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Designation: D 881 – 90

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
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Standard Test Method for Deviation of Line of Sight Through Transparent Plastics¹

This standard is issued under the fixed designation D 881; 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 This test method describes a procedure for measuring, by means of a telescope and a target, the deviation of the line of sight through flat or curved sections made of transparent plastics.

1.2 The values stated in minutes ($\pi/10800$ rad) units are to be regarded as the standard.

1.3 *This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Document

2.1 ASTM Standard:

D 618 Methods of Conditioning Plastics and Electrical Insulating Materials for Testing²

D 883 Definitions of Terms Relating to Plastics²

3. Terminology

3.1 *Definitions*—Definitions of terms applying to this test method appear in Definitions D 883.

4. Significance and Use

4.1 This is a functional test for sheets or formed articles, such as certain aircraft windshields and enclosures, the manner of use of which requires information about the deviation of the line of sight. The property measured is determined jointly by the prismatic power of the plastic at each point and by the angle made with the surface at that point by the line of sight. Thus the measurement should be considered as a specialized procedure capable of excellent precision and reproducibility but not applicable for determining optical distortions nor for defining optical quality in any general sense.

5. Summary of Test Method

5.1 A line of sight is established by focusing a telescope on a target. By placing the specimen to be tested in the line of sight, the apparent position of the cross hairs on the target is shifted. From the magnitude of the shift and the distance between the target and the specimen, the angular deviation of the line of sight by the specimen is calculated.

6. Apparatus

6.1 *Telescope*, rigidly mounted, equipped with cross hairs (Note 1). The telescope shall be sufficiently free of parallax so that when the eye of the observer is shifted, the corresponding movement of the image of the target relative to the cross hairs shall not exceed one tenth of the smallest scale division of the target. The magnifying power of the telescope shall be adequate to permit accurate reading of the position of the cross hairs on the target. The mounting of the telescope shall be such that it cannot be displaced readily after being clamped in position. To obtain clear images through some specimens, it may be necessary to stop down the objective of the telescope (Note 2).

NOTE 1—An engineer's transit is a very suitable instrument for measuring deviations of line of sight.

NOTE 2—The intended use of the article or material under test may determine the size of stop to be used. Thus, if the user will look through the material with his unaided eye, then the diameter of the stop should approximate that of the pupil of the eye. Larger apertures make for increase of brightness of the image, but frequently the definition is poorer and the measurements are more difficult or more fatiguing.

6.2 *Target*, with suitable scale. The markings shall be so made and the illumination shall be such that the divisions shall be clearly visible when viewed through the telescope (Note 3). Where deviation in one direction only is of interest, the target may consist of parallel straight lines; otherwise the most convenient form consists of concentric circles.

NOTE 3—Lines ruled in black on a white background, which may be either opaque with front lighting or translucent with back lighting, make the most suitable target for most purposes. The spacings of the lines can be calculated by a formula as follows:

$$s = \theta L / 3440$$

where:

s = spacing of the lines, in.

θ = angular deviation, min, corresponding to an apparent shift of the cross hairs from one cross line to the next line, and

L = distance of the target from that part of the test specimen which is under examination, in.

Thus, if the distance of specimen to target is 40 ft, and if an apparent shift of the cross hairs from one line to the next is to correspond to one minute of angular deviation by the specimen, the spacing of the lines will be:

$$s = (L \times 40 \times 12) / 3440 = 0.140 \text{ in.}$$

6.3 *Support for Specimen*—A suitable fixture for support of the specimen (Note 4). The specimen shall be held firmly during each measurement, and means shall be provided for moving the specimen quickly to each specified position.

NOTE 4—Small flat sheets may be supported by hand while measurements are being made. Large flat sheets and curved articles require special fixtures, the design of which is dictated by the specific optical requirements of each article.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.40 on Optical Properties.

Current edition approved October 26, 1990. Published December 1990. Originally published as D 881 – 46 T. Last previous edition D 881 – 86

² Annual Book of ASTM Standards, Vol 08.01.