Designation: D6855 – 17 (Reapproved 2023)

# Standard Test Method for Determination of Turbidity Below 5 NTU in Static Mode[1]

This standard is issued under the fixed designation D6855; 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 static determination of turbidity in water (see 4.1).

1.2 This test method is applicable to the measurement of turbidities under 5.0 nephelometric turbidity units (NTU).

1.3 This test method was tested on municipal drinking water, ultra-pure water, and low turbidity samples. It is the users responsibility to ensure the validity of this test method for waters of untested matrices.

1.4 This test method uses calibration standards are defined in NTU values, but other assigned turbidity units are assumed to be equivalent.

1.5 This test method assigns traceable reporting units to the type of respective technology that was used to perform the measurement. Units are numerically equivalent with respect to the calibration standard. For example, a 1.0 NTU formazin standard is also equal to a 1.0 FNU standard, a 1.0 FNRU standard, and so forth.

1.6 *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.* Refer to the MSDSs for all chemicals used in this test method.

1.7 *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:*[2]

D1129 Terminology Relating to Water

D1192 Guide for Equipment for Sampling Water and Steam in Closed Conduits (Withdrawn 2003)[3]

D1193 Specification for Reagent Water

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water

D3370 Practices for Sampling Water from Flowing Process Streams

D5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis

D7315 Test Method for Determination of Turbidity Above 1 Turbidity Unit (TU) in Static Mode

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

2.2 *Other Referenced Standards:*

U.S. EPA Method 180.1 Methods for Chemical Analysis of Water and Wastes, Turbidity[4]

ISO 7027 Water Quality—for the Determination of Turbidity[5]

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this standard, refer to Terminology D1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *calibration turbidity standard, n*—a turbidity standard that is traceable and equivalent to the reference turbidity standard to within statistical errors.

3.2.1.1 *Discussion*—Calibration turbidity standards include

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[2] 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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.

[5] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

commercially prepared 4000 NTU formazin, stabilized formazin (see 9.2.3), and styrenedivinylbenzene (SDVB) (see 9.2.4). These standards may be used to calibrate the instrument. Calibration standards may be instrument specific.

3.2.2 *calibration verification standards, n*—defined standards used to verify the accuracy of a calibration in the measurement range of interest.

3.2.2.1 *Discussion*—These standards may not be used to perform calibrations, only calibration verifications. Included standards are opto-mechanical light scatter devices, gel-like standards, or any other type of stable liquid standard. Calibration verification standards may be instrument specific.

3.2.3 *nephelometric turbidity measurement, n*—the measurement of light scatter from a sample in a direction that is at 90° with respect to the centerline of the incident light path.

3.2.3.1 *Discussion*—Units are NTU (nephelometric turbidity units); when ISO 7027 technology is employed units are in FNU (formazin nephelometric units).

3.2.4 *ratio turbidity measurement, n*—the measurement derived through the use of a nephelometric detector that serves as the primary detector and one or more other detectors used to compensate for variation in incident light fluctuation, stray light, instrument noise, or sample color.

3.2.5 *reference turbidity standard, n*—a standard that is synthesized reproducibly from traceable raw materials by the user.

3.2.5.1 *Discussion*—All other standards are traced back to this standard. The reference standard for turbidity is formazin (see 9.2.2).

3.2.6 *seasoning, n*—the process of conditioning labware with the standard to be diluted to a lower value.

3.2.6.1 *Discussion*—The process reduces contamination and dilution errors. See Appendix X2 for the suggested procedure.

3.2.7 *stray light, n*—all light reaching the detector other than that contributed by the sample.

3.2.7.1 *Discussion*—Examples: ambient light leakage, internal reflections and divergent light in optical systems.

3.2.8 *turbidimeter, n*—an instrument that measures light scatter caused by particulates within a sample and converts the measurement to a turbidity value.

3.2.8.1 *Discussion*—The detected light is quantitatively converted to a numeric value that is traced to a light-scatter standard.

3.2.9 *turbidity, n*—an expression of the optical properties of a sample that causes light rays to be scattered and absorbed rather than transmitted in straight lines through the sample.

3.2.9.1 *Discussion*—Turbidity of water is caused by the presence of suspended and dissolved matter such as clay, silt, finely divided organic matter, plankton, other microscopic organisms, organic acids, and dyes.

## 4. Summary of Test Method

4.1 The optical property expressed as turbidity is measured by the scattering effect that suspended particulate material have on light; the higher the intensity of scattered light, the higher the turbidity. In samples containing particulate material, the manner in which sample interferes with light transmittance is related to the size, shape, and composition of the particles in the water, and also to the wavelength of the incident light.

4.2 This test method is based upon a comparison of the intensity of light scattered by the sample with the intensity of light scattered by a reference suspension. Turbidity values are determined by a nephelometer, which measures light scatter from a sample in a direction that is at 90° with respect to the centerline of the incident light path.

## 5. Significance and Use

5.1 Turbidity is undesirable in drinking water, plant effluent waters, water for food and beverage processing, and for a large number of other water-dependent manufacturing processes. Removal is often accomplished by coagulation, settling, and filtration. Measurement of turbidity provides a rapid means of process control for when, how, and to what extent the water must be treated to meet specifications.

5.2 This test method is suitable to turbidity such as that found in drinking water, process water, and high purity industrial water.

5.3 When reporting the measured result, appropriate units should also be reported. The units are reflective of the technology used to generate the result, and if necessary, provide more adequate comparison to historical data sets.

5.3.1 Table 1 describes technologies and reporting results (see also Refs (**1-3**)).[6] Those technologies listed are appropriate for the range of measurement prescribed in this test method. Others may come available in the future. Fig. X5.1 provides a flow chart to aid in selection of the appropriate technology for low-level static turbidity applications.

5.3.2 If a design that falls outside of the criteria listed in Table 1 is used, the turbidity should be reported in turbidity units (TU) with a subscripted wavelength value to characterize the light source that was used.

## 6. Interferences

6.1 For this application, bubbles, color, and large particles, although they cause turbidity, may result in interferences in measured turbidity as determined by this test method. Bubbles cause a positive interference and color typically causes a negative interference. Dissolved material that imparts a color to the water may cause errors in pure nephelometric readings, unless the instrument has special compensating features to reduce these interferences. Certain turbulent motions also create unstable reading conditions of nephelometers.

6.2 Color is characterized by absorption of specific wavelengths of light. If the wavelengths of incident light are significantly absorbed, a negative interference will result unless the instrument has special compensating features.

6.3 Scratches, finger marks, or dirt on the walls of the sample cell may give erroneous readings. Sample cells should be kept scrupulously clean both inside and outside and discarded when they become etched or scratched. The sample

[6] The boldface numbers in parentheses refer to the list of references at the end of this standard.