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Measurement of water flow in open channels

Part 3.4: Velocity-area methods — Collection and processing of data for determination of uncertainties in measurement (ISO 1088:2007, IDT)



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Preface

This Standard was prepared by the Standards Australia Committee CE-024, Measurement of water flow in open channels and closed conduits, to supersede AS 3778.3.4 — 1990, *Measurement of water flow in open channels Part 3: Velocity-area methods, Method 3.4: Collection and processing of data for determination of errors in measurement*.

The objective of this document is to specify requirements for the collection and processing of data for the determination of the uncertainties in measurements of discharge in open channels by velocity-area methods using current meters.

To determine the discharge in open channels by the velocity-area method, components of the flow (velocity, depth and breadth) need to be measured. The component measurements are combined to compute the total discharge. The total uncertainty in the computed discharge is a combination of the uncertainties in the measured components.

This document is intended to be applied to velocity-area methods that involve measurement of point velocities at a relatively small number of discrete depths and transverse positions in the flow cross-section, as described in ISO 748. It is not intended to be applied to measurements made by Acoustic Doppler Velocity Profilers (ADVP) or other instruments that produce essentially continuous velocity profiles of the flow.

This document is identical with, and has been reproduced from, ISO 1088:2007, *Hydrometry — Velocity-area methods using current-meters — Collection and processing of data for determination of uncertainties in flow measurement*.

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The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

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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 1088 was prepared by Technical Committee ISO/TC 113, *Hydrology*, Subcommittee SC 5, *Instruments, equipment and data management*.

This third edition cancels and replaces the second edition (ISO 1088:1985), which has been revised to incorporate ISO/TR 7178 (based on ISO/DATA No. 2) and edited in accordance with ISO/IEC Guide 98:1995, *Guide to the expression of uncertainty in measurement (GUM)*. This third edition of ISO 1088 also cancels and replaces ISO/TR 7178, all provisions of which have been incorporated into this edition.

Introduction

All measurements of physical quantities are subject to uncertainties, which can be due to biases (systematic errors) introduced in the manufacture, calibration, and maintenance of measurement instruments, or to random scatter caused by a lack of sensitivity of the instruments, and to other sources of error.

During the preparation of the first edition of ISO 748, much discussion was given to the question of the magnitude of errors in measurements, and it was concluded that recommendations could only be formulated on the basis of an analysis of sufficient data. Moreover, it was recognized that to be able to analyze such data statistically, it was essential that the data be collected and recorded on a standardized basis and in a systematic manner, and this recognition led to the preparation of ISO 1088 and ISO/TR 7178.

On the basis of the procedures given in the first editions of ISO 748 (1968) and ISO 1088 (1973), data were subsequently collected and processed from the following rivers (see [Annex A](#) for the characteristics of these rivers) and ISO/TR 7178 was accordingly published:

- a) Rivers Ganga, Jalangi, Yamuna, and Visvesvaraya Canal, in India;
- b) River IJssel, in the Netherlands;
- c) Rivers Derwent, Eden, Lambourne, Ouse, Tyne, and Usk in the United Kingdom;
- d) Rivers Columbia and Mississippi, in the United States.

Further data obtained on the Rivers Ganga and Krishna, in India, and the Spey, Tay, Tweed, Tyne, Gala Water, Yarrow Water, Ettrick Water, and the Clyde, in the United Kingdom, were received later, but could not be included in the processing.

The procedures for estimating the component uncertainties and the uncertainty in discharge in this International Standard conform to the ISO/IEC Guide 98, *Guide to the expression of uncertainty in measurement (GUM)*.

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1 Scope

This International Standard provides a standard basis for the collection and processing of data for the determination of the uncertainties in measurements of discharge in open channels by velocity-area methods using current-meters.

To determine the discharge in open channels by the velocity-area method, components of the flow (velocity, depth and breadth) need to be measured. The component measurements are combined to compute the total discharge. The total uncertainty in the computed discharge is a combination of the uncertainties in the measured components.

[Clause 4](#) of this International Standard deals with the types of errors and uncertainties involved. [Clauses 5](#) and [6](#) present a standard procedure to estimate the component uncertainties by the collection and processing of the necessary data.

This International Standard is intended to be applied to velocity-area methods that involve measurement of point velocities at a relatively small number of discrete depth and transverse positions in the flow cross-section, as described in ISO 748. This International Standard is not intended to be applied to measurements made by Acoustic Doppler Velocity Profiler (ADV) or other instruments that produce essentially continuous velocity profiles of the flow field.

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 amendment) applies.

ISO 748, *Measurement of liquid flow in open channels — Velocity-area methods*

ISO 4363, *Measurement of liquid flow in open channels — Methods for measurement of characteristics of suspended sediment*

ISO 4364, *Measurement of liquid flow in open channels — Bed material sampling*

3 Symbols and abbreviated terms

a	coefficient of linear regression, slope of trend line
b_i	breadth (width) of segment i
a_i	depth at vertical in segment i
L	number of sets of measurements (error type ii)
J	number of measurements per set (error types ii and iii)
k'	time displacement in autocorrelation function (of time interval, etc.)
k	coverage factor for expanded uncertainty (taken as 2, corresponding to a level of confidence of approximately 95 %)