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Aerospace series - Test method for transparent materials for aircraft glazing - Part 9 : Determination of haze

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Luft-und Raumfahrt - Prüfverfahren für transparente Werkstoffe zur Verglasung von Luftfahrzeugen - Teil 9: Bestimmung der Trübung

Série aérospatiale - Méthodes d'essais pour matériaux transparents pour vitrages aéronautiques - Partie 9 : Détermination du flou

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English version

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to CEN Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
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Brief history

This European Standard has been prepared by the European Association of Aerospace Manufacturers (AECMA).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has successively received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

According to the Common CEN/CENELEC Rules, following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope and field of application

This standard specifies the determination of the haze of planar sections of transparent plastics, using a hazemeter based on an integrating sphere. This method is not recommended for the measurement of haze values greater than 30% as determined by this method.

2 Definitions

Haze is defined as the scatter of light from an accumulation of tiny particles within the material, or from very small defects on the surface. This can lead to an obscuration of the view through the material or the spreading of an image beyond its proper limits.

3 Apparatus

3.1 Hazemeter

The apparatus shall consist of a hazemeter, constructed essentially as shown in figure 1 or figure 2.

3.1.1 Integrating sphere

An integrating sphere shall be used to collect the transmitted flux. The sphere may be of any diameter so long as the total port area does not exceed 4% of the internal reflecting area of the sphere.

The entrance and exit ports shall be centred on the same great circle of the sphere and there shall be at least 170° of arc between centres. The exit port shall subtend an angle of 8° at the centre of the entrance port. The axis of the irradiating beam shall pass through the centres of the entrance and exit ports.

The photocell or photocells shall be positioned on the sphere (90 ± 10)° from the entrance port. In the pivotable model, figure 2, which is designed to use the interior sphere wall adjacent to the exit port as the reflectance standard, the angle of rotation shall not exceed 10°.

3.1.2 Light beam

The specimen shall be illuminated by a substantially unidirectional beam; the maximum angle which any ray of this beam makes with the direction of its axis shall not exceed 3°. The beam shall not be vignetted at either port of the sphere. When the beam is unobstructed by the specimen, its cross section at the exit port shall be approximately circular, sharply defined, and concentric within the exit port, leaving an annulus of (1,3 ± 0,1)° subtended at the entrance port. When the specimen is placed immediately against the integrating sphere at the entrance port, the angle between the normal to its surface and the axis of the beam shall not exceed 8°.

3.1.3 Reflecting surfaces

The surfaces of the interior of the integrating sphere, baffles, and reflectance standards shall be of substantially equal reflectance, matt, and highly reflecting throughout the visible wave lengths. (Freshly smoked magnesium oxide is excellent for this purpose but highly reflecting matt sphere paints are more durable).

3.1.4 Light trap

For some measurements the standard at the exit port is replaced by a light trap by actual removal of the reflectance standard or by pivoting the sphere (see figure 2). The light trap shall absorb the beam completely when no specimen is present.

Due to the absorbing annulus surrounding the unimpeded beam at the exit port, this trap will absorb slightly more than the undeviated portion of the total flux transmitted by the specimen.

3.1.5 Photoelectric cell

The radiant flux within the sphere shall be measured by a photoelectric cell, the output measurements of which shall be proportional within 1% to the incident flux over the range of intensity used. Spectral conditions for source and receiver shall be constant throughout the test or each specimen.

The design of the instrument shall be such that there shall be a zero reading of the galvanometer deflection or measuring instrument when the sphere is dark. The spectral response of the photocell shall be corrected to approximate that of the human eye.

For the purpose of this standard the light source is deemed to be illuminant A of the International Commission on Illuminant i.e. a tungsten filament lamp operated at a colour temperature of (2855 ± 285) K.

For nearly colourless transparent materials as used for aircraft glazing the values for % haze obtained using illuminant C instead of illuminant A are not generally significantly different.

3.2 The output from the photocell may be conveniently read on a digital voltmeter.

4 Specimens

4.1 Preparation

Specimens shall be taken from a sheet. The surfaces of the test specimens shall be substantially flat and parallel. Care shall be taken to remove dust and grease from the specimens prior to measurement. Specimens shall be free of scratches, blemishes, and visibly distinct internal voids and particles, unless it is specifically desired to measure the contribution to haze due to these imperfections. The effect of surface defects may be eliminated by immersing the specimen in a clear liquid of the same refractive index.

4.2 Dimensions

The test specimens shall be 35 mm in diameter, minimum, and small enough to be tangent to the sphere wall. The thickness of the test specimen shall be as furnished, or for comparative purposes, shall be (3 ± 0,1) mm.

5 Procedure

Readings - Determine the following four values for a given location on a specimen :

Reading designation	Specimen in position	Light trap in position	Reflection standard in position	Quantity represented
T_1	No	No	Yes	Incident light
T_2	Yes	No	Yes	Total light transmitted by specimen
T_3	No	Yes	No	Light scattered by instrument
T_4	Yes	Yes	No	Light scattered by instrument and specimen

6 Expression of results

6.1 Haze

Calculate percentage haze as follows :

$$\text{Haze } \% = \left(\frac{T_4}{T_2} - \frac{T_3}{T_1} \right) 100$$

6.2 Per cent haze shall be expressed to nearest 0,1%.

6.3 Thickness of specimen shall be measured in millimetres to nearest 0,02 mm.

7 Test report

The test report shall include :

7.1 Thickness of specimen

7.2 % haze.