
**Hydrometry — Direct depth sounding and
suspension equipment**

*Hydrométrie — Matériel de sondage et de suspension pour le mesurage
direct de la profondeur*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3454 was prepared by Technical Committee ISO/TC 113, *Hydrometry*, Subcommittee SC 5, *Instruments, equipment and data management*.

This third edition cancels and replaces the second edition (ISO 3454:1983), which has been technically revised.

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Introduction

The choice of suspension and sounding equipment depends on the depth of flow, the velocity of the current and the method of discharge measurement (by wading, from a boat, from a manned cableway or from a bridge).

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Hydrometry — Direct depth sounding and suspension equipment

1 Scope

This International Standard specifies the functional requirements of the equipment, excluding bankside cableway systems, used in the measurement of liquid flow in open channels for

- a) sounding (by direct method), and
- b) suspending the measuring equipment (for example, current-meter or sediment sampler) at the point of measurement.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 772, *Hydrometry — Vocabulary and symbols*.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 772 apply.

4 Sounding equipment

4.1 General

To obtain the correct vertical depth of water from surface to bed, either a sounding-rod or a sounding line is used depending on the velocity and depth of flow. The sounding rod can also be a wading rod. For measurements by either sounding rod or wading rod, the rod shall be held in a vertical position. For measurements by sounding line, appropriate weights shall be attached to keep it as close as practicable to vertical. Sounding equipment can also be employed as suspension equipment. Requirements for the deployment of suspension equipment, as described in Clause 5, also apply to sounding equipment.

4.2 Sounding rod, wading rod and sounding line

A sounding rod is a graduated rigid rod with a base plate; it is used for measurement of depths up to 5 m to 6 m in medium velocities (up to 2 m/s). For smaller depths and velocities, a wading rod is used; for greater depths, a sounding line is used.

5 Suspension equipment

5.1 Basic requirements

The basic requirements for making observations in flowing water with the help of meter-suspension equipment are as follows.

- a) Measuring equipment shall be placed at the point of measurement in such a way that it does not cause appreciable disturbances, irrespective of the depth of water and velocity of flow.
- b) Supporting devices, such as cableways, bridges and boats or wading rods, shall be appropriate to the measuring equipment suspended from them and capable of supporting the safe working load of the equipment with a suitable factor of safety.
- c) The method of deployment shall be in accordance with local health and safety regulations.

5.2 Types of suspension

5.2.1 General

Several types of suspension equipment have been developed to suit the basic requirements in 5.1. These can be classified into two broad categories:

- a) rigid-rod suspension equipment,
- b) cable suspension equipment.

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5.2.2 Rigid-rod suspension equipment

5.2.2.1 General

This type of equipment has the merit that the current-meter or sediment sampler can be placed at the point of measurement without any appreciable deflection from the vertical at which the observations are being made.

Rigid-rod suspension equipment includes:

- a) hand-operated suspension equipment, such as a wading rod;
- b) mechanically operated rigid-rod suspension equipment such as a rack-and-pinion arrangement.

5.2.2.2 Hand-held suspension equipment

Hand-held suspension equipment is simple to operate, can be manufactured from local resources, and can be used in water of depths up to approximately 3 m and velocities of 2 m/s. In the case of wading rods, the limits for the depth and velocity are approximately 1 m and 1 m/s, respectively.

5.2.2.3 Mechanically operated suspension equipment

Mechanically operated rigid-rod equipment is preferable because of the accuracy with which the instrument can be placed at the point of measurement, but it is heavier and requires very careful installation with suitable stabilizing counter-weights. This type of equipment can be used in water of depths up to approximately 6 m and velocities up to approximately 3 m/s. Limitations on the use of the equipment shall be clearly established and attached to the equipment so that safe working limits are not exceeded. Special care is needed in the presence of overhead power cables.

5.2.3 Cable suspension equipment

Cable suspension equipment is generally used in measurement of deep streams where rigid-rod suspension equipment cannot be used. Cableway systems for stream gauging are specified in ISO 4375.

Depending on the depth and velocity encountered, suitable weights are attached to the cable suspension to keep the cable as vertical as possible. Guidance on the selection of sounding weights is given in Annex A. If, with the maximum permissible sinker attached, the current-meter and weight are carried downstream, the measured depth will be greater than the true depth and will therefore require correction. In such situations where large vertical angles are induced, two separate corrections are required. These corrections are an “air-line” correction for that part of the cable which is between the point of suspension and the surface of water, and a “wet-line” correction for that portion of the cable which is in the water (see Annex B). To prevent large vertical angles, it may be necessary to use weights of several hundred kilograms to keep the cable as vertical as possible. Hand-operated or power-driven gauging-reels and cranes should handle such weights with an appropriate safe working load.

Cable suspension equipment includes:

- a) hand-line suspension;
- b) crane and gauging reel.

A hand-line suspension is operated by hand, is simple in design, and can be manufactured from local resources. Its application shall be limited to use with weights up to 15 kg and velocities up to 2 m/s. Gauging-reel suspension can be used under most conditions of flow. This type of equipment shall include an automatic brake and a means of overload protection.

6 Performance requirements

6.1 Rigid rods for sounding and suspension

6.1.1 Sounding rod

The sounding rod shall comply with the following requirements.

- a) It shall be straight and remain vertical during use.
- b) It shall be made as lightweight as possible, but have sufficient strength to withstand the force due to flowing water without itself undergoing any significant deflection or vibration.
- c) It shall not cause significant heading up of water due to its own obstruction.
- d) The smallest graduation should preferably correspond to 10 mm.
- e) It shall not penetrate into the bed of the channel.

6.1.2 Suspension rod

In addition to the requirements in 6.1.1 a) to e), the suspension rod shall have a suitable stabilizing arrangement to enable it to maintain proper orientation, especially when the immersed portion of the rod is long. Mechanically operated rigid-rod suspension equipment (see 5.2.2.3) shall comply with the following additional requirements.

- a) A load-activated brake shall be incorporated in the winding mechanism to prevent the winding handle from turning under the action of the load and to hold the suspension rod in the desired position. It shall not be possible for the sinker to be lowered except by the action of the handle.
- b) The mechanical arrangement shall be such that the suspension rod can be raised or lowered without the application of excessive effort. Manual handling regulations may apply.