



Standard Guide for Selection of Weirs and Flumes for Open-Channel Flow Measurement of Water¹

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1. Scope

1.1 This guide covers recommendations for the selection of weirs and flumes for the measurement of the volumetric flow rate of water and wastewater in open channels under a variety of field conditions.

1.2 This guide emphasizes the weirs and flumes for which ASTM standards are available, namely, thin-plate weirs, broad-crested weirs, Parshall flumes, and Palmer-Bowlus (and other long-throated) flumes. However, reference is also made to other measurement devices and methods that may be useful in specific situations.

1.3 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.

1.4 *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:²

D1129 Terminology Relating to Water

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

D3858 Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method

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

D5389 Test Method for Open-Channel Flow Measurement by Acoustic Velocity Meter Systems

¹ This guide 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 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.

D5390 Test Method for Open-Channel Flow Measurement of Water with Palmer-Bowlus Flumes

D5614 Test Method for Open Channel Flow Measurement of Water with Broad-Crested Weirs

2.2 ISO Standard:³

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

3. Terminology

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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *backwater*—an increase in the depth of flow upstream of a channel obstruction, in this case a weir or flume.

3.2.2 *contracted weirs*—contractions of thin-plate weirs refer to the widths of weir plate between the notch and the sidewalls of the approach channel. In fully contracted weirs, the ratio of the notch area to the cross-sectional area of the approach channel is small enough for the shape of the channel to have little effect. In suppressed (full-width) rectangular weirs, the contractions are suppressed, and the weir crest extends the full width of the channel.

3.2.3 *crest*—in rectangular thin-plate weirs, the horizontal bottom of the overflow section; in broad-crested weirs and flumes, the plane, level floor of the flow section.

3.2.4 *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.

3.2.4.1 *Discussion*—The Froude number is unity at critical flow.

3.2.5 *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.

3.2.6 *head*—in this context, the depth of flow referenced to the crest of the weir or flume and measured at a specified

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.