

**Ministry of Defence
Defence Procurement Agency, ADRP2
Abbey Wood
Bristol
BS34 8JH**

OBSOLESCENCE NOTICE

All DTD specifications were declared obsolescent from 1st April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

Further Guidance

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

Aerospace Material Specification
EXPANDED NITRILE EBONITE FOR SANDWICH CONSTRUCTION

NOTE 1. This specification is one of a series issued by the Procurement Executive, Ministry of Defence, either to meet a limited requirement not covered by an existing British Standard for aerospace material, or to serve as a basis for inspection of material, the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardization.

NOTE 2. This specification calls for the use of substances and test procedures that may be injurious to health if the adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations related to health and safety at any stage of manufacture or use.

This specification has been devised for the use of the Ministry of Defence and its contractors in the execution of contracts for the Ministry and, subject to the Unfair Contracts Terms Act 1977, the Ministry will not be liable in any way whatever (including but without limitation negligence on the part of the Ministry and its servants or agents) where the Specification is used for other purposes.

SECTION 1

Scope

1. Scope

The material specified in this document is intended primarily for use in the core of sandwich type radomes and other structures where transparency to electromagnetic radiation of radar frequencies is required, and covers boards of nominal thicknesses between 1.60 mm and 25.0 mm.

The tests employed are chosen to control the manufacture of material, the user should satisfy himself that the properties and tolerances are acceptable for the particular application.

SECTION 2

Related Documents

2. Related Documents

Reference is made in this document to the following:

BS 4370—Methods of test for Rigid Cellular Materials

BS 903 Part E2 (1958)—Methods of Testing Cellular Fibonite

Di-electric Materials and Applications A R Von Hippel

The related documents listed are those applicable at the date of publication of this specification. Their current applicability must be confirmed by all users of this specification. The Quality Assurance Authority will supply, on request, information concerning any changes that may be necessary due to cancellation, replacement, supersession or amendment of any related document.

SECTION 3

Description

3. Description

The material shall be supplied in the form of boards having a closed cell structure. The boards shall be manufactured from a suitably compounded butadiene/acrylonitrile rubber, expanded by the use of a chemical blowing agent and vulcanised to a hard ebonite stage. The mix shall be free of any ingredient likely to impair the electrical properties of the finished boards, eg carbon black.

Boards of a nominal thickness up to 5.0 mm may be made by splitting from thicker material at an intermediate manufacturing step. Boards of nominal thickness greater than 5.0 mm should be made directly from moulded blanks. Depending on the thickness, the boards may have continuous thin skin on one or both major surfaces, or no skin on either major surface. The finished boards shall be suitable for machining at normal temperatures and also for moulding to curved shapes after pre-heating to 110°C.

SECTION 4

Freedom from Defects

4. Freedom from Defects

The boards shall be substantially flat and free from obvious foreign matter. The cellular structure shall be substantially uniform and any major surface skins present shall be continuous. Any depressions in the surfaces shall be shallow and resulting thin areas within the thickness tolerances specified in 5.1.

SECTION 5

Test Procedures

5. Test Procedures

Boards shall be tested as supplied.

5.1 Dimensions

Boards shall be tested in accordance with BS 4370 Pt 1 Method 1A. The thickness at any point of each board shall not differ from the nominal thickness by more than ± 0.40 mm. The size shall be as stated in the contract or order.

5.2 Apparent Density

The apparent density of the board material, determined in accordance with BS 4370 Pt 1 Method 2, without removal of surface skin, shall be within the limits shown below.

Nominal thickness (mm)	Apparent density kg/m^3	
	Minimum	Maximum
Less than 8	190	220
8 up to, but not including 10	150	175
10 and over	130	150

5.3 Compressive Strength

The test piece shall be square having a side of length 50 mm or $1\frac{1}{2}$ times the thickness of the test piece, whichever is the greater, and shall be the thickness of the board from which it is cut.

The compressive strength of the board material when determined in accordance with BS 4370 Pt 1 Method 3 shall have values not less than:—

Nominal thickness (mm)	Compressive strength (kPa)
	Minimum
Less than 5	850
5 up to, but not including 10	800
10 up to, but not including 15	700
15 up to, but not including 20	500
20 and over	400

5.4 Plastic Yield

When determined at $70^\circ \pm 1^\circ\text{C}$ in accordance with Appendix 1, the plastic yield shall not be more than 12.5 mm.

NOTE: Test pieces with a skin on one face only shall be tested with the skin uppermost.

5.5 Stability and Formability at Moulding Temperature

The board material, when tested as described in Appendix 2, shall closely follow the contour of the mandrel and remain so shaped without fracture or formation of any surface blisters having a maximum dimension greater than 8.0 mm.

5.6 Electrical Properties

The power factor and permittivity of the board material, when determined by 'The Shorted Line Technique', Di-electric Materials and Applications at $23 \pm 2^\circ\text{C}$ and at a frequency of 9000-9500 Megahertz (MHz) shall comply with the following requirements:

Loss Tangent — 0.0065 Maximum

Permittivity — 1.25 ± 0.07

The electrical properties shall be measured without the removal of any surface skin.

SECTION 6

Type Approval

6. Type Approval

6.1 Before any material can be accepted as complying with the requirements of this specification, it shall have received type approval. To obtain such approval, the manufacturer (of the finished board) shall satisfy the Type Approval Authority that the material will meet all the requirements of this specification.

6.2 The Type Approval for material to this specification is:—

Director, Aeronautical Quality Assurance Directorate (AQD)
Harefield House
UXBRIDGE
Middlesex.

6.3 When applying for type approval the manufacturer shall submit the following:—

6.3.1 Full details of the composition together with details of the standard vulcanizing conditions applicable to the boards. This information will be treated as confidential.

6.3.2 A range of sample boards representative of the thickness range.

After type approval has been obtained, no change in composition or method of manufacture shall be made without the formal agreement of the Type Approval Authority.

SECTION 7

Routine Quality Control

7.1 Frequency of Testing

7.1.1 Each board shall be tested for compliance with Clause 4 and Clause 5 Para 5.1.

7.1.2 One board, representative of each batch of boards of each nominal thickness, shall be tested for compliance with Clause 5, Paras 5.2, 5.3, 5.4 and 5.5.

7.1.3 At least one board from every batch of mix shall also be tested for compliance with Clause 5, Para 5.6, subject to each nominal thickness being tested periodically.

7.1.4 A batch of boards shall be a number of boards so designated by the manufacturer, of the same nominal thickness manufactured from one batch of mix or from one homogeneous blend of mixes.

7.2 Further Testing

The Quality Assurance Authority named in the contract may at any time require the manufacturer to test for compliance with any of the provisions of this specification.

APPENDIX I

Determination of plastic yield

1. Test Piece

The test piece shall be a bar 200 ± 5 mm long 25 ± 1 mm wide and the thickness of the board. It shall be cut not less than 12.5 mm from an edge of a sample board. The cutting instrument used shall be of a type which will give a cleanly cut edge; a fine band-saw is convenient for this purpose. Normally all the test pieces shall have the originally moulded major surface at the top and bottom and freshly cut sides. Any test pieces showing imperfections shall not be used.

2. Apparatus

The apparatus comprises two rigid parallel supports not less than 30 mm long and with the horizontal upper surfaces machined to 12.5 ± 0.5 mm radius, and so arranged that the lines of contact with the test piece are 178.0 ± 0.5 mm apart, together with a metal loading member radiused at the bearing surface to 35.7 ± 0.5 mm. The loading member shall be positioned midway between the two supports and its mass shall vary according to the thickness of the material being tested and shall be calculated from the following formula:-

$$\text{Mass in grammes} = 2.5 \times t^2$$

where t is the thickness of the test piece in millimetres.

The mass used shall be within 2 per cent of the calculated mass.

NOTE: A suitable apparatus is described in BS 903 Part E2.

Suitable means of measuring the vertical movement of the test piece.

3. Test Procedure

3.1 Conditioning of Samples and Test Pieces

Test pieces shall be cut not less than 24 hours after vulcanization and tests shall be carried out not less than 48 hours after vulcanization.

Samples and test pieces shall be protected from light as completely as possible during the interval between vulcanization and testing.

3.2 Determination of Plastic Yield at a Specific Temperature

The test apparatus and loading member shall be placed in the oven and brought to $70^{\circ} \pm 1^{\circ}\text{C}$.

The test piece with one of the moulded faces uppermost shall then be placed symmetrically in position on the apparatus. The mounting of the test piece shall be effected as quickly as possible so that the oven is not allowed to cool unduly during the operation. The position of the top surface of the test piece at its centre, after a period of 30 ± 5 minutes in the oven, shall be taken as the zero position relative to the base. The loading member shall then immediately be placed centrally on the test piece, without disturbing the temperature conditions in the oven.

The apparatus and the loaded test piece shall then be maintained for 30 ± 1 minutes at $70^{\circ} \pm 1^{\circ}\text{C}$.

The displacement in millimetres of the top surface of the test piece at its centre from the zero position after this period shall be recorded as the plastic yield of the test piece.

The mean of the results on three test pieces shall be reported as the plastic yield of the material.

4. Report

The report shall state:—

- (i) Plastic yield in millimetres at the test temperature.
- (ii) Nominal thickness of material.

APPENDIX II

Method of Test for Stability and Formability at Moulded Temperature

The test piece may be a complete board or a piece lengthwise, cut from a board, at least 50 mm wide and 300 mm long. It shall be supported flatwise in an air oven at $110^{\circ} \pm 1^{\circ}\text{C}$ and then immediately rolled around a steel mandrel which has also been heated to the moulding temperature.

NOTE: Test pieces with a skin on one face only shall be tested with the skin against the mandrel.

The test piece shall be held in contact with the mandrel whilst cooling to room temperature and then examined for signs of fracture and blistering.

The pre-heating time at moulding temperature and the diameter of the mandrel shall be appropriate to the nominal thickness of the test piece as shown in the Table:—

Nominal thickness (mm)	Pre-heating time (min)	Diameter of mandrel (mm)
Less than 7	10	100
7 up to, but not including 10	10	200
10 up to, but not including 15	15	300
15 and over 30	30	300

Approved for issue,

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