Designation: D5073 – 02 (Reapproved 2013)

Standard Practice for Depth Measurement of Surface Water[1]

This standard is issued under the fixed designation D5073; 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 practice guides the user in selection of procedures commonly used to measure depth in water bodies that are as follows:

	Sections
Procedure A—Manual Measurement	6 through 11
Procedure B—Electronic Sonic-Echo Sounding	12 through 13
Procedure C—Electronic Nonacoustic Measurement	14 through 15

The text specifies depth measuring terminology, describes measurement of depth by manual and electronic equipment, outlines specific uses of electronic sounders, and describes an electronic procedure for depth measurement other than using sonar.

1.2 The references cited and listed at the end of this practice contain information that may help in the design of a high quality measurement program.

1.3 The information provided on depth measurement is descriptive in nature and not intended to endorse any particular item of manufactured equipment or procedure.

1.4 This practice pertains to depth measurement in quiescent or low-velocity flow. For depth measurement related to stream gaging see Test Method D3858. For depth measurements related to reservoir surveys see Guide D4581.

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 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

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

D4410 Terminology for Fluvial Sediment

D4581 Guide for Measurement of Morphologic Characteristics of Surface Water Bodies

3. Terminology

3.1 *Definitions*—For definition of terms used in this practice refer to Terminologies D1129 and D4410.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bar-check, n*—a method for determining depth below a survey vessel by means of a long, narrow metal bar or beam suspended on a marked line beneath a sounding transducer.

3.2.2 *bar sweep, n*—a bar or pipes, suspended by wire or cable beneath a floating vessel, used to search for submerged snags or obstructions hazardous to navigation.

3.2.3 *beam width, n*—the angle in degrees made by the main lobe of acoustical energy emitted from the radiating face of a transducer.

3.2.4 *bottom profile, n*—a line trace of the bottom surface beneath a water body.

3.2.5 *sonar, n*—a method for detecting and locating objects submerged in water by means of the sound waves they reflect or produce.

3.2.6 *sound, vt*—to determine the depth of water (**1**).[3]

3.2.7 *sounding line, n*—a rope or cable used for supporting a weight while the weight is lowered below the water surface to determine depth.

3.2.8 *sounding weight, n*—a heavy object usually of lead, that may be bell-shaped, for use in still water and soft bottom materials or torpedo shaped with stabilizing fins, for use in flowing water.

3.2.9 *stray, n*—spurious marks on the graphic depth records caused by surfaces other than the bottom surface of a water body below the sounding vessel.

3.2.10 *subbottom profile, n*—a trace of a subsurface horizon due to a change in the acoustic properties of the medium through which the sound energy has traveled.

[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] 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.

[3] The boldface numbers in parentheses refer to a list of references at the end of this practice.

3.2.11 *towfish, n*—a streamlined container, containing acoustical equipment for sounding depth, and designed to be pulled behind or beneath a survey vessel.

3.2.12 *transducer, n*—a device for translating electrical energy to acoustical energy and acoustical energy back to electrical energy.

3.2.13 *transducer draft, n*—the distance from the water surface to the radiating face of a transducer.

3.2.14 *vertical control, n*—a horizontal plane of reference used to convert measured depth to bottom elevation.

4. Summary of Practices

4.1 These practices include the following three general techniques for acquiring depth measurements in surface water:

4.1.1 The first general technique is to determine depth by manual procedures. The equipment to perform these procedures may be most readily available and most practical under certain conditions.

4.1.2 The second general technique is to determine depth by electronic sonic-echo sounding procedures. These procedures are most commonly used because of their reliability and the variety of instruments available that meet specific measuring requirements.

4.1.3 The third general technique is to determine depth by an electronic procedure other than acoustic sounding. A procedure using ground penetrating radar is currently being used for measuring water depth for specific applications.

5. Significance and Use

5.1 This is a general practice intended to give direction in the selection of depth measuring procedures and equipment for use under a wide range of conditions encountered in surface water bodies. Physical conditions at the measuring site, the quality of data required, and the availability of appropriate measuring equipment govern the selection process. A step-by-step procedure for actually obtaining a depth measurement is not discussed. This practice is to be used in conjunction with a practice on positioning techniques and another practice on bathymetric survey procedures to obtain horizontal location and bottom elevations of points on a water body.

PROCEDURE A—MANUAL MEASUREMENT

6. Scope

6.1 This procedure explains the measurement of water depth using manual techniques and equipment. These include the use of sounding rods, sounding lines, sounding reels, or a bar sweep.

6.2 Description of techniques and equipment are general in nature. Techniques and equipment may need to be modified for use in specific field conditions.

7. Significance and Use

7.1 Prior to the development of acoustic sounding equipment, manual techniques provided the only means of depth measurement. Some circumstances may still require sounding by manual techniques such as shallow areas where depth is not sufficient for acoustic sounding. Manual procedures continue to serve several useful purposes such as the following:

7.1.1 To search for and confirm the minimum depths over shallow area of sunken obstacles.

7.1.2 To confirm bottom soundings in areas with submerged vegetation, or other soft bottom materials.

7.1.3 To assist in obtaining bottom samples.

7.1.4 To calibrate electronic sounding equipment.

7.1.5 To suspend other measuring instruments to known depths for making various physical or chemical water quality measurements (**2**).

8. Sounding Rod (Manual Procedure)

8.1 The sounding rod (or sounding pole) can be used to measure depth over extensive flat, shallow areas more easily and more accurately than by other means. Use of the sounding rod should be restricted to still water or where the velocity is relatively low, and to depths less than 12 ft (3.7 m). Sounding rods are usually not used in depths over 6 ft (1.8 m) except to provide supplemental soundings to aid in interpreting analog depth records. A weighted, flat shoe (see Fig. 1) should be attached to the bottom of the rod to prevent it from penetration of the bottom sediments. The rod may be graduated in feet and tenths of a foot; zero being at the bottom of the shoe (**3**).

8.2 Modern sounding rods may be made of light-weight metals for strength, neutral buoyancy, and sound transmitting capability. An experienced operator can measure the water depth and can distinguish the relative firmness of the bottom

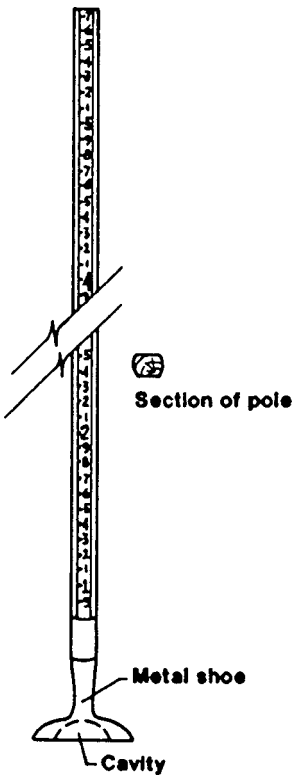

FIG. 1 Graduated Sounding Rod with Shoe Attached

material by the feel of the rod and the tone produced by the metal pole as it contacts the bottom (**4**).

8.3 When sounding in still water the operator should lower the rod into the water until the bottom plate makes contact with the bottom surface. After determining that a firm bottom material has been encountered, the water surface level is visually read on the rod. When sounding in flowing water, to achieve vertical sounding, a long wire or cable anchored upstream and attached to the lower end of the rod may be necessary.

9. Sounding Line (Manual Procedure)

9.1 The sounding line (see Fig. 2) can be used to measure depths of large magnitude but is seldom used for depths greater than 15 ft (4.57 m). The sounding line should be of a material that does not shrink or stretch, or lengthen from wear or corrosion of the material as will occur in chain links over several years of use. Though manila rope and cotton, or other materials that require prestretching before use, have been employed for large depths, small-diameter high-strength steel cable wound and released from a reel with a gear driven depth indicator are readily available and greatly simplify the work (**1**). The stretch of the high-strength cable is very small for its intended use, and therefore, a considerable length of cable may be used without introducing significant error. Depth indicators, calibrated in either inch-pound or metric units, or both, are available (**5**).

9.2 Markings on the sounding line should be easy to see and understand to avoid making errors in determining the readings. For sounding relatively shallow depths, marking at 0.5-ft intervals with different colors to identify the 1, 2, and 10-ft intervals is recommended. Care must be exercised so that the first marker is the correct distance from the bottom of the sounding weight when the weight is attached. When sounding, depths are obtained from the difference in readings at an index point on the bridge or boat rail, when the base of the sounding weight is at the water surface, and when it is at the bottom. A short steel tape or folding rule is usually employed to measure the fractional distance from the line markers to the reference point. Within the minimum 0.5-ft markings depths are estimated and recorded to the nearest 0.1 ft. For sounding in deep water, a sounding reel with depth indicator and an unmarked high-strength steel cable is recommended (**4**).

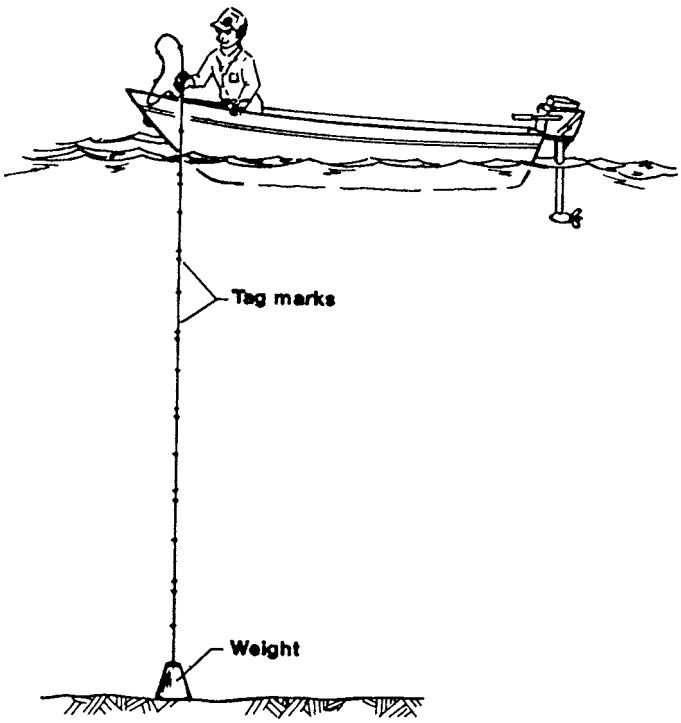

FIG. 2 Sounding Line Used from Small Boat

9.2.1 When the metric system of units is used, the sounding line for use in shallow depths is usually marked at 0.5-m intervals with different colors to identify the 1 and 2-m intervals. Depths are recorded to the nearest 0.01 m.

9.3 Weights used in sounding are usually of lead, aluminum, or brass. For application in still water, the weights are bell-shaped (see Fig. 3a) and made of cast aluminum or lead. The amount of weight should be from 5 to 10 lb (2.3 to 4.5 kg).

9.3.1 For application in flowing water, the weight should be of circular cross section and steamlined with fins (see Fig. 3b) to turn the weight nose first into the current to offer a minimum of resistance to the flow. The amount of weight should be varied, depending on the water depth and flow velocity at a cross section. A rule of thumb is that the weight in pounds should be greater than the maximum product of velocity and depth in the cross section. If debris or ice is flowing or the stream is shallow or swift, use a heavier weight than the rule designates. A variety of sizes of sounding weights from 15 to 300 lb (7 to 136 kg) should be available with appropriate means of attaching to the sounding line (**1**). Sounding weights should always be attached to the sounding line using a hanger bar, clevis, snap hook, or thimble of brass or stainless steel to protect the line from wear or damage.

9.4 The procedure for making soundings will vary depending on depth, current velocity, and means of locating where the soundings are taken. Once at the location where a depth measurement is needed, the basic procedure is to lower the weight until the bottom of the weight is at the water surface. When using a marked sounding line, the distance is read from the sounding line at a reference point on the bridge or boat after which the weight is lowered to the bottom, and a new distance is read from the line and recorded. When using a sounding reel the indicator is set to zero after which the weight is lowered to the bottom and the depth is read and recorded. It is usually of some importance, especially when sounding an uneven bottom, to have the locations of the soundings accurately known relative to the surroundings. When sounding from a boat using weighted line, the boat should be stationary and should remain at that position until the sounding has been completed and the location is determined.

9.5 Sounding through the ice cover of a lake or river may be taken after boring holes in the ice with an ice auger. In this case, a marked sounding line with an appropriate sounding weight attached at the end, is lowered through the hole and the determined depth is recorded.