

Australian Standard<sup>®</sup>

## Meters for non-urban water supply

### Part 2: Technical requirements for closed conduit meters fully charged



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 9 January 2013.  
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The following are represented on Committee CE-024:

- Australian Industry Group
  - Australian Water Association
  - Department of Environment and Resource Management, Qld
  - Institute of Instrumentation, Control and Automation Australia
  - Irrigation Australia
  - National Farmers Federation
  - National Irrigators Council
  - National Measurement Institute
  - University of South Australia
  - Water Services Association of Australia
- 

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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## Meters for non-urban water supply

### Part 2: Technical requirements for closed conduit meters fully charged

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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 ATS 4747.2—2008, *Meters for non-urban water supply, Part 2: Specification for closed conduit meters fully charged*.

The objective of the 4747 series of Standards is to provide requirements for the installation and commissioning of irrigation and non-urban water meters to meet the requirements of the National Water Initiative, Clause 88.

It should be noted that NMI M 10-1, *Meters Intended for the Metering of Non-urban Water in Full Flowing Pipes, Part 1: Metrological and Technical Requirements*, specifies the metrological and technical requirements for pattern approval and verification of water meters to comply with the National Measurement Regulation.

This Standard includes essential requirements that are up to date with technology in the water meter industry.

This document is part of a series of Standards covering the metering of non-urban water supply, as follows:

## AS

- 4747 Meters for non-urban water supply
- 4747.1 Part 1: Glossary of terms
- 4747.2 Part 2: Technical requirements for closed conduit meters fully charged (this Standard)
- 4747.3 Part 3: Technical requirements for open channel meters
- 4747.5 Part 5: Installation and commissioning of closed conduit meters fully charged
- 4747.6 Part 6: Installation and commissioning of open channel meters
- 4747.8 Part 8: In-service compliance for non-urban water meters

The above documents were originally released as Australian Technical Specifications for a period of over two years. Following review and consideration of industry feedback, they have been revised and released as Standards.

Significant changes to the series include the following:

- (a) The method of handling meters that are beyond the limit of what can be practicably pattern-approved has been revised, which applies to AS 4747.2 and AS 4747.3.
- (b) Overlap with the National Measurement Institute (NMI) documents has also been removed, and the NMI documents are to be read in conjunction with the above Standards.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the Appendix to which they apply. A 'normative' Appendix is an integral part of a Standard. An 'informative' Appendix is for information and guidance only.

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## STANDARDS AUSTRALIA

**Australian Standard**  
**Meters for non-urban water supply**

**Part 2: Technical requirements for closed conduit meters fully charged**

SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE**

This Standard sets out requirements for water meters for use in non-urban applications. It primarily covers metering for irrigation water; however, it is intended that it be used for non-urban water applications other than applications covered by AS 3565.1.

Two types of meters are covered in this Standard, as follows:

- (a) A ‘self-contained unit’—a meter that defines its own geometry, is able to be pattern-approved as a complete water meter, calibrated upon assembly and supplied by a single supplier.
- (b) A ‘modular metering system’—a device or group of instruments (which may be supplied as a pattern-approved metering system,) that does not define the installation geometry and requires configuration after installation.

## NOTES:

- 1 The requirements for these types of meters to demonstrate compliance with this Standard, and hence with the National Framework are described in Section 4 and illustrated in Figure 4.1.
- 2 Purchasing guidelines are given in Appendix A.

This Standard applies to meters that are—

- (i) self-contained or modular and capable of continuously determining, within the accuracy limits, the volume of water that has flowed through them; and
- (ii) continuously updating the volume on a cumulative basis.

NOTE: In this Standard a meter installation is considered to include—

- (a) the meter, its indicating device and all ancillary equipment; and
- (b) the upstream and downstream pipe or emplacement that may have a material effect on the meter unit.

This Standard applies to meters that operate under the following conditions:

- (A) Closed conduit under full flow.
- (B) Pressure ranges minimum 0.03 MPa to a value specified by the manufacturer. As a minimum, insertion or clamp-on meters will need to have the same working pressure range as the pipes they are designed to operate in.
- (C) Working water temperature range of 0.1°C to 30°C. The maximum admissible temperature is 50°C, which is the limiting condition for the meter.
- (D) Ambient air temperature range of –5°C to 55°C.
- (E) Ambient humidity range of 0% to 100% except for remote indicating devices where the range is 0% to 93%.

## 1.2 APPLICATION

This Standard is intended to be used to meet the Australian National Water Initiative for metering non-urban water.

Where applicable, non-urban water meters may be required to be pattern-approved under National Measurement Regulations. Pattern approval requirements principally cover the metrological requirements of NMI M 10-1.

Meters up to  $Q_3 = 16$  kL/h shall be in accordance with AS 3565.1 and NMI R 49-1.

Demonstration of compliance with this Standard shall be in accordance with Appendix B.

Meters that are capable of being pattern-approved shall comply with this Standard in its entirety.

NOTE: Meters that are not capable of being pattern-approved should comply with the scope, materials, design and product documentation sections of this Standard.

## 1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

### AS

- |        |                                                                                                                    |
|--------|--------------------------------------------------------------------------------------------------------------------|
| 1565   | Copper and copper alloys—Ingots and castings                                                                       |
| 1722   | Pipe threads of Whitworth form                                                                                     |
| 1722.2 | Part 2: Fastening pipe threads                                                                                     |
| 2129   | Flanges for pipes, valves and fittings                                                                             |
| 2345   | Dezincification resistance of copper alloys                                                                        |
| 2738   | Copper and copper alloys—Compositions and designations of refinery products, wrought products, ingots and castings |
| 3558   | Methods of testing plastics and composite materials sanitary plumbing fixtures                                     |
| 3558.5 | Part 5: Determination of degradation by ultraviolet light                                                          |
| 3565   | Meters for water supply                                                                                            |
| 3565.1 | Part 1: Cold water meters                                                                                          |
| 3778   | Measurement of water flow in open channels                                                                         |
| 3778.1 | Part 1: Hydrometric determinations—Vocabulary and symbols                                                          |
| 4087   | Metallic flanges for waterworks purposes                                                                           |
| 4747   | Meters for non-urban water supply                                                                                  |
| 4747.1 | Part 1: Glossary of terms                                                                                          |

### AS/NZS

- |      |                                                          |
|------|----------------------------------------------------------|
| 1567 | Copper and copper alloys—Wrought rods, bars and sections |
|------|----------------------------------------------------------|

### ASTM

- |      |                                                                                                                            |
|------|----------------------------------------------------------------------------------------------------------------------------|
| A276 | Standard Specification for Stainless Steel Bars and Shapes                                                                 |
| A480 | Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip |
| A743 | Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application     |

### ISO/IEC

- |                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| Guide 98           | Uncertainty of measurement                                       |
| Guide 98-3 Part 3: | Guide to the expression of uncertainty in measurement (GUM:1995) |

## OIML

International Vocabulary of Terms in Legal Metrology (VIML)

International Vocabulary of Metrology—Basic and General Concepts and Associated Terms (VIM)

NMI National Measurement Institute

M 10 Meters Intended for the Metering of Non-urban Water in Full Flowing Pipes

M 10-1 Part 1: Metrological and Technical Requirements

M 10-2 Part 2: Test Methods

R49 Water Meters Intended for the Metering of Cold Potable Water and Hot Water

R 49-1 Part 1: Metrological and Technical Requirements

**1.4 DEFINITIONS**

For the purposes of this Standard, the definitions in the *International Vocabulary of Metrology—Basic and General Concepts and Associated Terms* (VIM), the *International Vocabulary of Terms in Legal Metrology* (VIML), AS 3778.1 and AS 4747.1 apply.

**1.5 PREFERRED UNITS**

‘Megalitres’ (ML) or kilolitres (kL) are the preferred units of volume; however, ‘cubic metres’ (m<sup>3</sup>) is an acceptable alternative to the latter.

Where megalitres (ML), kilolitres (kL) or cubic metres (m<sup>3</sup>) are specified in this Standard, the alternatives are acceptable.

Megalitres per day (ML/d) or litres per second (L/s) are the preferred units for flow rate.

## SECTION 2 MATERIALS

### 2.1 GENERAL

Materials used in the manufacture of meters shall comply with the relevant Standards and shall have the following characteristics:

- (a) Metals shall be resistant to internal and external corrosion.
- (b) External plastics components shall comply with Clause 2.3.

### 2.2 RESISTANCE TO CORROSION

#### 2.2.1 General

Construction materials shall be selected to provide consistent operation for the life of the meter in the operating conditions.

Metal components, which are in contact with either the metered water or buried in the surrounding ground and groundwater, shall be of corrosion-resistant material or rendered resistant by suitable coating or other surface treatment.

NOTE: Non-metallic materials in contact with the metered water should resist chemical or physical degradation by the dissolved compounds and suspended matter commonly found in the metered water.

#### 2.2.2 Corrosion-resistant materials

For the purposes of this Standard, for most water chemistries, the following materials are deemed to be corrosion resistant:

- (a) Copper alloys complying with AS 1565, AS/NZS 1567 or AS 2345.
- (b) Austenitic stainless steel complying with ASTM A276 (grades to be suitable for the application).
- (c) Stainless steel complying with ASTM A480 or ASTM A743.
- (d) Phosphor bronze complying with AS 2738 alloy 518.
- (e) Copper nickel alloy complying with AS 2738 alloy 706 or alloy 715.
- (f) Aluminium grades 5083-H321, 5052-H34, 6351 T5, 6352 T5, 6353 T5, 6354 T5, 6355 T5, 6063 T6.

#### NOTES:

- 1 Where there is a history of corrosion, the type and material composition of the meter should be considered when choosing a meter.
- 2 Other materials may be considered, based on demonstrated corrosion-resistance data.
- 3 Combinations of the above may breach the resistance to corrosion requirement.
- 4 High solute or aggressive waters may require site-specific design beyond the scope of this Standard.

### 2.3 MATERIAL DURABILITY TESTS

#### 2.3.1 Ultraviolet exposure test

Plastics components of meters exposed to sunlight shall be exposed to the ultraviolet light exposure test specified in AS 3558.5, using ultraviolet sunlamps f/28, 220–240 V, 300 ±50 W, or equivalent.

The components shall be exposed for 8 cycles of 16 h on, 8 h off as well as for 48 h continuous, after which there shall be no observed cracking, crazing or other failures.

#### 2.3.2 Polymer-bodied meter durability test

Where requested by the purchaser, polymer-bodied meters shall be tested in accordance with Appendix F for material durability.

## SECTION 3 DESIGN

### 3.1 DIMENSIONS AND CONNECTIONS

#### 3.1.1 Dimensions

NOTE: The preferred dimensions (based on ISO 4064-1) are given in Appendix C.

#### 3.1.2 Threaded end connections

Threaded end connections shall comply with AS 1722.2.

#### 3.1.3 Flanged end connections

Flanged end connections shall comply with AS 4087 (preferred) or AS 2129 for the maximum pressure corresponding to that of the water meter.

The manufacturer shall provide a reasonable clearance behind the rear face of the flange to allow access for installation and removal.

#### 3.1.4 Other end connections

Other end connections shall comply with the relevant pipe Standard.

#### 3.1.5 Other connections

Other connections shall be in accordance with the manufacturer's specifications.

### 3.2 OUTPUT

#### 3.2.1 General

Meters shall include output signals capable of interfacing with equipment connected for the purposes of data recording and/or data transmission. The form of each output and its operation will depend on the power available at the meter as well as the requirements of the connected equipment.

The selection of outputs may be determined by many factors, including rate of information exchange, available power, form of communication (whether radio or telecom), ability or requirement to connect many meters to the same link, etc.

The output types specified in Clauses 3.2.2 to 3.2.4 are acceptable as specified. The full scale setting of flow rate outputs shall be marked in the installation documentation.

NOTE: Care should be taken to ensure that connected equipment is calibrated to the same range.

#### 3.2.2 Flow rate

##### 3.2.2.1 Mechanical meter

A mechanical meter output is an inductive or optical sensor activated at high speed (e.g., 0–500 Hz) by a rotating part to indicate when each unit of known volume has passed through the meter. The output shall be treated as a frequency signal proportional to flow. The maximum frequency ( $F_{\max}$ ) shall correspond to not less than the operating range of the meter. Power for the sensor is provided by the interrogation voltage of the connected equipment. The frequency/flow ratio setting shall be marked on the meter plate.

### 3.2.2.2 *Electronic meter with mains power*

Mains power flow meters may have analogue outputs where current or voltage is proportional to flow rate. Such outputs are not normally possible with battery-powered devices operating in stand-alone fashion. The output signal from an electronic meter with mains power may be one of the following:

- (a) *4–20 mA continuous signal proportional to flow* The current signal may be either active (sourced from the flow meter) or passive (sourced from the connected equipment and controlled by the flow meter output). Installation instructions shall clearly describe the form of 4–20 mA output to avoid loop power conflicts. The signal shall be calibrated such that 4 mA represents zero flow, and 20 mA represents the operating range of the meter.
- (b) *0–1, 0–5 or 0–10 V d.c. continuous signal proportional to flow* The signal shall be calibrated such that the 0 V d.c. represents zero flow, while the maximum voltage represents the operating range of the meter. Other maximum voltages may be calibrated in order to align with connected (especially low voltage) equipment. The volt/flow ratio shall be marked on the site installation plate.

### 3.2.2.3 *Electronic meter with low-power supply*

Electronic meters with low-power supply may be one of the following:

- (a) *0–0.5, 0–1 or 0–2.5 V d.c. (i.e., very low) continuous signal proportional to flow* The signal shall be calibrated such that 0 V d.c. represents zero flow, while the maximum represented voltage shall correspond to not less than the operating range of the meter. Other maximum voltages may be calibrated in order to align with connected equipment. The volt/flow ratio shall be marked on the site installation plate.
- (b) *Transistor switched frequency signal continuously proportional to flow* The maximum frequency ( $F_{\max}$ ) shall equate with the operating range of the meter. Power for output shall be provided by the interrogation voltage of the connected equipment. The mark/space ratio of pulse duration versus off time shall be not more than 0.5, to prevent overlap. The preferred mark/space ratio is 0.5 for all frequencies. The frequency/flow ratio setting shall be marked on the site installation plate.

## 3.2.3 Flow volume

### 3.2.3.1 *Mechanical meter*

The mechanical meter output may include a reed switch or inductive device operated by a rotating part to indicate when each unit of known volume has passed through the meter. The volume unit per pulse shall be marked on the meter plate.

### 3.2.3.2 *Electronic meter with mains power*

An electronic meter with mains power shall include transistor or relay-switched pulse signal for each unit of volume. The value of the volume unit, expressed in megalitres (cubic metres or kilolitres), shall be in the form  $1 \times 10^n$ , or  $2 \times 10^n$ , or  $5 \times 10^n$ , where 'n' is a positive or negative whole number, or zero. The volume unit per pulse shall be marked on the site installation plate. The direction of the volume output shall be primarily forward (supply) flow. If another output is available, it may be used to signal flow direction or reverse flow volume. Reverse flow shall not cause the forward output to count. The volume unit per pulse shall be marked on the site installation plate.

### 3.2.3.3 *Electronic meter with low-power supply*

An electronic meter with low-power supply shall include transistor-switched pulse signal for each unit of volume. The value of the volume unit, expressed in megalitres (cubic metres or kilolitres), shall be in the form  $1 \times 10^n$ , or  $2 \times 10^n$ , or  $5 \times 10^n$ , where 'n' is a positive or negative whole number, or zero. The volume unit per pulse shall be marked on the site installation plate.

The direction of the volume output shall be primarily forward (supply) flow. If another output is available, it may be used to signal flow direction or reverse flow volume. Reverse flow shall not cause the forward output to count. The volume unit shall be selected so that the pulse frequency and, therefore, meter power consumption will not adversely affect power supply continuity.

### 3.2.4 **Data output**

Data output, such as that by serial communication, will allow a significant amount of information to be exchanged between the flow meter and the connected equipment. The information may include set and operating parameters, as follows:

- (a) *Meter identification* Product identity code or reference and meter size, serial number (of both sensor and signal converter), meter tag or location identity, site reference and  $Q_3$  rating.
- (b) *Meter construction* Geometry parameters, materials in contact with the water, installed cable length, etc.
- (c) *Meter set-up* Details including factors required for flow calculation, adjustments specific to the installation, flow rate and volume output settings, network address if the serial communication is shared among many meters.
- (d) *Meter operational status* Flow rate, accumulated volume, errors, alerts, checksum and other operation integrity details, measuring condition status, battery or supply voltage values, other metering information such as water conductivity or sound speed.

Selection of the parameters to be transferred at each interrogation depends on the installation and communication requirements. As a minimum, where data output by serial communication is employed, the following parameters shall be transferred for data storage or transmission at the nominated intervals:

- (i) Frequently for instantaneous readings:
  - (A) Meter tag.
  - (B) Forward flow rate or signed flow rate.
  - (C) Forward flow volume.
  - (D) Meter status (error code, etc.).
- (ii) Daily for monitoring meter status (or other regular period to suit the information requirements):
  - (A) Meter tag.
  - (B) Forward flow volume.
  - (C) Reverse flow volume.
  - (D) Meter status.
  - (E) Meter status changes since last transmission.

(iii) On request for auditing purposes:

- (A) Meter tag.
- (B) Product identification including serial numbers.
- (C) Geometry or other factors specific to the meter.
- (D) Flow rate, volume, pulse output settings as applicable.
- (E) Calibration details (for comparison with existing data).
- (F) Battery or power supply condition.
- (G) Operating parameters, such as speed of sound in the water, as applicable.

NOTE: Clause 3.2.4 refers variously to meter or site installation plates. This is valid since the settings for interfacing to connected equipment are site dependent, whereas, for instance, the volume per pulse output from a mechanical meter is meter dependent.

### 3.3 ELECTRONIC STORAGE

Data shall not be lost if the battery fails.

Data shall be backed up to a non-volatile device at least every hour.

### 3.4 FREQUENCY OF MEASUREMENT

The period between measurements shall be no greater than 5 min, totalized continuously.

The period shall be able to be adjusted to a lesser period.