

BRITISH STANDARD : AUTOMOBILE SERIES  
SPECIFICATION FOR  
RUBBERIZED HAIR COMPONENTS

FOREWORD

This British Standard, which is published under the authority of the Automobile Industry Standards Committee of the B.S.I., is based upon data-sheet SMMT 183: 1961 of the Society of Motor Manufacturers and Traders Ltd.

The attention of designers is drawn to the fact that the density of rubberized hair cannot be satisfactorily related to its hardness, and to the important property differences, in particular indentation set, which exist between different classes of material. The permissible extent of this set, and therefore the class of material to be used, will necessarily have to be related to the service application and the thickness of the component.

SPECIFICATION

SCOPE

1. This British Standard specifies requirements for rubberized hair components for use in automobiles.

DEFINITIONS

2. For the purposes of this British Standard, the following definitions apply:

Original thickness	A dimension which is determined by placing a specimen of the material 6 x 6 in cut from the sample sheet, horizontally between two larger flat plates, such that the total load on the upper surface of the specimen is 1 lb. The original thickness is then taken to be the average distance of separation of the plates. NOTE 1. A steel plate measuring 9 x 9 in, and of thickness 0.048 in (18 SWG) weighs 1 lb. NOTE 2. The original thickness is subject to the tolerances given in Table 2.
Initial thickness	The thickness of the material after it has been mechanically conditioned in accordance with Appendix C4b.
Total thickness	The original thickness of superimposed samples necessary when the individual sample has an original thickness of less than 1½ in (38 mm).

GRADING AND CLASSIFICATION

3. a. *Classification.* The rubberized hair component shall be classified by its indentation set, as follows:  
Class 1. Loadbearing components such as cushions, and in general those requiring the least amount of indentation set.  
Class 2. Loadbearing and other components such as overlays or squabs, whose service application tolerates a greater degree of indentation set.  
Class 3. Components which are recommended only for non-loadbearing functions, such as filling and padding.

b. *Grading.* The rubberized hair shall be graded by its indentation hardness index (see Clause 9) as follows:

Grade	Indentation hardness index (using 12 in indentor)
	kg
B	10.5 - 14.0
C	14.0 - 17.5
D	17.5 - 22.0
E	22.0 - 27.0
F	27.0 - 33.0
G	33.0 - 41.0

#### MATERIALS

4. The components shall be manufactured from material consisting essentially of curled animal hair, suitably coated with natural rubbers, synthetic rubbers, or both. The rubberized hair structure shall be uniform and free from voids, knots and corms.

Other mixtures of materials may be used by agreement between the purchaser and the manufacturer; the manufacturer shall disclose the fibre content of rubberized hair components when fibre is contained in proportions exceeding 5 per cent by weight of the hair excluding rubber, or 2½ per cent by weight of the total component.

The materials shall comply with the requirements of B.S.1425\* for cleanliness.

#### CONSTRUCTION

5. The components may be supplied as moulded or fabricated shapes, or both, or in sheet form.

#### ODOUR

6. The odour of the components shall be as slight as possible, and shall not be objectionable.

#### COLOUR

7. The colour of the components shall be as agreed between the purchaser and the manufacturer.

Where secondhand hair is used, the component shall be coloured black.

#### DIMENSIONS

8. The dimensions of components shall be as specified by the purchaser, and unless otherwise agreed between the purchaser and the manufacturer, shall be subject to the tolerances shown in Tables 1 and 2.

TABLE 1. TOLERANCES ON LENGTH AND WIDTH

Dimensions	Tolerances
in (mm)	in (mm)
Up to and including 12 (305) moulded:	-0 + ¼ (6.4)
otherwise shaped or fabricated:	-0 + ½ (12.7)
Over 12 (305) up to and including 25 (635)	-0 + ½ (12.7)
Over 25 (635) up to and including 50 (1270)	-0 + ¾ (19)
Over 50 (1270) up to and including 75 (1905)	-0 + 1¼ (32)
Over 75 (1905) up to and including 88 (2235)	-0 + 1¾ (44)

NOTE. The trimming allowances are the sole responsibility of the designer. The actual dimensions of a rubberized hair article used in upholstery should be greater than the nominal dimensions by a small amount in order to allow the component to be slightly compressed by a cover made up to nominal dimensions.

\*B.S.1425, 'Cleanliness of fillings and stuffings for bedding, upholstery, toys and other domestic articles'.

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TABLE 2. TOLERANCES ON ORIGINAL (FREE) THICKNESS

Dimensions	Tolerances
in (mm)	in (mm)
Up to and including 1 (25.4)	-0 + 1/4 (6.4)
Over 1 (25.4) up to and including 3 (76)	-0 + 1/2 (12.7)
Over 3 (76)	-0 + 3/4 (19)

## PHYSICAL REQUIREMENTS

9. Rubberized hair components, when tested by the appropriate method, shall comply with the requirements given in Tables 3 and 4.

TABLE 3. INDENTATION HARDNESS GRADES

Grade	B	C	D	E	F	G	Method of test
Hardness index (kg) using a 12 inch indenter	10.5-14	14-17.5	17.5-22	22-27	27-33	33-41	Appendix C

TABLE 4. PHYSICAL REQUIREMENTS

	Class 1	Class 2	Class 3	Method of test
Indentation set test:				
Indentation set, maximum per cent	6	11	30	Appendix D
Hardness index change, maximum per cent	+0 -15	+0 -25	+0 -40	Appendix D
Humidity ageing: hardness index change, maximum per cent	±7.5	±10	±15	Appendix E
Heat ageing: hardness index change, maximum per cent	±5	±10		Appendix F
Pounding fatigue test (optional):				
Set, maximum per cent	5	5		Appendix G
Hardness index change, maximum per cent	+0 -15	+0 -15		Appendix G
Organic materials staining	Shall not stain Shall conform to requirements of B.S.1425*			Appendix H
Cleanliness				

\*B.S.1425, 'Cleanliness of fillings and stuffings for bedding, upholstery, toys and other domestic articles'.

## SAMPLES FOR APPROVAL

10. Samples representative of the particular component shall be submitted for approval of dimensions and other requirements specified in the preceding clauses, and the number of samples submitted shall be sufficient to allow the individual tests prescribed in the Appendices to be carried out on separate samples.

Samples shall also be submitted for material approval as distinct from component approval, and shall preferably be in the form of sheet 1 1/4 in to 2 1/2 in (32mm to 63mm) in thickness and not less than 36 in (914mm) square. The thickness dimension may be alternatively achieved by superimposing sheets of less thickness.

**APPENDIX A. NOTES FOR DESIGNERS**

**A1.** Drawings should bear the number of this British Standard, the material class and the hardness grade, e.g.:

B.S.AU 123/1 Grade D

B.S.AU 123/2 Grade D

B.S.AU 123/3 Grade D

Additional material property requirements shall not be specified without prior agreement between the purchaser and supplier.

**A2.** Indentation hardness indices referred to in the standard relate to 12 in (305mm) diameter indentor tests only.

When the size of a component necessitates the use of a 6 in (152mm) diameter indentor, this fact shall be stated on the drawing, and the hardness index grade will be as agreed between purchaser and manufacturer, e.g. B.S.AU 123/2-6 inch indentor, Grade D.

**A3.** Where components of substantially non-rectangular cross sections are concerned, drawings shall include a diagram clearly indicating the location of the indentor during testing. Such a diagram will be prepared only after experimentation with materials and design has led to agreement between purchaser and supplier (see also Appendix C).

**APPENDIX B. CONDITIONING AND TEST ATMOSPHERES**

Components or specimens shall not be tested until at least 72 hours have elapsed after manufacture. Unless otherwise agreed between the purchaser and the manufacturer, samples shall be conditioned prior to test for a minimum period of 24 hours at  $65 \pm 5$  per cent relative humidity at a temperature of  $20 \pm 2^\circ\text{C}$ .

Humidity has a pronounced influence on the hardness of rubberized hair and all testing should be carried out under reasonably constant conditions. All tests should be carried out with the face side (i.e. the smoother surface) of the component upwards.

**APPENDIX C. INDENTATION HARDNESS INDEX**

**C1. Terminology.** The indentation hardness index is the load in kilogrammes required to produce an indentation in the sample equivalent in depth to 40 per cent of the initial thickness of the sample under specified conditions.

**NOTE.** The indentation hardness index determined with the 12 in (305mm) indentor is in no way comparable with that determined with the 6 in (152mm) indentor, and will vary with the thickness of the sample.

**C2. Samples.** Normally the tests shall be carried out on a complete article; components or sheet material of thickness less than  $1\frac{1}{4}$  in (32mm) shall be superimposed to provide a test thickness of not less than  $1\frac{1}{4}$  in (32mm) nor more than  $2\frac{1}{2}$  in (63mm).

Samples shall be of substantially rectangular cross section in the test area, and shall be of such size to allow a margin of not less than 1 in (25.4mm) all round the indentor used. Where components of substantially non-rectangular cross section are concerned the area to be tested shall be indicated on the relevant drawing and the method of support shall be as specified by the purchaser.

**C3 Apparatus.**

*a. Testing machine.* The testing machine shall be capable of compressing the sample by means of an indentor moving vertically at a uniform rate of 2-3 mm per second and shall have means of measuring the load required to produce the specified indentations within 1 per cent or  $\pm 0.1$  kg whichever results in the greater accuracy and of measuring sample thickness under load with an accuracy of  $\pm 0.005$  in (0.13 mm). It shall be capable of applying loads of  $0.5 \pm 0.1$  kg and  $2 \pm 0.1$  kg and of maintaining the same degree of indentation to within  $\pm 0.005$  in (0.13 mm) for a period of one minute.

Unless otherwise specified the sample shall be supported on a smooth, flat, horizontal and rigid surface, at least 24 in (610mm) square and suitably vented with holes approximately  $\frac{3}{8}$  in (10mm) in diameter at approximately  $2\frac{3}{4}$  in (70mm) pitch in order to allow the escape of air from below the sample.

*b. Indentor.* The circular indentor shall be mounted from a ball joint free from vertical movement and shall be  $12 \pm 0.040$  in ( $305 \pm 1$ mm) in diameter with a  $1 \pm 0.040$  in ( $25.4 \pm 1$ mm) radius at the lower

edge. When a component is too small to allow the margin specified above, the indenter shall be  $6 \pm 0.040$  in ( $152 \pm 1$  mm) diameter with a radius of  $\frac{1}{2} \pm 0.040$  in ( $13 \pm 1$  mm) at the lower edge.

#### C4. Procedure.

*a. Sample orientation.* The sample shall be placed with any cavities or profiled surface facing downward on the support plate; sheet type components shall be placed with their smooth surface facing upward. Any parts of the sample projecting beyond the support shall be supported in the same plane.

*b. Mechanical conditioning.* Before testing, the selected test area shall be mechanically conditioned by indenting momentarily by 70 per cent of the original thickness. This operation shall be carried out five times consecutively.

The test shall then be carried out within one minute of release of the mechanical conditioning load.

*c. Thickness and hardness measurement.* The initial thickness of the test area shall be measured under a load of  $2 \pm 0.1$  kg ( $0.5 \pm 0.1$  kg for 6 in (152 mm) indenter) applied by the indenter. The sample shall then be further indented at a uniform rate of 2-3 mm/s. When an indentation of 40 per cent of the initial thickness has been reached this shall be maintained for a period of 60 seconds and the total load then read.

If repeat tests on the sample location are required, a minimum recovery period of 6 hours shall be allowed between each test.

NOTE. Rubberized hair is not satisfactorily stabilized or mechanically conditioned by maintaining the material in a state of compression for a given period. The repeated indentations produce some measure of rearrangements of the rubberized hairs.

### APPENDIX D. STATIC INDENTATION TEST

**D1. Introduction.** This test consists of indenting a component under constant load for a period, and thereafter measuring the set or temporary loss of thickness suffered by the component and its change in hardness index.

**D2. Samples.** The requirements shall be as given in Appendix C2.

Where the component is too small to permit the use of the specified indenter, the test shall be carried out on a representative sample of the same thickness and of sufficient size.

**D3. Indenter.** The circular flat indenter shall have a diameter of  $12 \pm 0.040$  in ( $305 \pm 1$  mm) with a radius of approximately  $\frac{5}{16}$  in (2 mm) at the lower edge.

NOTE. This indenter has a larger flat surface than the indenter specified in Appendix C to permit the use of the 1 inch radius indenter for the subsequent hardness test required by Clause D4 below.

**D4. Procedure.** The initial thickness (see Clause 2) of the test area and the indentation hardness index shall be determined using the apparatus and indenter specified in Appendix C.

The flat indenter described in Clause D3 above shall then be placed on the component in the test location and loaded so as to produce a total load as follows:

Hardness Grade*	Total applied load
B	15 kg
C, D	25
E, F, G	35

\*Hardness Grades are as determined with the 12 in (305 mm) indenter specified in Appendix C.

The indenter shall be allowed to remain in position for a period of 72 hours, after which it shall be removed and the component allowed to recover for a period of 1 hour.

The thickness and indentation hardness index shall then be redetermined by the method described in Appendix C.

**D5. Expression of results.** The indentation set shall be reported as a percentage of the initial thickness.

$$\text{Per cent set} = \frac{\text{Initial thickness} - \text{Final thickness}}{\text{Initial thickness}} \times 100$$

The change in indentation hardness index shall be reported as a percentage of the original indentation hardness index.

Per cent indentation hardness index change =

$$\frac{\text{Original hardness index} - \text{Final hardness index}}{\text{Original indentation hardness index}} \times 100$$

#### **APPENDIX E. HUMIDITY AGEING**

**E1. Introduction.** This test consists in ageing a rubberized hair test piece under humid conditions and determining changes in the indentation hardness.

**E2. Test pieces.** These shall be components or portions of components such as may be hardness tested using a 6 in (152 mm) diameter indenter.

**E3. Ageing conditions.** The test piece shall be completely exposed to an atmosphere of 95-100 per cent relative humidity at a temperature of  $70 \pm 1^\circ\text{C}$  for a period of fourteen days. Thereafter the test piece shall be dried at a temperature of  $70 \pm 1^\circ\text{C}$  for a period of not less than 3 hours followed by a minimum 16 hours conditioning period at  $20 \pm 2^\circ\text{C}$  and  $65 \pm 5$  per cent relative humidity prior to testing as specified below.

**E4. Indentation hardness index change.** The indentation hardness index shall be determined in accordance with the requirements of Appendix C, using a 6 in (152 mm) indenter before and after ageing and the results shall be reported as a percentage change. The same sample shall be used both before and after ageing.

Per cent indentation hardness index change =

$$\frac{\text{Original hardness index} - \text{Final hardness index}}{\text{Original hardness index}} \times 100$$

#### **APPENDIX F. HEAT AGEING**

**F1. Introduction.** This test consists in ageing a rubberized hair test piece under conditions of dry heat and determining the resultant changes in the Indentation hardness index, with the 6 in (152 mm) indenter.

**F2. Test pieces.** The requirements shall be as given in Appendix E2.

**F3. Ageing conditions.** The test piece shall be maintained in a well ventilated oven at a temperature of  $70 \pm 2^\circ\text{C}$  for a period of fourteen days. Thereafter the test piece shall be conditioned for a period of not less than 16 hours in an atmosphere of  $65 \pm 5$  per cent relative humidity at  $20 \pm 2^\circ\text{C}$ .

**F4. Indentation hardness index change.** The requirements shall be as given in Appendix E4.

#### **APPENDIX G. POUNDING FATIGUE TEST**

**G1. Introduction.** This test is optional and is intended to provide information regarding the loss in thickness or the loss in hardness likely to be suffered by a rubberized hair component in service. Whilst performance limits have been set in the standard, this should not be taken to indicate that exact correlations have been established between service and laboratory test conditions.

The test is of the constant deflection type, and it is anticipated that the test will be replaced by a more severe constant load test, when the dynamic testing of cushioning materials in general has been rationalized.

**G2. Apparatus.** The apparatus shall consist of any suitable means by which the test materials may be repeatedly indented by 40 per cent of their original thickness, at a rate of 1-4 cycles per second

The circular indenter shall be  $18 \pm 0.040$  in ( $457 \pm 1$  mm) in diameter with a  $3 \pm 0.040$  in ( $76 \pm 1$  mm) radius at the outer edge and shall be supported from a ball joint. The component shall be supported by a plate suitably vented with holes as laid down in Appendix C3.

**G3. Procedure.** The test sample shall be mechanically conditioned in the desired test location following the procedure laid down in Appendix C4 b and following on immediately the initial thickness of the material shall be recorded under a  $2.0 \pm 0.1$  kg load applied by a 12 in (305 mm) diameter indenter.

Thereafter, the original hardness index of the component shall be determined as laid down in Appendix C.

The component shall then be positioned and secured in the pounding apparatus, and submitted to 250 000 indentations.

The thickness of the component and its hardness index in the test area shall then be determined without delay as laid down in this clause.

#### G4. Expression of results.

*Set.*

$$\text{Percentage set} = \frac{\text{Initial thickness} - \text{Final thickness}}{\text{Initial thickness}} \times 100$$

*Hardness index change.*

$$\text{Percentage hardness index change} = \frac{\text{Original hardness} - \text{Final hardness}}{\text{Original hardness}} \times 100$$

### APPENDIX H. ORGANIC MATERIALS STAINING TEST

**H1. Introduction.** This test is intended to provide information as to whether components made of rubberized hair will cause discoloration of plastics materials or organic finishes with which they may be in contact in service.

**H2. Samples.** The surface of the samples shall be freed from loosely adhering matter by brushing with a clean soft brush.

**H3. Test panels.** The test panels shall consist of suitably dimensioned pieces of any organically finished material which may present a visibly significant surface in use, such as may come into contact with rubberized hair in service.

Normally the test panels shall consist of supported or unsupported, light coloured (cream or white) PVC as specified by the purchaser.

**H4. Procedure.** The sample shall be held in contact with the test panel under a load of approximately 2.13 lbf/in<sup>2</sup> (0.15 kgf/cm<sup>2</sup>) of contact area. The test assembly shall then be subjected to a temperature of 70±1°C in a well ventilated air oven for a period of 24 hours. After cooling and removal of the test piece, the test panel together with a panel which has not been in contact with the test piece shall be exposed to an artificial source of ultra-violet light from a mercury vapour lamp or carbon arc for a period of 6 hours.

### APPENDIX J. CONDITIONS OF STORAGE

Rubberized hair components should be kept in well ventilated stores, in an atmosphere free from the products of combustion from any heating appliance and free from solvent vapours.

Under no circumstances should components be stored in direct sunlight or exposed to ultra-violet light.

When components are stacked in storage, care should be taken to avoid undue compression or distortion. Special care should be taken when stacking moulded or fabricated components of irregular shape.

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This British Standard, having been approved by the Automobile Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council of the Institution on 25th March, 1966.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

*British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.*

The following B.S.I. reference relates to the work on this standard:  
Committee reference AUE:-

