



Designation: D5413 – 21

Standard Test Methods for Measurement of Water Levels in Open-Water Bodies¹

This standard is issued under the fixed designation D5413; 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 These test methods cover equipment and procedures used in obtaining water levels of rivers, lakes, and reservoirs or other water bodies. Three types of equipment are available as follows:

Test Method A—Nonrecording water-level measurement devices

Test Method B—Recording water-level measurement devices

Test Method C—Remote-interrogation water-level measurement devices

1.2 The procedures detailed in these test methods are widely used by those responsible for investigations of streams, lakes, reservoirs, and estuaries, for example, the U.S. Agricultural Research Service, the U.S. Army Corp of Engineers, and the U.S. Geological Survey.² The referenced ISO standard also furnishes useful information.

1.3 It is the responsibility of the user of these test methods to determine the acceptability of a specific device or procedure to meet operational requirements. Compatibility between sensors, recorders, retrieval equipment, and operational systems is necessary, and data requirements and environmental operating conditions must be considered in equipment selection.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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 Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards:*³

D1129 Terminology Relating to Water

D1941 Test Method for Open Channel Flow Measurement of Water with the Parshall Flume

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

D5242 Test Method for Open-Channel Flow Measurement of Water with Thin-Plate Weirs

2.2 *ISO Standard:*⁴

ISO 4373 Measurement of Liquid Flow in Open Channels—Water Level Measuring Devices

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 *elevation, n*—the vertical distance from a datum to a point.

3.2.2 *datum, n*—a level plane that represents a zero or some defined elevation.

3.2.3 *gauge, n*—a generic term that includes water level measuring devices.

3.2.4 *gauge datum, n*—a datum whose surface is at the zero elevation of all the gauges at a gauging station; this datum is often at a known elevation referenced to National Geodetic Vertical Datum of 1929 (NGVD).

3.2.5 *gauge height, n*—the height of a water surface above an established or arbitrary datum at a particular gauging station; also termed stage.

3.2.6 *gauging station, n*—a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

¹ These test methods are under the jurisdiction of ASTM Committee **D19** on Water and is the direct responsibility of Subcommittee **D19.07** on Sediments, Geomorphology, and Open-Channel Flow.

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² Sauer, V. B., and Turnipseed, D. P., “Stage Measurement at Gauging Stations,” *Techniques of Water Resources Investigations*, Book 3, Chapter A-7, U.S. Geological Survey, 2010.

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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

3.2.7 *National Geodetic Vertical Datum of 1929 (NGVD)*, *n*—a datum prior to 1973 known as mean sea level; a spheroidal datum in the conterminous United States and Canada that approximates mean sea level but does not necessarily agree with sea level at a specific location.

4. Significance and Use

4.1 These test methods are used to determine the gauge height or elevation of a river or other body of water above a given datum.

4.2 Water level data can serve as an easily recorded parameter, and through use of a stage-discharge relation provide an indirect value of stream discharge, often at a gauging station.

4.3 These test methods can be used in conjunction with other determinations of biological, physical, or chemical properties of waters.

TEST METHOD A—NONRECORDING WATER-LEVEL MEASUREMENT DEVICES

5. Summary of Test Method

5.1 These test methods are usually applicable to conditions where continuous records of water level or discharge are not required. However, in some situations, daily or twice daily observations from a nonrecording water-level device can provide a satisfactory record of daily water levels or discharge. Water levels obtained by the nonrecording devices described in these test methods can be used to calibrate recording water-level devices described in Test Methods B and C.

5.2 Devices included in these test methods are of two general types: those that are read directly, such as a staff gauge; and those that are read by measurement to the water surface from a fixed point, such as wire-weight, float-tape, electric-tape, point and hook gauges.

5.2.1 Staff, wire-weight, and chain gauges are commonly used as both outside auxiliary and reference gauges. Vertical and inclined-staff, float-tape, electric-tape, hook and point gauges are commonly used as inside auxiliary and reference gauges.

5.3 Documentation of observations must be manually recorded.

6. Apparatus

6.1 Staff Gauges:

6.1.1 *Vertical Staff Gauges*—Staff gauges are usually graduated porcelain-enameled plates attached to wooden piers or pilings, bridge piers, or other hydraulic structures. They may also be installed on the inside of gauging station stilling wells as inside reference gauges. They are precisely graduated, usually to 0.02 ft or 2 mm, although other markings may be used for specific applications (see Fig. 1).

6.1.2 *Inclined Staff Gauges*—Inclined staff gauges usually consist of markings on heavy timbers, steel beams, or occasionally concrete beams built partially embedded into the natural streambed slope. Since they are essentially flush with the adjoining streambed, floating debris and ice are less likely

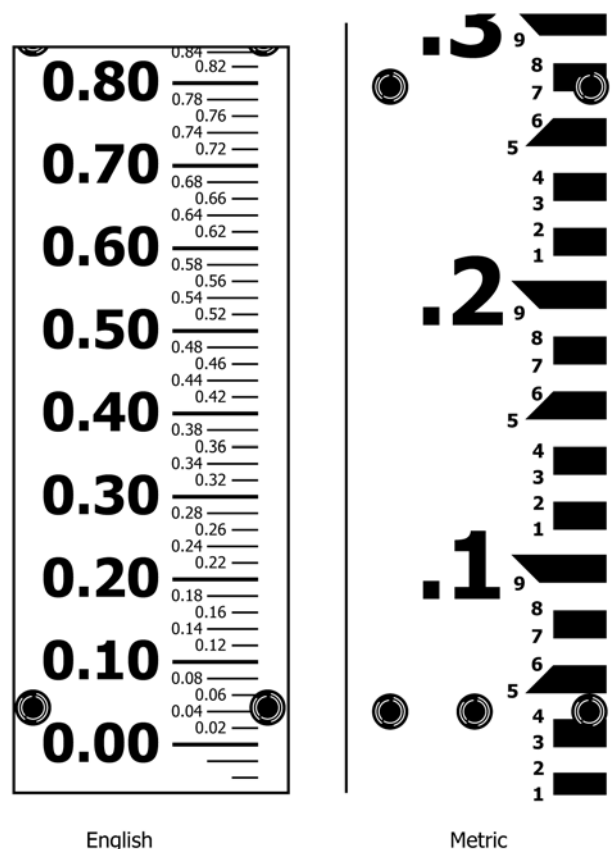


FIG. 1 Staff Gauges

to cause damage than for a vertical staff gauge. Individual graduation and marking of the installed gauges by engineering levels are required due to the variability of bank slope.

6.2 *Wire-Weight Gauge*—An instrument that is mounted on a bridge or other structure above a water body. Water levels are obtained by direct measurement of the distances between the device and the water surface. A wire-weight gauge consists of a drum wound with a single layer of cable, a bronze weight attached to the end of the cable, a graduated disk, a counter, and a check bar, all contained within a protective housing (see Fig. 2). The disk is graduated and is permanently connected to

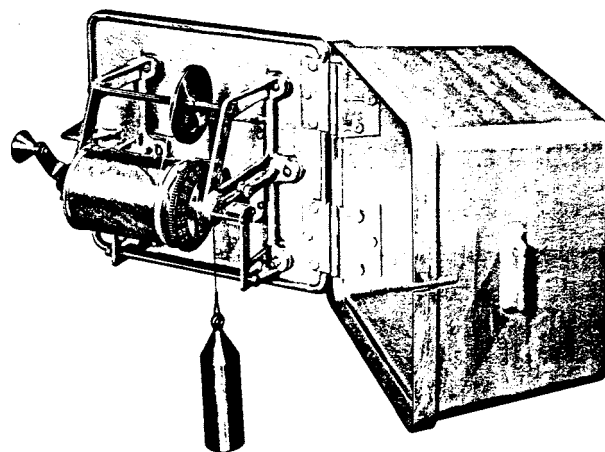


FIG. 2 Type A Wire-Weight Gauge