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An American National Standard

Standard Test Method for Open Channel Flow Measurement of Water with Broad-Crested Weirs[1]

This standard is issued under the fixed designation D 5614; 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 measurement of the volumetric flow rate of water in open channels with two types of horizontal broad-crested weirs: those having a square (sharp) upstream corner and those having a well-rounded upstream corner.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 *ASTM Standards:*

D 1129 Terminology Relating to Water[2]

D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D19 on Water[2]

D 3858 Practice for Open-Channel Flow Measurement of Water by Velocity-Area Method[2]

2.2 *ISO Standards:*

ISO 555-1973 Liquid Flow Measurement in Open Channels—Dilution Methods for Measurement of Steady Flow—Constant Rate Injection Method[3]

ISO 3846-1989 Liquid Flow Measurement in Open Channels by Weirs and Flumes—Rectangular Broad-Crested Weirs[3]

ISO 4373-1979 Measurement of Liquid Flow in Open Channels—Water Level Measuring Devices[3]

ISO 4374-1990 Liquid Flow Measurement in Open Channels by Weirs and Flumes—Round-Nose Horizontal Crest Weirs[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D 1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *boundary layer displacement thickness*—the boundary layer is a layer of fluid flow adjacent to a solid surface (in this case, the weir crest and sidewalls) in which, due to viscous friction, the velocity increases from zero at the stationary surface to an essentially frictionless-flow value at the edge of the layer. The displacement thickness is a distance normal to the solid surface that the flow streamlines can be considered to have been displaced by virtue of the boundary-layer information.

3.2.2 *crest*—the horizontal plane surface of the weir.

3.2.3 *critical flow*—open channel flow in which the energy, expressed in terms of depth plus velocity head, is a minimum for a given flow rate and channel. The Froude number is unity at critical flow.

3.2.4 *Froude number*—a dimensionless number expressing the ratio of inertial to gravity forces in free surface flow. It is equal to the average velocity divided by the square root of the product of the average depth and the acceleration due to gravity.

3.2.5 *head—in this test method*, the depth of water above a specified elevation. The measuring head is the depth of flow above the weir crest measured at an appropriate location upstream of the weir; the downstream head is referenced similarly to the crest elevation and measured downstream of the weir. The head plus the corresponding velocity head is often termed the total head or total energy head.

3.2.6 *hydraulic jump*—an abrupt transition from supercritical flow to subcritical or tranquil flow, accompanied by considerable turbulence or gravity waves, or both.

3.2.7 *nappe*—the curved sheet or jet of water overfalling the downstream end of the weir.

3.2.8 *primary device*—the device (in this case, the weir) that creates a hydrodynamic condition that can be sensed by the secondary instrument.

3.2.9 *Reynolds number*—a dimensionless number expressing the ratio of inertial to viscous forces in a flow. The pertinent Reynolds number on the weir crest is equal to the (critical)

[1] This test method is 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] *Annual Book of ASTM Standards*, Vol 11.01.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036..

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