



Designation: D6698 – 25

Standard Test Method for On-Line Measurement of Turbidity Below 5 NTU in Water¹

This standard is issued under the fixed designation D6698; 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 is applicable to the on-line measurement of turbidity under 5 nephelometric turbidity units (NTU) in water.

1.2 It is the user's responsibility to ensure the validity of this test method for waters of untested matrices.

1.3 In this test method calibration standards are defined in NTU values, but other assigned turbidity units are assumed to be equivalent.

1.4 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 NTU formazin standard is also equal to a 1 FNU (formazin nephelometric units) standard, a 1 FNRU (formazin nephelometric ratio units) standard, and so forth.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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.*

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.*

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.03 on Sampling Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

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2. Referenced Documents

2.1 ASTM Standards:²

- D1129 Terminology Relating to Water
- 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
- D3864 Guide for On-Line Monitoring Systems for Water Analysis
- D7315 Test Method for Determination of Turbidity Above 1 Turbidity Unit (TU) in Static Mode
- D7725 Test Method for the Continuous Measurement of Turbidity Above 1 Turbidity Unit (TU)

2.2 Other Documents:

- U.S. Patent 4,283,143 Patterson, James A. 1981. Optical Characterization of a Suspension. United States Patent 4,283,143, filed November 19, 1979, and issued August 11, 1981.³
- U.S. Patent 4,291,980 Patterson, James A. 1981. Styrene-Divinylbenzene Copolymer and Method of Manufacturer. United States Patent 4,291,980, filed August 14, 1978, and issued September 29, 1981.³
- U.S. Patent 5,777,011 Sadar, Michael J. 1998. Stabilized Formazin Composition. United States Patent 5,777,011, filed December 1, 1995, and issued July 7, 1998.⁴

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D1129.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from AMCO Clear of GFS Chemicals, Inc. 155 Hidden Ravines Dr., Powell, OH 43065 <https://amcoclear.com>

⁴ This document is covered by a patent. Interested parties are invited to submit information regarding the identification of alternatives to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

*A Summary of Changes section appears at the end of this standard

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; calibration turbidity standards include commercially prepared 4000 NTU formazin, stabilized formazin, and styrenedivinylbenzene (SDVB).

3.2.1.1 *Discussion*—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 verification 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 *in-situ nephelometer, n*—a turbidimeter that determines the turbidity of a sample using a sensor that is placed directly in the sample.

3.2.3.1 *Discussion*—This turbidimeter does not require transport of the sample to or from the sensor.

3.2.4 *light emitting diode (LED), n*—a semiconductor device that emits light when current flows through it.

3.2.4.1 *Discussion*—The device is commonly referred to as an LED and is used as an incident light source in various designs of turbidimeters.

3.2.5 *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.

3.2.5.1 *Discussion*—Units are NTU (Nephelometric Turbidity Units). When ISO 7027 technology is employed, units are FNU (Formazin Nephelometric Units). See Ref. (1).⁵

3.2.6 *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.

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

3.2.7.1 *Discussion*—All other standards are traced back to this standard. The reference standard for turbidity is formazin.

3.2.8 *seasoning, v*—the process of conditioning labware with the standard that will be diluted to a lower value to reduce contamination and dilution errors. See [Appendix X2](#) for suggested procedure.

3.2.9 *slip stream nephelometer, n*—an on-line turbidimeter that determines the turbidity of a sample as the sample flows through a sampling chamber.

3.2.9.1 *Discussion*—The sample is drawn from the source into the turbidimeter, analyzed and then transported to drain.

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

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

3.2.11.1 *Discussion*—The detected light is quantitatively converted to a numeric value that is traced to a light-scatter standard. See Test Method [D7315](#).

3.2.12 *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.

3.2.12.1 *Discussion*—Turbidity of water is caused by the presence of 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 solids have on light; the higher the intensity of scattered light, the higher the turbidity. In samples containing particulate matter, the manner in which the particulate matter interacts 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 of suspended matter is accomplished by coagulation, settling, and filtration. Measurement of turbidity provides a rapid means of process control to determine when, how, and to what extent the water must be treated to meet specifications.

5.2 This test method is suitable for the on-line monitoring of turbidity such as that found in drinking water, process water, and high purity industrial waters.

5.3 The instrumentation used must allow for the continuous on-line monitoring of a sample stream.

NOTE 1—See [8.2](#) for discussion on signal spikes resulting from bubbles.

5.4 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.

5.4.1 [Table 1](#) describes technologies and reporting results. Those technologies listed are appropriate for the range of measurement prescribed in this test method are mentioned, though others may come available.

NOTE 2—The typical instrument ranges that are cited in [Table 1](#) may exceed the measurement range that is cited in the scope of this test method. For measurements above 5 NTU, refer to Test Method [D7315](#).

⁵ The boldface numbers in parentheses refer to a list of references at the end of this standard.