



Designation: D 5089 – 95 (Reapproved 1999)

Standard Test Method for Velocity Measurements of Water in Open Channels with Electromagnetic Current Meters¹

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1. Scope

1.1 This test method covers the use of single-axis or dual-axis electromagnetic current meters for the measurement of water velocities in open channels.

1.2 This test method covers only these components and appurtenances of portable open-channel current-meter systems, which are customarily required when an operator is in attendance.

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 Water²

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

D 3858 Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method²

D 4409 Test Method for Velocity Measurements in Open Channels with Rotating-Element Current Meters²

2.2 ISO Standards:

ISO 3454 Liquid Flow Measurement in Open Channels—Sounding and Suspension Equipment³

ISO 3455 Liquid Flow Measurement in Open Channels—Calibration of Rotating Element Current Meters in Straight Open Tanks³

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*—a relatively thin layer of viscous influence adjacent to the probe (or any solid) surface caused by

the requirement that the water velocity must be zero at the wall.

3.2.2 *cosine response*—the ability of a meter, placed at an angle to the oncoming flow, to sense the component of velocity parallel to its axis.

3.2.3 *turbulence*—irregular condition of flow in which the various quantities show a random variation with time and space coordinates so that statistically distinct average values can be discerned.

4. Summary of Test Method

4.1 Electromagnetic liquid flow current meters are based on the Faraday principle of electromagnetic induction, which states that voltage is proportional not only to flow speed but also to the magnetic flux density and the distance between electrodes. In the application of the electromagnetic liquid current meter, a conductor (water) moving in a magnetic field (created from within the sensor) generates a voltage that is proportional to the rate of flow of water through the magnetic field. This variable voltage lies in a plane that is perpendicular to both the water velocity vector and the magnetic field vector and is sensed by pairs of electrodes.

5. Significance and Use

5.1 This test method is particularly used for measuring the velocity at a point in an open channel as part of a velocity-area traverse to determine the flowrate of water. To this end it should be used in conjunction with Test Method D 3858. A single axis probe with cosine response will suffice for most of these applications.

5.2 This test method is also useful in applications where the velocity itself (rather than a volumetric flowrate) is the desired end product.

6. Interferences

6.1 As with any intrusive flow measuring device, electromagnetic current meter sensors may be fouled by pieces of debris of the type that can cling to or wrap around the sensor which could affect measurement accuracy, and sensors may be damaged by heavy debris in very high velocity flow.

6.2 Electromechanical flow sensors can be affected by oil or other materials coating the sensor.

6.3 Electromagnetic flow sensors can be affected by external electrical noise such as that caused by nearby heavy electrical equipment, and by voltage gradients caused by

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.

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

³ “Measurement of Liquid Flow in Open Channels,” *ISO Standards Handbook* 16, 1983. Available from American National Standards Institute, 1430 Broadway, New York, NY 10018.