



Standard Practice for Developing a Stage-Discharge Relation for Open Channel Flow¹

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1. Scope

1.1 This practice covers the development of a curve relating stage (elevation) to discharge. Standard test methods have been documented for measuring discharge and for measuring stage (see Practice [D3858](#), and Test Methods [D5129](#), [D5130](#), [D5243](#), [D5388](#), and [D5413](#)). This practice takes the discharge and stage determined by each respective test method and shows a relation between them using a curved line. This curved line is called a stage-discharge relation or rating curve.

1.2 The procedures described in this practice are used commonly by those responsible for investigations of streamflow, for example, the U.S. Geological Survey, Army Corps of Engineers, Bureau of Reclamation, and U.S. Agriculture Research Service. For the most part, these procedures are adapted from reports of the U.S. Geological Survey.^{2,3}

1.3 The procedures described in this practice apply only to simple freely flowing open-channel flow. Ratings for complex hydraulic conditions of extremely low slope channels using multiple-stage inputs, channels affected by man-induced regulation, or tidal conditions are not described. These types of ratings are described in detail in the documents listed in Footnotes 2 and 3.^{2,3}

1.4 This practice uses the results of current-meter discharge measurements or indirect discharge measurements and the corresponding measured stage to define as much of the stage-discharge relation curve as possible. A theoretical curve is developed for the full range of stage and discharge to shape the curve.

1.5 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.

1.6 *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:⁴

- [D1129 Terminology Relating to Water](#)
- [D3858 Test Method for Open-Channel Flow Measurement of Water by Velocity-Area Method](#)
- [D5129 Test Method for Open Channel Flow Measurement of Water Indirectly by Using Width Contractions](#)
- [D5130 Test Method for Open-Channel Flow Measurement of Water Indirectly by Slope-Area Method](#)
- [D5243 Test Method for Open-Channel Flow Measurement of Water Indirectly at Culverts](#)
- [D5388 Test Method for Indirect Measurements of Discharge by Step-Backwater Method](#)
- [D5413 Test Methods for Measurement of Water Levels in Open-Water Bodies](#)

2.2 ISO Standard:⁵

- [ISO 1100/2 Liquid Flow Measurement in Open Channels—Part 2, Determination of Stage-Discharge Relation](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology [D1129](#).

3.2 Symbols:

- 3.2.1 *GH*—gauge height or stage, ft (m).
- 3.2.2 *Q*—discharge, ft³/s (m³/s).

¹ This practice 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 Kennedy, E. J., “Discharge Ratings at Gaging Stations: U.S. Geological Survey,” *Techniques of Water-Resource Investigations*, Book 3, Chapt. A10, 1984, p. 59.

³ Rantz, S. E., et al., *Measurement and Computation of Streamflow: Vol 2, Computation of Discharge*, U.S. Geological Survey, Water-Supply Paper No. 2175, 1982, p. 631.

⁴ 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.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.