D.T.D.869A

Ministry of Defence
Defence Procurement Agency, ADRP2
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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.

MINISTRY OF SUPPLY

D.T.D. 869A

(Superseding D.TD. 869)
November, 1957

Aircraft Material Specification

LAMINATED SAFETY GLASS, HIGH LIGHT TRANSMISSION

NOTE 1. — This specification is one of a series issued by the Ministry of Supply either tmeet a limited requirement not covered by an existing British Standard, or to serve as a basis for inspection of materials the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardisation.

NOTE 2. — For bullet resistant safety glass, high light transmission, see Specification No. D.T.D.870A.

SECTION I

Requirements

1. Description

Each safety glass panel shall consist of two or more pieces of flat or curved transparent glass cemented together with a transparent plastic interlayer or interlayers. The plastic interlayer may be extended beyond the edge of the glass to provide a flexible mounting and may be fitted with metal reinforcement, as specified in the contract.

2. Type and quality of glass

The glass used shall be one or more of the following types as specified in the contract:—

Type 1 .. .. strengthened glass
Type 2 .. .. toughened glass
Type 3 .. .. annealed glass

The sweep toughening process shall be used in the manufacture of Types 1 and 2.

The quality of the glass shall be that known as " special white plate " having a thickness of $\frac{3}{16}$ in. and upwards.

3. Type and thickness of interlayer

(a) The interlayer shall consist of polyvinyl butyral plasticised with dibutyl sebacate or tri-ethylene glycol di-hexoate. The plasticiser content shall be 17 ± 3 per cent. when the glass is provided with a flexible mounting, or 29 ± 3 per cent. when the glass is not so provided.

(b) The minimum thickness of interlayer shall be:—

0.120 inch when the glass is provided with a flexible mounting.
0.020 inch when the glass is not so provided.

(c) Where metal reinforcement is specified, the metal shall preferably be a continuous frame of aluminium coated aluminium alloy sheet to Specification B.S. L.72.

The minimum thickness of the metal shall be 0.022 in. (24 S.W.G.).

The metal shall be embedded within the plastic edge around the periphery of the panel and shall penetrate to a depth of not less than ¼ in. into the glass sandwich*, or otherwise as agreed by the Director, Royal Aircraft Establishment (Structures Department).

4. Thickness

The thickness of the panel shall be as specified in the contract. The tolerance on overall thickness shall be ± 0.032 in.

5. Freedom from defects

5.1. Each panel shall be free from defects such as separation, stones, bubbles, broken seeds, scratches, polishing cut, blockrake, likely to affect its serviceability.

The surfaces of main load carrying members of panels shall be free of " pluck surface" defects, but such defects are acceptable on the surfaces of thin facing members provided that, when regarded as seed, the total seed present is not greater than that shewn in the standard reference panels.†

5.2. Ream and seed may be present in each panel to an extent not greater than that shewn in the Standard Reference Panels.* The direction of the ream shall not depart by more than 20° from being parallel to the longitudinal axis of the panel.

5.3. Defects such as ream and seed occurring within ½ in. of the edges may be ignored.

5.4. Removal of defects by local polishing will not be permitted.

5.5. Small indentations within ½ in. of the edge of Types 1 and 2 glass shall not be cause for rejection.

Notes-

* The manufacturing tolerances on glass size are + 0, — $\frac{1}{16}$ in., and the depth of penetration will be affected to this extent.

† The Standard Reference Panels are held by the Director of Aeronautical Inspection, INMI Harefield House, Harefield, Middlesex.

6. Edge finish

All edges shall be arrised and all sharp corners removed.

7. Deviation

7.1. The deviation of parallel pencils of rays passing through the panel shall comply with the following requirements when determined by the method described in Appendix I or other approved method:—

7.1.1. The absolute deviation in the central area, as defined in the relevant aircraft drawing shall not exceed 15 minutes of arc.

7.1.2. The absolute deviation at any point other than the central area shall not exceed 23 minutes of arc.

7.1.3. The difference in deviation at any two points on the panel traversed by a pair of parallel sight lines separated by a horizontal distance of 2½ in. shall not exceed 8 minutes of arc.

8. Light transmission

The amount of visible light transmitted by each panel, when determined by the method described in Appendix II or other approved method, shall be not less than 84 per cent.

9. Resistance to low temperature

The resistance to low temperature shall be such that, when determined by the method described in Appendix III, no cracks, separation of plies, or bubbles in the interlayer shall occur.

10. Resistance to high humidity

The resistance to high humidity shall be such that, when determined by the method described in Appendix IV, no cracks, separation of plies, bubbles in the interlayer or discoloration shall occur.

11. Resistance to impact

The resistance to impact shall be such that, when determined by the method described in Appendix V, no separation of glass and interlayer, and no puncture of interlayer shall occur. In addition, no glass shall be detached from the underside of the panel in such a way as to expose the interlayer.

SECTION 2

Inspection

12. Process approval

Each panel released to this specification must be certified as manufactured by a process which has received approval from the Director of Aeronautical Inspection, stating also the approval reference and date.

13. Routine inspection.

13.1. Each panel shall be examined for compliance with clauses 1 to 8 inclusive.

13.2. Two specimens shall be examined, at intervals to be decided by the Director of Aeronautical Inspection, for compliance with clauses 9, 10 and 11.

13.3. The tests at 13.2 above shall be arranged in such a way that a systematic check is made on the adhesion properties of all the various constructions of laminated glass released by each factory. The tests shall be made in numerical order on each of the two panels selected.

APPENDIX I

Method for the Determination of Deviation

The whole area of each panel, to within 1 in. of the edges, shall be examined in a horizontal beam of parallel light between the object glass of a collimator and a viewing telescope. The front of the panel shall face the collimator and the top and outer face shall be uppermost.

The panel shall be supported at such an angle that the axis of the viewing telescope is identical with a line of sight from the designed eye position, as shown on the appropriate drawings, to a central area of the panel approximately 1½ in. in diameter. The support shall be arranged to rotate the panel about vertical and horizontal axes passing through the designed eye position, the horizontal axis being at right angles to the line of sight.

The collimator shall have an object glass of approximately 2 in. diameter and a focal length of not less than 20 in. The graticule shall be a black cross with a central opaque disc on a transparent ground. The angular dimensions of the graticule in the focal plane of the collimator objective shall be as follows:—

Diameter of disc	8 minutes of arc
Thickness of crossline	¼ minute of arc

The telescope shall have an object glass of approximately 1 in. diameter and a focal length of not less than 20 in. the overall magnification to be approximately 15. The graticule shall be a central opaque spot and a black concentric circle. The angular dimensions of the graticule in the focal plane of the telescope objective shall be as follows:—

Diameter of central spot	½ minute of arc
Mean radius of circle	19 minutes of arc
Thickness of circle	½ minute of arc.

(a) Absolute deviation

After the centres of the two graticules have been brought into coincidence with no panel in position, and with the aperture of the telescope objective limited to approximately ¼ in. the panel with a template limiting the area to be examined to the central area, shall be placed in position, and any necessary adjustments to the level of the colimator due to the displacement of the light beam by the panel shall be made. The collimator axis shall remain parallel to the telescope axis. No portion of the central disc of the collimator graticule shall extend beyond the ring of the telescope graticule.

(b) Variation of deviation

Binocular units shall then be placed over the telescope and collimator objectives so that the panel is scanned by two parallel pencils of light ¼ in. diameter, separated by a horizontal distance of 2½ in.

The template shall then be removed and the variation of deviation shall be determined over the whole of the panel (except that neither pencil of light in any part of its path shall be less than one inch from the nearest edge) by scanning along a series of horizontal traverses, the angular separation between adjacent traverses about a horizontal axis through the eye position being not greater than 3 degrees. The scanning operation shall then be extended to include three equally spaced vertical traverses. Differential deviation between the two pencils of light will result in doubling of the image of the disc in the collimator graticule. No complete image of the disc in the collimator graticule formed by either pencil of light shall be outside the circle of the telescope graticule and there shall be no complete separation of the two images of the disc in the collimator graticule. The movement of the image shall be continuous and non-oscillatory at all times.

APPENDIX II

Method for the Determination of Light Transmission

A 12 volt, 12 watt tungsten filament lamp, operated by an accumulator giving a steady current, shall be fixed at one end of a straight metal bar, held rigidly and graduated in centimetres. A selenium-iron rectifier cell shall be fixed in a suitable stand on the bar at a distance of approximately 90 cm. from the lamp. The response of the photo-cell shall be measured by a mirror scale galvanometer. The panel shall be placed immediately in front of the photo-cell, and the latter moved along the bar towards the lamp until the initial intensity is restored, i.e. until the previous deflection on the galvanometer scale is obtained.

The distance the cell has been moved shall then be measured, the cell returned to its initial position and the test repeated. The mean of three readings for the above distance shall be taken.

If x = initial distance of photo-cell from lamp, and y = distance through which the cell has been moved towards the lamp with the panel interposed, percentage light transmission of panel

$$= \frac{(x-y)^2 \times 100}{x^2}$$

The determination shall be made in a darkened room, reflection from the walls being avoided by means of a screen of dull black fabric.

APPENDIX III

Method for the Determination of Resistance to Low Temperature

The panel shall be placed in a refrigerator and the refrigerator maintained at a temperature of minus 60°C for 24 hours.

The panel shall then be removed from the refrigerator and examined on again attaining room temperature. No precautions shall be taken to retard the temperature changes of the panel occurring on insertion in and removal from the refrigerator.

APPENDIX IV

Method for the Determination of Resistance to High Humidity

The panel shall be suspended in an airtight box containing a tray of water at the bottom. The depth of water shall be not less than ½ in. The lower edge of the panel shall be at least 1 in. above the level of the water. The temperature of the box shall be maintained thermostatically at 70°C ± 2°C for 10 hours (preferably during the day time). The box and panel shall then be allowed to cool down to room temperature and the heating recommenced on the following day, the complete heating and cooling cycle occupying 24 hours. This procedure shall be carried out on 5 successive days. The panel shall then be removed from the box and examined after an interval of not less than 24 hours.

APPENDIX V

Method for the Determination of Resistance to Impact

The panel shall be placed horizontally on a square oak frame so that the panel rests symmetrically on the frame with its centre portion unsupported.

The inner and outer dimensions of the frame shall be 10 in. square and 16 in. square respectively.

The frame shall be rigidly mounted on a half in. steel plate so that the safety glass panel is approximately 3 in. above the steel plate. The screws or bolts used for attaching the frame to the steel plate, shall not project below the under surface of the plate. The complete frame shall stand upon a substantial concrete bed.

A steel ball with diameter of 2½ in. (wt. 2 lb. 5 oz. ± 1 oz.) shall be dropped freely on to the centre of the panel, striking the panel on that face which would be glazed to the outside of the aircraft. The height of drop shall be 1½ feet per $\frac{1}{16}$ in. overall thickness of panel.

A convenient method for releasing the ball is by means of an electromagnet.

Approved for issue,

H. SUTTON,

Director of Materials Research and Development (Air).

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