



Standard Test Method for Measuring Optical Retardation and Analyzing Stress in Glass¹

This standard is issued under the fixed designation F218; 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 covers the analysis of stress in glass by means of a polarimeter based on the principles developed by Jessop and Friedel (1, 2).² Stress is evaluated as a function of optical retardation, that is expressed as the angle of rotation of an analyzing polarizer that causes extinction in the glass.

1.2 There is no known ISO equivalent to this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, 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 Documents

2.1 *ASTM Standards:*³

C162 Terminology of Glass and Glass Products

C770 Test Method for Measurement of Glass Stress—Optical Coefficient

C978 Test Method for Photoelastic Determination of Residual Stress in a Transparent Glass Matrix Using a Polarizing Microscope and Optical Retardation Compensation Procedures

C1426 Practices for Verification and Calibration of Polarimeters

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

3. Terminology

3.1 For definitions of terms used in this standard, refer to Terminology C162.

¹ This test method is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.04 on Physical and Mechanical Properties.

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² The boldface numbers in parentheses refer to the reports and papers appearing in the list of references at the end of this test method.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Significance and Use

4.1 The performance of glass products may be affected by presence of residual stresses due to process, differential thermal expansion between fused components, and by inclusions. This test method provides means of quantitative evaluation of stresses.

5. Calibration and Standardization

5.1 Whenever calibration of the polarimeter is required by product specification, Practices C1426 for verification and calibration should be used.

6. Polarimeter

6.1 The polarimeter shall consist of an arrangement similar to that shown in Fig. 1. A description of each component follows:

6.1.1 *Source of Light*—Either a white light or a monochromatic source such as sodium light (λ 589 nm) or a white light covered with a narrow-band interferential filter B, (see Fig. 1,) transmitting the desired monochromatic wavelength.

NOTE 1—The white light should provide a source of illumination with solar temperature of at least that of Illuminant A.

6.1.2 *Filter*—The filter should be placed between the light source and the polarizer, or between the analyzer and the viewer (see Fig. 1).

6.1.3 *Diffuser*—A piece of opal glass or a ground glass of photographic quality.

6.1.4 *Polarizer*—A polarizing element housed in a rotatable mount capable of being locked in a fixed position shown in Fig. 2 and Fig. 4.

6.1.5 *Immersion Cell*—Rectangular glass jar with strain-free, retardation-free viewing sides filled with a liquid having the same index of refraction as the glass specimen to be measured. It may be surmounted with a suitable device for holding and rotating the specimen, such that it does not stress the specimen.

NOTE 2—Suitable index liquids may be purchased or mixed as required. Dibutyl phthalate (refractive index 1.489), and tricresyl phosphate (index 1.555) may be mixed to produce any desired refractive index between the two limits, the refractive index being a linear function of the proportion of one liquid to the other. Other liquids that may be used are: