AS 3778.3.7—2001
ISO 6416:1992



Australian Standard™

# Measurement of water flow in open channels

## Part 3.7: Velocity-area methods—Measurement by ultrasonic (acoustic) method

[ISO title: Measurement of liquid flow in open channels—Measurement of discharge by the ultrasonic (acoustic) method]

Standards Australia

This Australian Standard was prepared by Committee CE-024, Measurement of Water Flow in Open Channels and Closed Conduits. It was approved on behalf of the Council of Standards Australia on 25 September 2000 and published on 12 March 2001.

---

The following interests are represented on Committee CE-024:

Australian Water and Wastewater Association

Department of Natural Resources, Qld

Institute of Instrumentation and Control Australia

Department of Land and Water Conservation, New South Wales

Department of Public Works and Services, New South Wales

South Australian Water Corporation

Sydney Water Corporation

University of New South Wales

University of Adelaide

University of Technology, Sydney

---

**Keeping Standards up-to-date**

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Australia web site at www.standards.com.au and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Australian Standard*, has a full listing of revisions and amendments published each month.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at mail@standards.com.au, or write to the Chief Executive, Standards Australia International Ltd, GPO Box 5420, Sydney, NSW 2001.

---

*This Standard was issued in draft form for comment as DR 99553.*

Australian Standard™

# Measurement of water flow in open channels

# Part 3.7: Velocity-area methods—Measurement by ultrasonic (acoustic) method

Originated as AS 3778.3.7—1990.
Second edition 2001.



Published by Standards Australia International Ltd
GPO Box 5420, Sydney, NSW 2001, Australia

ISBN 0 7337 3651 3

# PREFACE

This Standard was prepared by the Standards Australia Committee CE-024, Measurement of Water Flow in Open Channels and Closed Conduits.

This Standard is identical to and is reproduced from ISO 6416:1992, *Measurement of liquid flow in open channels—Measurement of discharge by the ultrasonic (acoustic) method.*

This Standard is Part 3.7 of AS 3778, *Measurement of water flow in open channels*, which is published in parts as follows:

| AS | | |
|---|---|---|
| 3778 | | Measurement of water flow in open channels |
| 3778.1 | Part 1: | Vocabulary and symbols |
| 3778.2 | Part 2: | General |
| 3778.2.1 | Part 2.1: | Guidelines for the selection of methods of measurement |
| 3778.2.2 | Part 2.2: | Establishment and operation of a gauging station |
| 3778.2.3 | Part 2.3: | Determination of the stage-discharge relation |
| 3778.2.4 | Part 2.4: | Estimation of uncertainty of a flow-rate measurement |
| 3778.2.5 | Part 2.5: | Guidelines for the selection of flow gauging structures |
| 3778.3 | Part 3: | Velocity-area method |
| 3778.3.1 | Part 3.1: | Measurement by current meters and floats |
| 3778.3.2 | Part 3.2: | Measurement by moving boat method |
| 3778.3.3 | Part 3.3: | Measurement by slope-area method |
| 3778.3.4 | Part 3.4: | Collection and processing of data for determination of errors in measurement |
| 3778.3.5 | Part 3.5: | Investigation of total error |
| 3778.3.6 | Part 3.6: | Measurement of flow in tidal channels |
| 3778.3.7 | Part 3.7: | Measurement by ultrasonic (acoustic) method (this Standard) |
| 3778.3.8 | Part 3.8: | Electromagnetic method using a full-channel-width coil |
| 3778.4 | Part 4: | Measurement using flow gauging structures |
| 3778.4.1 | Part 4.1: | Thin-plate weirs |
| 3778.4.2 | Part 4.2: | Rectangular broad-crested weirs |
| 3778.4.3 | Part 4.3: | Round-nose horizontal broad-crested weirs` |
| 3778.4.4 | Part 4.4: | V-shaped broad-crested weirs |
| 3778.4.5 | Part 4.5: | Triangular profile weirs |
| 3778.4.6 | Part 4.6: | Flat-V weirs |
| 3778.4.7 | Part 4.7: | Rectangular, trapezoidal and U-shaped flumes |
| 3778.4.8 | Part 4.8: | Trapezoidal profile weirs |
| 3778.4.9 | Part 4.9: | Parshall and Saniiri flumes |
| 3778.4.10 | Part 4.10: | End-depth method for estimation of flow in rectangular channels with a free overfall |
| 3778.4.11 | Part 4.11: | End-depth method for estimation of flow in rectangular channels with a free overfall (approximate method) |
| 3778.5 | Part 5: | Dilution method |
| 3778.5.1 | Part 5.1: | Constant-rate injection method for the measurement of steady flow |
| 3778.5.2 | Part 5.2: | Integration method for the measurement of steady flow |
| 3778.6 | Part 6: | Measuring devices, instruments and equipment |
| 3778.6.1 | Part 6.1: | Rotating element current-meters |
| 3778.6.2 | Part 6.2: | Direct depth sounding and suspension equipment |
| 3778.6.3 | Part 6.3: | Calibration of rotating element current meters in straight open tanks |
| 3778.6.4 | Part 6.4: | Echo sounders for water depth measurements |
| 3778.6.5 | Part 6.5: | Water level measuring devices |
| 3778.6.6 | Part 6.6: | Cableway system for stream gauging |
| 3778.6.7 | Part 6.7: | Ultrasonic (acoustic) velocity meters |
| 3778.6.8 | Part 6.8: | Position fixing equipment for hydrometric boats |

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) In the source text ‘this International Standard’ should read ‘this Australian Standard’.

(d) A full point should be substituted for a comma when referring to a decimal marker.

(e) French text on figures should be ignored.

References to International Standards should be replaced by references to equivalent Australian Standards, as follows:

| *Reference to International Standard* | | *Australian Standard* | |
|---|---|---|---|
| ISO | | AS | |
| 772 | Liquid flow measurement in open channels—Vocabulary and symbols | 3778 | Measurement of water flow in open channels |
| | | 3778.1 | Part 1: Vocabulary and symbols |
| 1100 | Liquid flow measurement in open channels— | 3778.2.3 | Part 2.3: General—Determination of the stage-discharge relation |
| 1100.2 | Part 2: Determination of the stage-discharge relation | | |
| 5168 | Measurement of fluid flow — Estimation of uncertainty of a flow-rate measurement | 3778.2.4 | Part 2.4: General — Estimation of uncertainty of a flow-rate measurement |
| 748 | Liquid flow measurement in open channels — Velocity area methods | 3778.3.1 | Part 3.1: Velocity-area methods — Measurement by current-meters and floats |

# CONTENTS

AUSTRALIAN STANDARD

# Measurement of water flow in open channels

## Part 3.7:
## Velocity-area methods—Measurement by ultrasonic (acoustic) method

## Section 1: General

### 1.1 Scope

This International Standard describes the establishment and operation of an ultrasonic (acoustic) gauging station for the measurement of discharge in a river, an open channel, or a closed conduit with a free water surface. It also describes the basic principles on which the method is based, and the operation and performance of associated instrumentation. It is limited to the "time of travel of acoustic pulses" technique, and does not apply to systems that make use of the "Doppler shift" or "correlation" or "level-to-flow" techniques.

### 1.2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 748:1979, *Liquid flow measurement in open channels — Velocity-area methods.*

ISO 772:1988, *Liquid flow measurement in open channels — Vocabulary and symbols.*

ISO 1100-2:1982, *Liquid flow measurement in open channels — Part 2: Determination of the stage-discharge relation.*

ISO 4373:1979, *Measurement of liquid flow in open channels — Water level measuring devices.*

ISO 5168:1978, *Measurement of fluid flow — Estimation of uncertainty of a flow-rate measurement.*

### 1.3 Definitions

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

### 1.4 Units of measurement

The International System of Units (SI) is used in this International Standard.