



Designation: E3070 – 18

# Standard Test Method for Shear Thinning Index of Non-Newtonian Liquids Using a Rotational Viscometer<sup>1</sup>

This standard is issued under the fixed designation E3070; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method describes the determination of the shear thinning index of a shear-rate dependent (non-Newtonian) fluid using a rotational viscometer. A value of the shear thinning index of unity indicates that the material is Newtonian in behavior. A value greater than unity indicates shear thinning behavior.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[E473 Terminology Relating to Thermal Analysis and Rheology](#)

[E1142 Terminology Relating to Thermophysical Properties](#)

[E2975 Test Method for Calibration or Calibration Verification of Concentric Cylinder Rotational Viscometers](#)

## 3. Terminology

3.1 *Definitions*—Specific technical terms used in this standard method are described in Terminologies [E473](#) and [E1142](#)

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.08 on Rheology.

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<sup>2</sup> 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.

including *Celsius, non-Newtonian, rheometry, viscosity, and viscometer.*

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *shear thinning, n*—a decrease in viscosity with increasing shear rate.

3.2.2 *shear thinning index, n*—the ratio of apparent viscosity at two rotational speeds or shear rates.

## 4. Summary of Test Method

4.1 For Newtonian fluids, viscosity is independent of shear rate. Non-Newtonian fluids are those for which the viscosity changes as a function of shear rate. Many materials of interest are non-Newtonian in behavior.

4.2 The viscosity of a non-Newtonian fluid is measured at different shear rates and the values compared as their ratio. This is known as the shear thinning index. For Newtonian fluids the shear thinning ratio is unity. For non-Newtonian fluids the shear thinning ratio increases with increasing non-Newtonian nature.

4.3 The shear thinning index of non-Newtonian fluids is determined by the ratio of viscosity measurements made at two rotational speeds, preferably a decade apart.

## 5. Significance and Use

5.1 The flow behavior of many fluids of interest is non-Newtonian in nature. Non-Newtonian behavior is best studied using rheometry apparatus. Nonetheless, estimations on non-Newtonian behavior may be made by recording viscosity at differing rotational speeds (or shear rates) using rotational viscometers.

5.2 The shear thinning index provides a tool for the estimation of the amount of non-Newtonian behavior.

5.3 The shear thinning index may be used in quality assessment, trouble shooting, specification acceptance, and research.

## 6. Apparatus

6.1 *Rotational Viscometer*—The essential instrumentation required providing the minimum rotational viscometer analytical capabilities include: