AS 2360.6.2—1993
ISO 8316:1987

Australian Standard®

Measurement of fluid flow in closed conduits

Part 6.2: Volumetric methods—By volume

[ISO title: Measurement of liquid flow in closed conduits—Method by collection of the liquid in a volumetric tank]

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Association of Consulting Engineers of Australia

Department of Water Resources, New South Wales

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Forestry Commission of New South Wales

Institute of Instrumentation and Control, Australia

Melbourne Water

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University of Queensland

Water Authority of Western Australia

Water Board, Sydney— Illawarra—Blue Mountains

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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 8316:1987, *Measurement of liquid flow in closed conduits—Method by collection of the liquid in a volumetric tank*.

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This Standard is one of a series, to be published progressively, which deals with methods of measurement of fluid flow in closed conduits. The following Parts were published concurrently with this Part:

AS		
2360	Measurement of fluid flow in closed circuits	
2360.0	Part 0:	Vocabulary and symbols
2360.1.1	Part 1.1:	Pressure differential methods—Measurement using orifice plates, nozzles or Venturi tubes—Conduits with diameters from 50 mm to 1200 mm
2360.1.2	Part 1.2:	Pressure differential methods—Measurement using orifice plates or nozzles—Conduits with diameters less than 50 mm
2360.1.3	Part 1.3:	Pressure differential methods—Measurement using orifice plates, nozzles or Venturi tubes—Guide to the use of methods specified in Parts 1.1 and 1.2
2360.1.4	Part 1.4:	Pressure differential methods—Measurement using orifice plates, nozzles or Venturi tubes—Guide to the effect of departure from the conditions specified in Part 1.1
2360.1.5	Part 1.5:	Pressure differential methods—Measurement using orifice plates, nozzles or Venturi tubes—Pulsating flow, in particular sinusoidal or square wave intermittent periodic-type fluctuations
2360.6.1	Part 6.1:	Volumetric methods—By mass
2360.6.2	Part 6.2:	Volumetric methods—By volume (*this Standard*)
2360.7.1	Part 7.1:	Assessment of uncertainty in the calibration and use of flow measurement devices—Linear calibration relationships
2360.7.2	Part 7.2:	Assessment of uncertainty in the calibration and use of flow measurement devices—Non-linear calibration relationships

At the date of publication of this Part the following Parts, with the numbers of the parent international Standards in parenthesis, had not been published:

Pressure differential methods—Measurement using orifice plates, nozzles or Venturi tubes—Connections for pressure signal transmissions between primary and secondary elements (ISO 2186)

Pitot static tube methods—Measurement of velocity at a point of the cross-section of a conduit (ISO 7145)

Pitot static tube methods—Measurement using Pitot-static tubes (ISO 3966)

Pitot static tube methods—Measurement in swirling or asymmetric flow conditions using ISO 3966 or ISO 3354 (ISO 7194)

Current meters method—Measurement of clean water in full conduits and under regular flow conditions using current meters (ISO 3354)

Non-radioactive tracer methods—Review of alternative methods (ISO 2975.1)

Non-radioactive tracer methods—Measurement using constant rate injection (ISO 2975.2)

Non-radioactive tracer methods—Measurement using transit time (ISO 2975.6)

Weighing methods—Verification of static type (ISO 9368.1)

Weighing methods—Verification of dynamic type (ISO 9368.2, not published)

When published, the details for the above unpublished Australian Standards will be listed in the Catalogue of Australian Standards and Other Products.

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) Substitute a full stop (.) for a comma (,) as a decimal marker.

(iii) The references to other publications should be replaced by references to Australian Standards as follows:

Reference to International Standard		*Australian Standard*	
ISO		AS	
4006	Measurement of fluid flow in closed conduits—Vocabulary and symbols	2360	Measurement of fluid flow in closed conduits
		2360.0	Part 0: Vocabulary and symbols
4185	Measurement of liquid flow in closed conduits—Weighting method	2360.6.1	Part 6.1: Volumetric methods—By mass
4373	Measurement of liquid flow in open channels—Water level measuring devices	3778	Measurement of water flow in open channels
		3778.6.5	Part 6.5: Measuring devices, instruments and equipment—Water level measuring devices
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

CONTENTS

Measurement of fluid flow in closed conduits

Part 6.2:
Volumetric methods—By volume

1 Scope and field of application

This International Standard specifies methods for the measurement of liquid flow in closed conduits by determining the volume of liquid collected in a volumetric tank in a known time interval. It deals in particular with the measuring apparatus, the procedure, the method for calculating the flow-rate and the assessment of uncertainties associated with the measurements.

The method described may be applied to any liquid provided that

a) its vapour pressure is sufficiently low to ensure that any escape of liquid by vaporization from the volumetric tank does not affect the required measurement accuracy;

b) its viscosity is sufficiently low so as not to alter or delay unduly the measurement of the level in the volumetric tank;

c) it is non-toxic and non-corrosive.

Theoretically, there is no limit to the application of this method, but, for practical reasons, this method of measurement is normally used for flow-rates less than approximately 1,5 m^3/s and is used on the whole in fixed laboratory installations only. However, there is a variation of this method which uses a natural or artificial storage pond as a volumetric tank, but this application is not dealt with in this International Standard.

Owing to its high potential accuracy, this method is often used as a primary method for calibrating other methods or devices for volume flow-rate measurement or for mass flow-rate measurement; for the latter method or device, it is necessary to know the density of the liquid accurately.

If the installation for flow-rate measurement by the volumetric method is used for purposes of legal metrology, it shall be certified and registered by the national metrology service. Such installations are then subject to periodic inspection at stated intervals. If a national metrology service does not exist, a certified record of the basic measurement standards (length, time and temperature), and error analysis in accordance with this International Standard and ISO 5168, shall also constitute certification for legal metrology purposes.

Annex A forms an integral part of this International Standard. Annexes B to E, however, are given for information only.

2 References

ISO 4006, *Measurement of fluid flow in closed conduits — Vocabulary and symbols.*

ISO 4185, *Measurement of liquid flow in closed conduits — Weighing method.*

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

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

3 Symbols and definitions

3.1 Symbols (see also ISO 4006)

Table 1

Symbol	Quantity	Dimensions	SI unit
e_R	Random uncertainty, in absolute terms	*	*
E_R	Random uncertainty, as a percentage	—	—
e_S	systematic uncertainty, in absolute terms	*	*
E_S	systematic uncertainty, as a percentage	—	—
q_m	Mass flow-rate	MT^{-1}	kg/s
q_V	Volume flow-rate	L^3T^{-1}	m^3/s
t	Filling time of the tank	T	s
V	Discharged or measured volume	L^3	m^3
z	Liquid level in the tank	L	m
ρ	Density	ML^{-3}	kg/m^3

* The dimensions and units are those of the quantities in question.