TECHNICAL SPECIFICATION

ISO/TS 3716

First edition
2006-08-15

Hydrometry — Functional requirements and characteristics of suspended-sediment samplers

Hydrométrie — Spécifications de fonctionnement et caractéristiques des appareils d'échantillonnage pour la détermination des charges sédimentaires en suspension

Reference number
ISO/TS 3716:2006(E)

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Published in Switzerland

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Foreword

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

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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/TS 3716 was prepared by Technical Committee ISO/TC 113, *Hydrometry*, Subcommittee SC 6, *Sediment transport*.

This first edition of ISO/TS 3716 cancels and replaces ISO 3716:1977, which has been technically revised.

Introduction

Suspended-sediment samplers are used to collect a representative sample of the water-sediment mixture of rivers and streams. Ideally, the sampler should be able to collect samples that represent the mean concentration of suspended sediment or define the horizontal and vertical variation of suspended-sediment concentration so that the mean concentration can be determined. Samplers have gradually evolved from those that collect an instantaneous sample at one point in a stream or river to streamlined samplers that collect time and/or depth-integrated samples. There are a number of different types of samplers available for collecting suspended sediment, including open containers, vertical and horizontal cylinders, bottle samplers, pumping samplers, single-stage samplers, point-integrating samplers and depth-integrating samplers. Some samplers have also been adapted to enable the collection of clean (uncontaminated) samples of trace metal and organic compounds that are commonly associated with suspended sediment in streams and rivers.

Hydrometry — Functional requirements and characteristics of suspended-sediment samplers

1 Scope

This Technical Specification specifies the functional requirements and characteristics of the different types of suspended-sediment samplers.

NOTE The units of measurement used in this Technical Specification are SI units.

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, *Hydrometric determinations — Vocabulary and symbols*

3 Terms and definitions

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

3.1
isokinetic
intake velocity of the suspended-sediment sampler equals the ambient stream velocity

4 Requirements of samplers

In order that the samples taken by a sampler are truly representative of the sediment concentration of a stream at a point of sampling, the ideal sampler should fulfil the following technical requirements.

a) The sampler shall be streamlined to reduce drag and to minimize disturbances to normal sediment flow.

b) The velocity of inflow in the mouth of the sampler, nozzle or sampling tube shall be isokinetic or as close as possible to the velocity of the current of water at the sampling point, irrespective of what this velocity may be or irrespective of what the depth of submergence at this point may be. This aspect is most important if large sampling errors are to be avoided.

c) The mouth/intake of the sampler shall always face into the current at the sampling point.

d) The mouth/intake of the sampler shall be outside the zone of the disturbances of the flow set up by the body of the sampler and its operating gear, and the flow lines shall be disturbed as little as possible, especially near the mouth.

e) Filling arrangements shall be smooth so that there is no sudden inrush of water-sediment mixture; the air escaping from the sampler shall not hinder the entry of the sample; this necessitates a separate port for air exhaust.

f) The sampler shall be able to collect samples at the desired depth without the samples being disturbed or contaminated by the water-sediment mixture at other points while the sampler is being raised or lowered.

g) It shall be possible to take a sample exactly when and where it is required, in particular when sampling close to the streambed.

h) The sampler shall be portable, yet sufficiently heavy to minimize deflection of the supporting cable from the vertical due to current drag.

i) The sampler shall be simple in design and robust in construction and shall require minimum care in maintenance and operation.

j) The removable-type container within the sampler shall be easily removed, readily capped or sealed and easily transported to a laboratory without loss of contents. Alternatively, if the container forms part of the sampler, it shall be installed so as to secure complete drainage of the contents.

k) The volume of the sample collected by the sampler shall be sufficient for determining the concentration and size distribution of the sediment. The minimum sample size is generally 0,5 l.

l) Depth-integrating samplers should be lowered or raised at a uniform and slow speed, a fraction of the current velocity (for example, between 1/15 and 2/5 – see Note).

NOTE Depth integration (with uniform vertical motion – see Figure 1):

$A \cdot v \cdot t = V$, assuming $v = v_n$ (1)

$i = k \cdot v$, where $k = v_n/v$ (2)

$h = i \cdot t$ (3)

where

A is the area of the mouth or tube;

v is the current velocity;

v_n is the velocity in the mouth/intake (nozzle) of the sampler;

t is the maximum duration of sampling;

V is the sample volume to be taken;

i is the uniform rate for sampler movement;

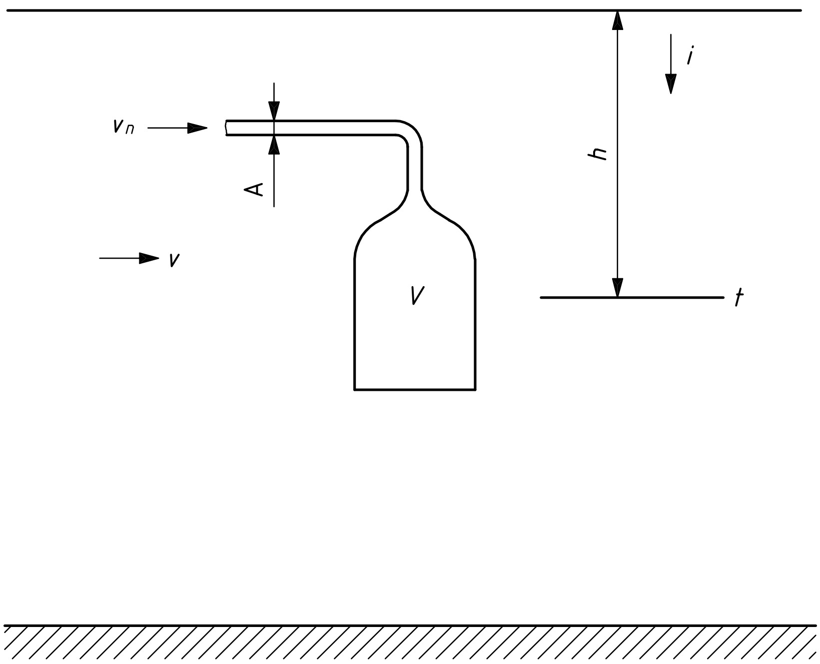
k is the transit rate ratio;

h is the maximum vertical distance for sampling.

From Equations (1), (2) and (3):

$$h = k \frac{V}{A} \quad (4)$$

For example, with $A = 28{,}3\ \text{mm}^2$ (Φ 6 mm), $k = 1/10$ and $V = 0{,}5$ l, the maximum depth of sampling is 1,76 m. If the flow depth is greater, sampling should be done with two or more sections in the vertical.



Key

A area of the mouth or tube

v current velocity

v_n velocity in the mouth/intake (nozzle) of the sampler

t maximum duration of sampling

V sample volume to be taken

i uniform rate for sampler movement

h maximum vertical distance for sampling

Figure 1 — Schematic diagram of a suspended-sediment sampler and the factors affecting sample volume

5 Characteristics of suspended-sediment samplers

Since the sampling conditions encountered in streams vary widely, a single sampler for all the conditions cannot be recommended. Factors such as availability, cost and specific requirements of the sampling also influence the choice of the sampler to a great extent. The different types of samplers include open containers, vertical and horizontal cylinders, bottle samplers, pumping samplers, single-stage samplers, point-integrating samplers and depth-integrating samplers. All of these types of samplers can collect a representative sample of the water-sediment mixture in a river or stream under the right conditions, but many of them cannot be used in rivers with swift currents and a non-uniform distribution of sediment concentration. For general use in rivers and streams, point-integrating and depth-integrating samplers are recommended. The use of trade, product or firm names in this document is for descriptive purposes only and does not imply endorsement.

6 Types of samplers

6.1 Open containers

This type of sampler consists of an ordinary pail, can or open bottle. The sample is collected by holding the container under the surface of the water or by lowering it to the water surface with a rope or cable. The filled container can be sealed for transport and subsequent analysis or the sample can be transferred into another container that can be sealed.