

AS 3778.3.6—1990

ISO 2425: 1974

Australian Standard[®]

**Measurement of water flow in
open channels**

**Part 3: Velocity-area methods
Method 3.6: Measurement of flow
in tidal channels**

This Australian Standard was prepared by Committee CE/24, Measurement of Water Flow in Open Channels and Closed Conduits. It was approved on behalf of the Council of Standards Australia on 9 April 1990 and published on 10 December 1990.

The following interests are represented on Committee CE/24:

Association of Consulting Engineers of Australia
Australian Water and Wastewater Association
Board of Works, Melbourne
Department of Water Resources, NSW
Engineering and Water Supply Department of South Australia
Forestry Commission, NSW
Institute of Instrumentation and Control
Monash University
Public Works Department, NSW
Snowy Mountains Engineering Corporation
University of New South Wales
University of Queensland
Water Authority of Western Australia
Water Board, Sydney
Water Resources Commission, Queensland

Review of Australian Standards. To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

Australian Standard[®]

**Measurement of water flow in
open channels**

**Part 3: Velocity-area methods
Method 3.6. Measurement of flow
in tidal channels**

First published as AS 3778.3.6—1990.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 6300 1

PREFACE

This Standard was prepared by the Standards Australia Committee on Measurement of Water Flow in Open Channels and Closed Conduits. It is identical with and has been reproduced from ISO 2425—1974/Amendment 1—1982, *Measurement of flow in tidal channels*.

This Standard is one of a series which deals with methods of measurement of water flow in open channels. The series when complete will consist of the following parts:

- Part 1: Vocabulary and symbols
- Part 2.1: General—Guidelines for the selection of methods of measurement
- Part 2.2: General—Establishment and operation of a gauging station
- Part 2.3: General—Determination of the stage-discharge relation
- Part 2.4: General—Estimation of uncertainty of a flow-rate measurement
- Part 2.5: General—Guidelines for the selection of flow gauging structures
- Part 3: Velocity-area methods—
 - Method 3.1: Measurement by current meters and floats
 - Method 3.2: Measurement by moving-boat method
 - Method 3.3: Measurement by slope-area method
 - Method 3.4: Collection and processing of data for determination of errors in measurement
 - Method 3.5: Investigation of total error
 - Method 3.6: Measurement of flow in tidal channels (this Standard)
 - Method 3.7: Measurement by ultrasonic (acoustic) method
 - Method 3.8: Electromagnetic method using a full-channel-width coil
- Part 4: Measurement structure methods—
 - Method 4.1: Thin-plate weirs
 - Method 4.2: Rectangular broad-crested weirs
 - Method 4.3: Round-nose horizontal broad-crested weirs
 - Method 4.4: V-shaped broad-crested weirs
 - Method 4.5: Triangular profile weirs
 - Method 4.6: Flat-V weirs
 - Method 4.7: Flumes
 - Method 4.8: Trapezoidal profile weirs for free discharge
 - Method 4.9: End-depth method for estimation of flow in rectangular channels with a free overfall
 - Method 4.10: End-depth method for estimation of flow in non-rectangular channels with a free overfall (approximate method)
- Part 5: Dilution methods—
 - Method 5.1: Constant-rate injection method for the measurement of steady flow
 - Method 5.2: Integration method for the measurement of steady flow
- Part 6.1: Measuring devices, instruments and equipment—Rotating element current-meters
- Part 6.2: Measuring devices, instruments and equipment—Direct depth sounding and suspension equipment
- Part 6.3: Measuring devices, instruments and equipment—Calibration of rotating element current-meters in straight open tanks
- Part 6.4: Measuring devices, instruments and equipment—Echo sounders for water depth measurements
- Part 6.5: Measuring devices, instruments and equipment—Water level measuring devices
- Part 6.6: Measuring devices, instruments and equipment—Cableway system for stream gauging
- Part 6.7: Measuring devices, instruments and equipment—Ultrasonic (acoustic) velocity meters
- Part 6.8: Measuring devices, instruments and equipment—Position fixing equipment for hydrometric boats

For the purposes of this Australian Standard, the ISO text should be modified as follows:

- (a) Wherever the words 'International Standard' appear, referring to this Standard, they should be read as 'Australian Standard'.
- (b) Wherever the word 'fluid' appears, it should be read as 'water'.
- (c) Substitute a point (.) for a comma (,) as a decimal marker.
- (d) The references to other publications should be replaced by references to Australian Standards.

<i>Reference to International Standard</i>	<i>Australian Standard</i>
ISO	AS
	3778 Measurement of water flow in open channels
772 Liquid flow measurement in open channels—Vocabulary and symbols	3778.1 Part 1: Vocabulary and symbols

748	Liquid flow measurement in open channels— Velocity-area methods	3778.3.1 Part 3: Velocity-area methods— Method 3.1: Measurement by current meters and floats
4369	Liquid flow measurement in open channels— The moving-boat method	3778.3.2 Part 3: Velocity-area methods— Method 3.2: Measurement by moving-boat method
6416	Liquid flow measurement in open channels— Measurement of discharge by the ultrasonic (acoustic) method	3778.3.7 Part 3: Velocity-area methods— Method 3.7: Measurement by ultrasonic (acoustic) method

© Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

Measurement of water flow in open channels

Part 3: Velocity-area methods

Method 3.6: Measurement of flow in tidal channels

0 INTRODUCTION

This International Standard provides information about the measurement of liquid flow in tidal channels, which poses problems additional to those encountered in uni-directional streams. Two different methods used generally for measuring tidal flow are covered by this International Standard

- a) direct measurement of flow by the measurement of velocities and cross-sectional areas, and
- b) cubature methods.

For various reasons, direct measurements of velocity in tidal channels are more liable to large errors than are those made under conditions of uni-directional flow.

An important feature of this International Standard is clause 10, dealing with errors in tidal flow measurement, both in the direct measurements (10.1) and in methods of measurement by cubature (10.2).

Annexes are included to illustrate examples and applications of the two basic equations which are to be used with the cubature method.

1 SCOPE AND FIELD OF APPLICATION

This International Standard, which forms a supplement to ISO 748, specifies the methods of measurement of velocities in tidal channels to be applied in order to draw the total discharge curve and to compute the ebb and flood volumes. It also specifies the alternative method of cubature.

2 REFERENCES

ISO 4369, *Liquid flow measurement in open channels — The moving-boat method.*

ISO 6416, *Liquid flow measurement in open channels — Measurement of discharge by the ultrasonic (acoustic) method.*

ISO 1118, *Liquid flow measurement in open channels — Ultrasonic (acoustic) velocity meters.*

3 TERMINOLOGY

For the purposes of this International Standard, in addition to the definitions given in ISO 772, the following definitions shall apply.

3.1 cubature: A numerical technique of computing discharges in a tidal channel at a cross-section from the rates of change in volume of water up to the tidal limit, with algebraic allowance for the fresh water discharges entering the channel.

3.2 density current: The phenomenon of gravity flow of a liquid relative to another liquid, or of relative flow within a liquid medium due to difference in density.

NOTE — The salt-water wedge is a specific case of density current when stratification occurs between identifiable flow masses (see 3.7).

3.3 ebb-tide: The occurrence of falling water surface of a tide.

3.4 ebb-current: The seaward movement of water along a tidal channel.

3.5 flood-tide: The occurrence of rising water surface of a tide.

3.6 flood-current: The landward movement of water along a tidal channel.

3.7 salt-water wedge: The wedge-like intrusion of a large mass of salt water flowing in from the sea under the fresh water in a tidal waterway, where mixing by turbulence is inappreciable.

3.8 estuary: A partially enclosed body of water in the lower reaches of a river which is freely connected with the sea and which may generally receive fresh water supplies from upland drainage areas.

3.9 tide: The periodic rise and fall of the water due principally to the gravitational attraction of the sun and moon.

3.10 tidal channel (tidal waterway): The channel in which the flow is subject to tidal action.

NOTE — A tidal waterway consists of one or more tidal channels together with the shallows and the banks or sides by which the flow at high water is bounded.

3.11 tidal prism: The volume of water that flows into a tidal channel and out again during a complete tide, with the movement of the tide, excluding any upland discharges.