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Standard Terminology Relating to Aerospace Transparent Materials and Enclosures[1]

This standard is issued under the fixed designation F2429; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These definitions cover generic optical terms which appear in one of more standards relating to aerospace transparent materials and enclosures.

1.2 The definitions cover, in most cases, special meanings used in the transparency industry. No attempt has been made to include common meanings of the same terms as used outside of the transparency industry.

1.3 Definitions included have, in general, been approved as standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

2.1 *Definitions:*

angular deviation—the angular displacement of a light ray from its original path caused by non-parallelism of opposite surfaces as it passes through a transparent material, which is expressed in units of angle (degree, minutes of arc, milliradians) and is a function of the angle of incidence at each surface of the material and the index of refraction of the material.

angular displacement—the angular separation of the secondary image from the primary image as measured from the design eye position of a transparency.

binocular disparity—the difference in angular deviation between two light rays passing through a transparency, originating from two eye positions located 2.5 in. apart.

birefringence—the separation of a light beam as it penetrates a doubly refracting material into two diverging beams commonly known as ordinary and extraordinary beams, which have been known to appear in transparencies as rainbowing or the apparent random dispersion of light into its component colors.

crazing—the occurrence of very small, localized, micro-cracks at or under the surface of, but not extending entirely through, a transparent material, which act like tiny mirrors that reflect light in unwanted directions.

design eye—the reference point in aircraft design from which all visual or optical anthropometrical design considerations are taken.

distortion—the rate of change of angular deviation across the transparency, usually characterized by grid-line slope, resulting in the non-linear mapping of objects viewed through the transparency.

grid line slope—an optical distortion evaluation parameter that compares the slope of a deviated grid line to that of a non-deviated grid line, which is expressed as a ratio such as 1 in 8 or 1 in 20 (the visual optical quality improves as the second number of the ratio gets larger).

halation—the scattering of light by the transparency into the viewer's line-of-sight reducing the perceived contrast of external objects, also referred to as haze.

haze—the percent of transmitted light that is scattered so that its direction deviates more than a specified angle from the direction of the incident beam, resulting in the reduction of contrast of objects viewed through the transparency.

multiple imaging separation—the angular separation of primary and secondary multiple images as measured from the design eye position.

rainbowing—colored patterns in a transparency produced by the photo-elastic molecular nature of the material and stress gradients in the transparency in which certain angles and light polarizations in relation to some windscreen designs have been known to produce localized bands of color in the transparency, often referred to as birefringence.

scratch—any marking or tearing of the surface in glass or plastic caused by an abrasive material.

secondary image—the image resulting from internal reflections of light rays at the surfaces of the transparency.

[1] This terminology is under the jurisdiction of ASTM Committee F07 on Aerospace and Aircraft and is the direct responsibility of Subcommittee F07.08 on Transparent Enclosures and Materials.

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transmission coefficient—the ratio of the amount of radiant energy leaving the last surface of an optical system to the amount of radiant energy incident on the first surface.

RELATED MATERIAL

ASTM Test Method D1003 for Haze and Luminous Transmittance of Transparent Plastics

ASTM Test Method F1165 for Measuring Angular Displacement of Multiple Images in Transparent Parts

ASTM Test Method F1316 for Measuring the Transmissivity of Transparent Parts

ASTM Test Method F2156 for Measuring Optical Distortion in Transparent Parts Using Grid Line Slope

AL-TR-1993-0036, *Definitions of Terms Relating to Aircraft Windscreens, Canopies, and Transparencies*, Authored by Barbato, Maryann H., Kama, William N., Task, Harry L., Hausmann, Martha A., Bridenbaugh, John C., Logicon Technical Services, Inc.