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Ministry of Defence
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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.

PROCUREMENT EXECUTIVE
MINISTRY OF DEFENCE

D.T.D. 5626

June, 1980

Aerospace Material Specification

HIGH LIGHT TRANSMISSION ANNEALED PLATE GLASS FOR AIRCRAFT GLAZING

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 (Aerospace Series) or to serve as a basis for inspection of material, the properties and uses of which are not sufficiently established to warrant submission to the British Standards Institution for standardization.

NOTE 2. The tests employed in this specification are chosen for their reproducibility and ability to control the properties of the material. They are not intended to be simulated service tests which, because of variability of test conditions, may be unsatisfactory for control purposes.

NOTE 3. This specification calls for the use of substances and/or test procedures that may be injurious to health if 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.

SECTION 1

Scope

The specification defines the requirements for the supply of high light transmission annealed soda-lime silica glass suitable for toughening or bending and toughening and subsequent fabrication into aircraft and guided weapon transparent components. The glass shall be made by the plate process. From experience, the high optical standard of laminated windscreens constructed from high light transmission glass can only be met by using matched plies of glass.

SECTION 2

Related documents

Reference is made in this specification to the following:

2.1 Spectacle lens material. British Standard Specification 3062: 1970.

2.2 Colorimetry-official recommendations of the International Commission on Illumination, Publication CIE (E-1.3.1) 1971, available from: Bureau centrale de la CIE, 4 avenue du Recteur Poincaré, 75-Paris 16E.

2.3 Color Science-concepts and methods, quantitative data and formulas. Wyszecki and Stiles, pub. Wiley 1969.

2.4 Terminology of Defects in Glass/International Commission on Glass, UDC 001 4:666 11 019.

SECTION 3

Supply

Being ground and polished the glass can be made to any thickness agreed between the customer and supplier. The tolerance on thickness will not be greater than ±0.7 mm. Nominal thicknesses normally available are: 4.5, 6.4, 13, 16, 19 and 25 mm.

SECTION 4

Requirements

4.1 Light Transmission

The total visible light transmission shall be measured at normal incidence by the method given in Appendix 1.

Allowing for the permitted variation in composition and thickness the total visible light transmission shall not be less than the equivalent of 89% for a nominal thickness of 25 mm.

4.2 Colour

High light transmission glass shall comply with the colour specification for lens glass (Sec. 2.1; additional information is also provided in 2.2 and 2.3). Average absorptivities are determined for the wavebands.

400-500 nm
500-580 nm
580-700 nm

The mean absorptivity in the 500-580 nm band shall not exceed 1%/mm. The maximum difference between mean absorptivities for the three wavebands shall not exceed 0.8%/mm.

4.3 Angular Deviation

The absolute deviation shall be determined by the method given in Appendix 2 and shall be measured at zero optical incidence. Glass will be supplied in blank sizes for individual windscreen shapes on a vision area template supplied with the order. Within the vision area, the angular deviation shall not exceed 0.00087 radians (3 minutes of arc) but in critical vision areas, limits will be agreed between user and supplier.

4.4 Flatness

The glass shall be tested on a flat table with convex side down. By, measurement with a straight edge, which is at least 300 mm long, on the upper surface, the maximum departure from the flat should not exceed 0.25 mm/300 mm.

4.5 Optical Distortion

Since optical distortion is proportional to the rate of change of angular deviation, the test given in Appendix 2 will be used to determine the level of distortion. The change in angular deviation between any two points 100 mm apart shall not exceed 3 minutes of arc; in a critical vision area limits will be agreed between user and supplier.

SECTION 5

Permissible defects

Defects are generally as defined in paragraph 2.4. Defects on the surface and in the body of the glass are permitted within the following limits:

5.1 No visible stone or solid inclusion is permitted.

5.2 Seed, bubbles and clear or black knots shall be allowed up to 0.2 mm diameter. If the defect is elongated the mean of the maximum length and maximum width (measured perpendicular to each other) is used as an equivalent diameter. They shall be allowed also up to 0.5 mm diameter under the following conditions:

i Not more than 2 per square of 300 mm side.
ii Not closer than 150 mm to each other.
iii A local accumulation of defects within an area not greater than 125 sq mm shall constitute a single fault if the sum of their diameters does not exceed 0.5 mm.

5.3 Sleaks shall be allowed up to a width of 0.03 mm irrespective of length. Scratches, digs and surface bubbles shall be allowed up to a maximum width of 0.03 mm within the following limits:

i Maximum length of any one scratch to be 30 mm with not more than 90 mm cumulative length in any one square of 300 mm side.
ii No scratches to be closer than 100 mm to each other.

There shall be no pad marks, short finish or stains on the surface.

5.4 An inspection method for identifying and measuring the above defects (paragraphs 5.2 and 5.3) is given in Appendix 3 but other equivalent methods may be preferred by the glass manufacturer. However, in cases of dispute the methods described in Appendix 3 shall be used.

5.5 Ream or striae is acceptable only if it is barely discernible when viewed on a shadowgraph in the manner described in Appendix 4.

SECTION 6

Qualification

6.1 Before any manufacturer's materials are supplied as complying with this specification the manufacturer should obtain qualification approval. Application for this approval shall be submitted to AM Division, Aeronautical Quality Assurance Directorate, Harefield House, Harefield, Uxbridge, Middlesex UB9 6BB.

6.2 When applying for qualification approval the manufacturer shall submit the following:

i Evidence that the materials comply with all the requirements of this specification.
ii Samples of the material at least 0.7 m x 0.5 m for which approval is sought.
iii Details of the composition of the glass. All data will be regarded as confidential.
iv Details of the available sizes and thickness with tolerances.

6.3 In certain cases it may be preferable for the windscreen manufacturer to apply for approval on behalf of the glass manufacturer.

6.4 Any proposed changes by the manufacturer either in the composition as stated in 6.2 (iii) or in the production process which would affect the glass properties shall be notified to the qualification approval authority. If the latter considers the change to be significant, the product shall be designated a new product which shall require specific and separate approval. The changed material, if approved, shall be given a new name or trade symbol.

SECTION 7

Routine quality control

7.1 The glass shall comply with all the requirements of this specification.

7.2 The extent and frequency of testing will be defined by the Quality Assurance Authority named in the contract.

SECTION 8

Packaging

The glass shall be supplied in packing defined in the contract.

APPENDIX 1

METHOD FOR THE MEASUREMENT OF IN-LINE VISUAL LIGHT TRANSMISSION

1 INTRODUCTION

A photometric method is used employing a defined light source and a photocell matched to the response of the human eye. Because this method deals with materials which are basically colourless certain deviations from the ideal conditions are allowable and these are indicated.

2 APPARATUS (See Figure 1)

2.1 Light Source

2.1.1 For the purposes of this specification the light source is deemed to be illuminant A as defined by the C.I.E., ie a tungsten filament lamp operated at a colour temperature of 2855.5K (see note below). For practical purposes the colour temperature tolerance may be ±10% and this will be attained by employing a gas filled tungsten filament lamp operated at its rated voltage.

2.1.2 The light source is combined with an optical system to produce a parallel beam.

NOTE: Although source 'A' does not correspond to solar radiation temperature, it has been chosen for simplicity in use, and ease of maintaining a standard. Practical tests have shown that measurements made with a photometer corrected to approximate eye response did not reveal a change in transmission of more than 0.5% when the illuminant was changed from 'A' to 'C'. These tests were made on a selection of nearly colourless materials of 50 to 95% transmission.

2.2 Power Supply

The power supply to the lamp should be stabilized. The short-term change in voltage output should be not more than ±0.1%.

2.3 Photometer-Geometry

The photometric measurements may be made either with a photocell or alternatively with a photometric integrating sphere.

2.3.1 The photocell should be fitted with a diffusion screen and should be of sufficient dimension to cover the whole of the parallel light beam.

2.3.2 The integrating sphere should conform to the requirements of BS Specification 354: Photometric Integrators. It should have an aperture of 70 mm diameter for the light beam and an aperture for fitting the photometer. There should be baffles fitted so that direct light does not reach the photometer from the aperture or the area on the sphere where the light beam falls. The diameter of the sphere shall be approximately 500 mm.

2.4 Photometer-Spectral Response

The spectral response of the photocell shall be corrected to approximate that of the human eye.

2.5 Photometer-Accuracy

The output response of the photometer shall be linear within ±0.5%. The output shall be capable of being read to an accuracy of ±0.5%.

3 CONDITIONS OF TEST

3.1 The glass shall be cleaned on both surfaces before measurements are made.

3.2 The area of the parallel light beam shall be at least 1 cm^2.

3.3 Precautions shall be taken to ensure that no other light by reflection or other means except that from the source shall reach the photocell.

4 M E T H O D

4.1 The light source is set up at a convenient distance from the photometer and both are rigidly mounted.

4.2 The apparatus is allowed appropriate time to reach thermal equilibrium before measurements are made.

4.3 A measurement is made without the glass (a) and a second measurement (b) with the specimen interposed between the lamp and the photometer. The percentage light transmission is then given by l00b/a.

5 CALIBRATION

Each of the parameters specified in paragraph 2, ie (a) colour temperature of light source, (b) accuracy and stability of power supply, (c) spectral response of photocell and (d) linearity of photometer may be qualified by submission to a British Calibration Services Approved Laboratory.

Alternatively, the Quality Assurance Authority may approve equipment after appropriate interchange of measurements between the applicant and an approved laboratory.

APPENDIX 2

METHOD FOR THE MEASUREMENT OF ANGULAR DEVIATION

1 INTRODUCTION

In this method a collimator and telescope are aligned and measurements of absolute deviation are made with the glass placed in between.

2 APPARATUS

2.1 The collimator shall have an object glass of at least 50 mm diameter and a focal length of not less than 500 mm.

2.2 The collimator graticule shall be a black cross on a transparent ground; the angular dimension of the thickness of the graticule in the focal plane of the collimator objective shall be ½ minute.

2.3 The telescope shall have an object glass of 25 mm diameter or greater and a focal length of approximately 500 mm. The magnification shall be approximately 15.

2.4 The telescope graticule shall consist of a centre black cross on a transparent ground. The angular dimensions of the graticule in the focal plane of the telescope objective shall be ½ minute,

2.5 The collimator and telescope shall be mounted on solid supports and aligned so that the graticule of the collimator when illuminated appears in the telescope eyepiece superimposed on the telescope graticule.

2.6 The glass shall be held in a support at 90° to the optical axis.

3 CONDITIONS OF TEST

3.1 The whole of each glass shall be examined.

3.2 The angular deviation shall be measured at points 100 mm apart, covering the entire area of the glass.

4 METHOD

4.1 The centres of the two graticules are brought into coincidence with no glass in position. The aperture of the telescope is limited to 25 mm.

4.2 The glass to be tested is mounted in the appropriate position and any change in position of the image of the collimator cross in the telescope noted (a gap equal to the width of one cross between the crosses means a deviation of 1 minute).

4.3 The glass is then moved to enable the second and subsequent points to be measured.

5 CALIBRATION

The angular subtense of the graticule may be qualified, either by submission to a British Calibration Approved Laboratory or by measurement with a certified instrument.

Alternatively, the Quality Assurance Authority may approve equipment after appropriate interchange of measurements between the applicant and an approved laboratory.

APPENDIX 3

METHOD FOR THE MEASUREMENT OF VISIBLE DEFECTS IN GLASS

1 INTRODUCTION

The glass is initially examined for the presence of defects by viewing against an evenly illuminated background. Identification and measurement of the defects are subsequently carried out under strong oblique illumination.

2 APPARATUS

2.1 A suitable apparatus consists of a horizontal matt white screen large enough to accommodate the area to be examined and provided with even illumination. A convenient arrangement is afforded by two 40 W

fluorescent lights set just below the glass and one on each side of it and shaded so that the screen is illuminated without direct line of vision between the viewer and these lights. Provision is made for the glass under examination to be supported parallel to the screen and at a convenient distance from it.

2.2 The white screen is replaced by a matt black screen and the shading of the light is adjusted so that the viewer can examine the panel against the strong oblique illumination provided by the lights but again without direct line of vision into them. Defects are measured using a x 10 magnifier fitted with a graticule graduated in 0.1 mm. A microscope fitted with a micrometer eyepiece may be used to measure scratches and other defects that are on the borderline.

3 METHOD

3.1 The glass under examination shall be cleaned on both surfaces before examination and measurement.

3.2 The glass shall be examined against the white background and the defects marked.

3.3 The glass shall be examined against the black background with oblique illumination and only additional visible defects marked.

3.4 The defects shall be measured and counted against whichever background should be most revealing using suitable masks to delineate the relevant areas.

APPENDIX 4

METHOD FOR ASSESSING REAM

A mercury vapour lamp type 200/250V AC/DC, 250W ME/D (Thorn) is used to project the shadowgraph image of the glass onto a matt white screen as shown in Fig. 2. The glass under test is stood parallel to the screen with the ream running horizontal, ie, at right angles to the axis of the lamp.

Approved for issue

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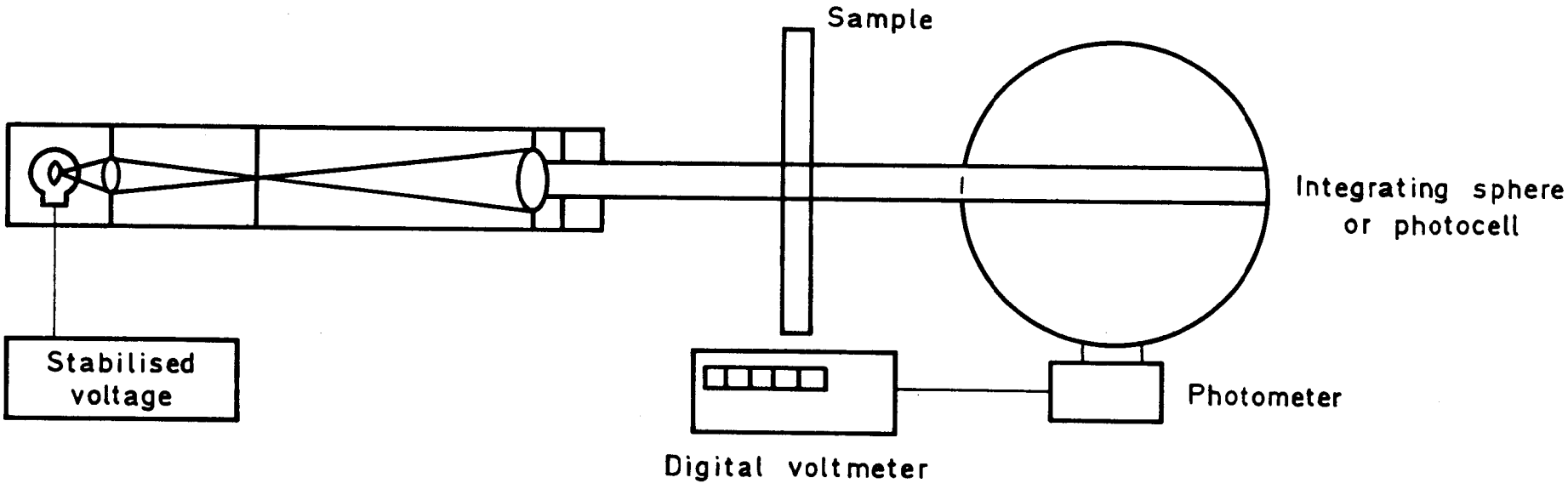

Fig 1 Measurement of in-line visual light transmission

D.T.D.5626

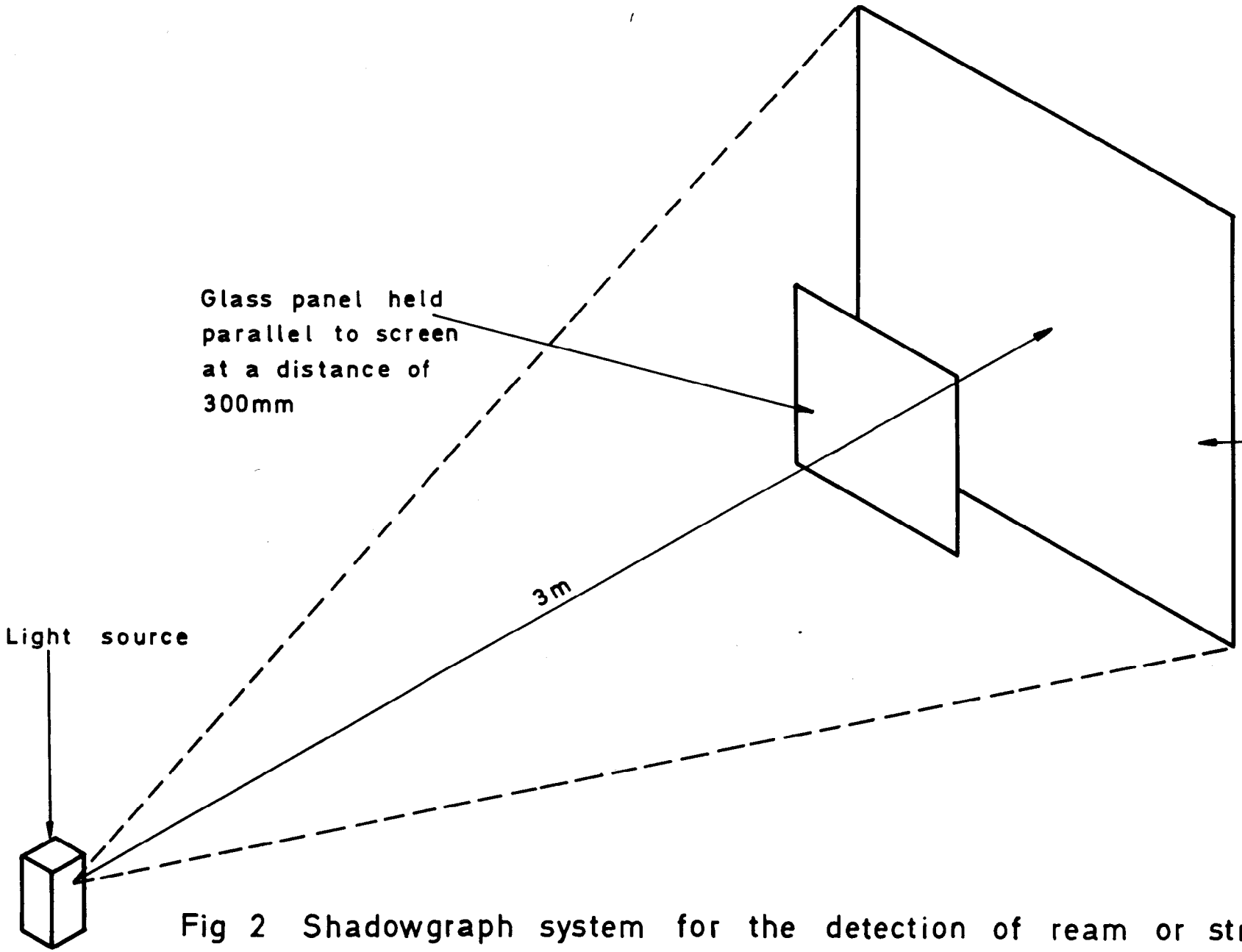

Fig 2 Shadowgraph system for the detection of ream or straie

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