

Australian Standard[®]

**Measurement of water flow in
open channels**

**Part 6.1: Measuring devices,
instruments and equipment—
Rotating element current-meters**

[ISO title: Liquid flow measurement in open channels—Rotating
element current-meters]

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 January 1992 and published on 16 April 1992.

The following interests are represented on Committee CE/24:

The Association of Consulting Engineers of Australia
Australian Water and Wastewater Association
Department of Water Resources, N.S.W.
Engineering and Water Supply Department of South Australia
Forestry Commission, N.S.W.
Institute of Instrumentation and Control
Melbourne Water
Monash University
Snowy Mountains Engineering Corporation
University of New South Wales
University of Queensland
Water Authority of Western Australia
Water Board, Sydney — Illawarra — Blue Mountains
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.

All 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which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.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 6.1: Measuring devices,
instruments and equipment—
Rotating element current-meters**

First published as AS 3778.6.1—1992.

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

ISBN 0 7262 7335 X

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 2537:1988, *Liquid flow measurement in open channels—Rotating element current-meters*. Under arrangements made between Standards Australia and the international Standards bodies, ISO and IEC, as well as certain other Standards organizations, users of this Australian Standard are advised of the following:

- (a) Copyright is vested in Standards Australia.
- (b) The number of this Standard is not reproduced on each page; its identity is shown only on the cover and title pages.
- (c) There may be occasional dual language sections, but English is always one of the languages reproduced.
- (d) Where any cross-references to page numbers appear within the text, these relate to page numbering in the International Standard and are to be disregarded.

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: | <i>Vocabulary and symbols</i> |
| Part 2.1: | <i>General—Guidelines for the selection of methods of measurement</i> |
| Part 2.2: | <i>General—Establishment and operation of a gauging station</i> |
| Part 2.3: | <i>General—Determination of the stage-discharge relation</i> |
| Part 2.4: | <i>General—Estimation of uncertainty of a flow-rate measurement</i> |
| Part 2.5: | <i>General—Guidelines for the selection of flow gauging structures</i> |
| Part 3: | <i>Velocity-area methods</i> |
| Method 3.1: | <i>Measurement by current-meters and floats</i> |
| Method 3.2: | <i>Measurement by moving-boat method</i> |
| Method 3.3: | <i>Measurement by slope-area method</i> |
| Method 3.4: | <i>Collection and processing of data for determination of errors in measurement</i> |
| Method 3.5: | <i>Investigation of total error</i> |
| Method 3.6: | <i>Measurement of flow in tidal channels</i> |
| Method 3.7: | <i>Measurement by ultrasonic (acoustic) method</i> |
| Method 3.8: | <i>Electromagnetic method using a full-channel-width coil</i> |
| Part 4: | <i>Measurement using flow gauging structures</i> |
| Method 4.1: | <i>Thin-plate weirs</i> |
| Method 4.2: | <i>Rectangular broad-crested weirs</i> |
| Method 4.3: | <i>Round-nose horizontal broad-crested weirs</i> |
| Method 4.4: | <i>V-shaped broad-crested weirs</i> |
| Method 4.5: | <i>Triangular profile weirs</i> |
| Method 4.6: | <i>Flat-V weirs</i> |
| Method 4.7: | <i>Rectangular, trapezoidal and U-shaped flumes</i> |
| Method 4.8: | <i>Trapezoidal profile weirs</i> |
| Method 4.9: | <i>Parshall and Saniiri flumes</i> |
| Method 4.10: | <i>End-depth method for estimation of flow in rectangular channels with a free overfall</i> |
| Method 4.11: | <i>End-depth method for estimation of flow in non-rectangular channels with a free overfall (approximate method)</i> |
| Part 5: | <i>Dilution methods</i> |
| Method 5.1: | <i>Constant-rate injection method for the measurement of steady flow</i> |
| Method 5.2: | <i>Integration method for the measurement of steady flow</i> |
| Part 6: | <i>Measuring devices</i> |
| Part 6.1: | <i>Measuring devices, instruments and equipment—Rotating element current-meters (this Standard)</i> |
| Part 6.2: | <i>Measuring devices, instruments and equipment—Direct depth sounding and suspension equipment</i> |
| Part 6.3: | <i>Measuring devices, instruments and equipment—Calibration of rotating element current-meters in straight open tanks</i> |
| Part 6.4: | <i>Measuring devices, instruments and equipment—Echo sounders for water depth measurements</i> |
| Part 6.5: | <i>Measuring devices, instruments and equipment—Water level measuring devices</i> |
| Part 6.6: | <i>Measuring devices, instruments and equipment—Cableway system for stream gauging</i> |
| Part 6.7: | <i>Measuring devices, instruments and equipment—Ultrasonic (acoustic) velocity meters</i> |
| Part 6.8: | <i>Measuring devices, instruments and equipment—Position fixing equipment for hydrometric boats</i> |

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

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

<i>Reference to International Standard or other Publication</i>	<i>Australian Standard</i>
ISO	AS
	3778 Measurement of water flow in open channels
748 Liquid flow measurement in open channels—Velocity area method	3778.3.1 Method 3.1: Velocity-area methods—Measurement by current-meters and floats
772 Liquid flow measurement in open channels—Vocabulary and symbols	3778.1 Part 1: Vocabulary and symbols
3454 Liquid flow measurement in open channels—Direct depth sounding and suspension equipment	3778.6.2 Part 6.2: Measuring devices, instruments, and equipment—Direct depth sounding and suspension equipment
3455 Liquid flow measurement in open channels—Calibration of rotating-element current-meters in straight open tanks	3778.6.3 Part 6.3: Measuring devices, instruments, and equipment—Calibration of rotating element current-meters in straight open tanks

CONTENTS

	<i>Page</i>
1 SCOPE AND FIELD OF APPLICATION	4
2 REFERENCES	4
3 DEFINITIONS	4
4 PRINCIPLE OF OPERATION	4
5 OPERATIONAL REQUIREMENTS	4
6 CONSTRUCTION FEATURES	5
7 CALIBRATION	6
8 MAINTENANCE	7
9 OPERATIONAL AND SERVICING MANUAL	8

© 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 6.1:

Measuring devices, instruments and equipment— Rotating element current-meters

1 Scope and field of application

This International Standard specifies the operational requirements, construction, calibration, and maintenance of rotating element devices for the measurement of flow velocities in open channels. This International Standard does not define the form of the signal produced by the equipment or the signal receiving equipment.

For the use of these devices, refer to ISO 748.

2 References

ISO 748, *Liquid flow measurement in open channels — Velocity-area method.*

ISO 772, *Liquid flow measurement in open channels — Vocabulary and symbols.*

ISO 3454, *Liquid flow measurement in open channels — Direct depth sounding and suspension equipment.*

ISO 3455, *Liquid flow measurement in open channels — Calibration of rotating-element current-meters in straight open tanks.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 772 apply.

4 Principle of operation

4.1 Proportionality

The rotating element of a current-meter is driven by the fluid to an angular velocity which is proportional to the local velocity of the fluid at the point of immersion when that velocity exceeds a critical value.

4.2 Positioning

The axis of the rotating element may be at right angles or it may be parallel to the direction of flow.

4.3 Types of current-meter

4.3.1 Cup-type current-meters

Cups or curved vanes attached at equal intervals around the perimeter of a hub comprise an assembly which will rotate when placed in a fluid flow. It is usual to mount the rotor with the axis vertical.

4.3.2 Propeller-type current meters

An assembly consisting of a number of straight, angled vanes attached at equal intervals around the perimeter of a hub, or of two or more helical screw blades formed around a hub that will rotate about a horizontal axis when placed in a fluid flow.

4.4 Flow velocity

The velocity of the fluid is determined by counting the number of revolutions of the rotor during a specified time interval or by observing the time required by the rotor to turn a given number of revolutions and consulting the meter calibration table or rating equation. The velocity of fluid movement may be determined from the sensing of signals emitted (such as electrical pulses) through the rotation of the rotor. The velocity may be determined from a direct reading of the speed of rotation of the rotating element by means of equipment designed for this purpose.

5 Operational requirements

5.1 Positioning

The equipment should maintain alignment with the flow in such a way that the rotating element responds to flow movement as intended. If a pivoted suspension is incorporated within the current-meter, it should permit freedom in the vertical plane to ensure correct alignment with the liquid flow. Alignment in the horizontal plane may be affected by the correct choice of suspension equipment (see ISO 3454).

Current-meters of conventional construction are intended to operate in a horizontal or near-horizontal position. Current-meters designed to operate in other positions are not covered by this International Standard.