± 1.0	1.0 ± 0.2	6.25 ± 0.1	1.0 ± 0.2	0.5 × 45°	10 ± 1.0
Precompression	Rate (mm/minute)	-	20 ± 0.4	100 ± 5	20 ± 0.4	-	-	-
	Number of Times	-	3	3	2	-	-	-
	Compressed Thickness in percent of	-	70	75	70	-	-	-
Recovery Time after Final Precompression (seconds)		-	0	0	-	-	-	-
Preload (N)		1.25 ± 0.15	1.0 ± 0.1	20 ± 0.25	1.25 ± 0.15	1.25 ± 0.15	1.0 ± 0.1	1.0 ± 0.1
Compression Rate (mm/minute)		50 ± 1.0	100 ± 1.0	100 ± 1.0	50 ± 1.0	20 ± 0.4	50 ± 1.0	50 ± 1.0
Measuring Force	(N)	-	-	-	10 ± 0.1 Note 2			
Measuring Deflection	(percent)	-	40	40	-		-	-
	(mm)	12.7 ± 1.0 Note 3	-	-	-	6 ± 0.5 Note 4	20 ± 1	14 ± 1.0 Note 5
< Dwell Time after which Hardness is Read (seconds)		5 ± 1	Immediately (i.e., Maximum Force)	Immediately (i.e., Maximum Force)	Immediately (i.e., Maximum Force)	5 ± 1.0	Immediately (i.e., Maximum Force)	Immediately (i.e., Maximum Force)

Note 1: Thin head restraint foam ≤ 25 mm thickness follow GMW14359 Code 5.

Note 2: Per GM Engineering, measuring force may be called out at 20 N on drawing.

Note 3: Per GM Engineering, measuring compression may be called out at 14 mm on drawing.

Note 4: Per GM Engineering, measuring compression may be called out at 2 mm on drawing.

Note 5: Per GM Engineering, measuring compression may be called out at 20 mm on drawing.