



Designation: D 1889 – 00

Standard Test Method for Turbidity of Water¹

This standard is issued under the fixed designation D 1889; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of turbidity in water and wastewater.

1.2 This test method is applicable to the measurement of turbidities in the range from 1.0 to 40 nephelometric turbidity units (NTU).

1.3 Higher turbidities may be measured using this test method by serial dilution to applicable range.

1.4 This test method was tested on municipal drinking water and final effluent discharges. It is the user's responsibility to ensure the validity of this test method for waters of untested matrices.

1.5 *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.* Refer to all material safety data sheets (MSDS) prior to preparing or using standards and before calibrating or performing instrument maintenance.

2. Referenced Documents

2.1 ASTM Standards:

D 1129 Terminology Relating to Water²

D 1192 Specification for Equipment for Sampling Water and Steam in Closed Conduits²

D 1193 Specification for Reagent Water²

D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D-19 on Water²

D 3370 Practices for Sampling Water from Closed Conduits²

2.2 EPA Standard:

EPA 180.1 Determination of Turbidity by Nephelometry³

¹ This test method is under the jurisdiction of ASTM Committee D-19 on Water and is the direct responsibility of Subcommittee D19.07 on Sediments, Geomorphology, and Open-Channel Flow.

Current edition approved July 10, 2000. Published October 2000. Originally published as D 1889 – 61. Last previous edition D 1889 – 99 ^ε1.

² *Annual Book of ASTM Standards*, Vol 11.01.

³ Available from Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.

3. Terminology

3.1 *Definitions:* The terms turbidity, and nephelometric turbidity are defined in Terminology D 1129. For definitions of other terms used in this test method, refer to Terminology D 1129.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *turbidity*—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. (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 Nephelometric Turbidity:

4.1.1 *Photoelectric Nephelometer*—The photoelectric nephelometer operation is based on instrumental comparison of the intensity of light scattered by the contained static water sample under defined conditions to the intensity of light scattered by a reference standard in the sample container. The higher the intensity of scattered light, the higher the turbidity of sample.

4.1.2 *Calibrated Slit Turbidimeter*—The calibrated slit turbidimeter operation is based on a visual comparison of the intensity of light scattered by the contained static water sample under defined conditions to the intensity of light scattered by a reference sample in the same container, the higher the intensity of scattered light the higher the turbidity of sample.

4.1.3 Nephelometric Turbidity Standards:

4.1.3.1 Styrene-divinylbenzene (SDVB) polymer standard (see Section 12). These standards are used as received from the manufacturers or distributor.

4.1.3.2 Formazin polymer preparation and dilution methods are given in 8.2.2-8.2.4.

5. Significance and Use

5.1 Turbidity in water is caused by the presence of suspended and dissolved particles of gas, liquid or solids of organic or inorganic matter. 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 for when, how, and to what extent the water must be treated to meet specifications. Methodology for the correlation of a sample NTU to the number or volume of suspended particles is now under evaluation. Specific gravity estimates would then give rapid NTU correlation to the weight concentration of suspended matter.

5.2 This test method is suitable for 1.0 to 40.0 NTU turbidity such as that found in drinking water and process water.

6. Interferences

6.1 Floating or suspended large particles and entrained air bubbles will give false or unstable readings. Certain turbulent motions also create unstable reading conditions of nephelometers.

6.2 Dissolved material that imparts a color to the water may cause serious errors in nephelometric reading 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. Cells should be kept scrupulously clean both inside and outside and discarded when they become etched or scratched. The cells must not be handled where the light strikes them when indexed in the instrument well.

6.4 Cuvette used must be indexed first for standardization followed by unknown (sample) determination. Indexing should be done according to manufacturers' recommendations.

7. Apparatus

7.1 Two types of instruments are available for the nephelometric method, the photoelectric nephelometer and the calibrated slit turbidimeter (Fig. 1 and Fig. 2). Both give a greater precision and sensitivity than the Jackson candle turbidity,

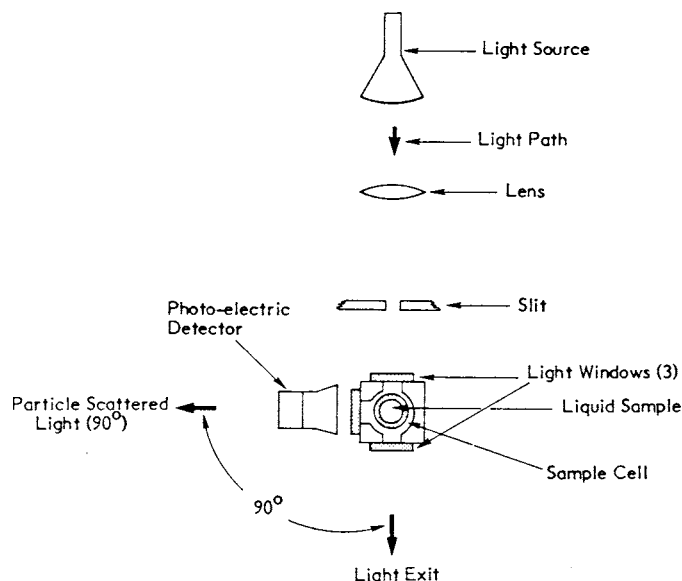


FIG. 1 Photoelectric Nephelometer

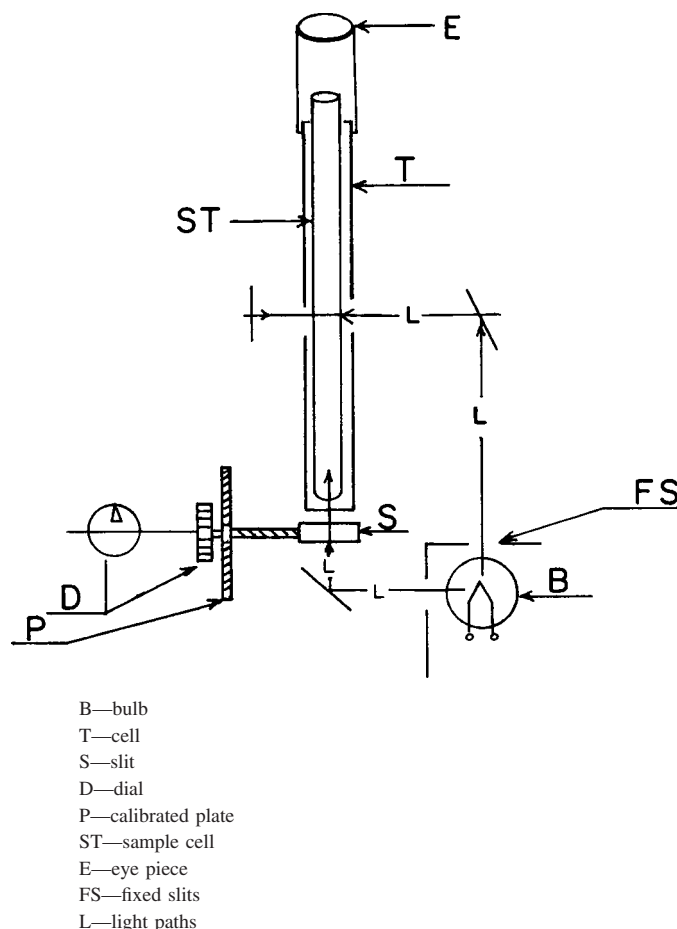


FIG. 2 Calibrated Slit Turbidimeter

within their applicable range from 0.05 to 40.0 NTU, to ranges as low as 0.05 to 1.00 NTU.

7.2 The sensitivity of the instruments should permit detection of differences of 0.1 NTU or less in waters having turbidities between 1.0 and 10.0 NTU. The instruments should measure the ranges from 1.0 to 10.00 NTU and 1.0 to 40.0 NTU. Linear calibration charts should be made with the additional ranges from 0.05 to 0.10 and 0.05 to 10.0 NTU if possible. Either of the two accepted standards, SDVB or Formazin, (8.2.1 or 8.2.2) can be used for this calibration. See 11.1 for calibration instruments.

7.3 Photoelectric Nephelometer:

7.3.1 This instrument uses a light source for illuminating the sample and one or more photoelectric detectors with a readout device to indicate the intensity of light scattered at right angles (90°) to the path of the incident light. The photoelectric nephelometer should be so designed that little stray light reaches the detector(s) in the absence of turbidity and should be free from significant drift after a short warm-up period.

7.3.2 Differences in physical design of photoelectric nephelometers will cause differences in measured values for turbidity, as will aging of a turbidimeter, even though the same suspension is used for calibrations. To minimize initial differences, the following design criteria should be observed (see Fig. 1).