AS 2360.6.1—1993
ISO 4185:1980

Australian Standard®

Measurement of fluid flow in closed conduits

Part 6.1: Volumetric methods—By mass

[ISO title: Measurement of liquid flow in closed conduits—Weighing method]

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The following interests are represented on Committee CE/24:

Association of Consulting Engineers of Australia

Department of Water Resources, New South Wales

Engineering and Water Supply Department, South Australia

Forestry Commission of New South Wales

Institute of Instrumentation and Control, Australia

Melbourne Water

Monash University

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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 4185:1980, *Measurement of liquid flow in closed conduits—Weighing method*.

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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 (*this Standard*)
2360.6.2	Part 6.2:	Volumetric methods—By volume
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
5168	Measurement of fluid flow—Estimation of uncertainty of a flow-rate measurement	3778	Measurement of water flow in open channels
		3778.2.4	Part 2.4: General—Estimation of uncertainty of a flow-rate measurement

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Measurement of fluid flow in closed conduits

Part 6.1:
Volumetric methods—By mass

1 General

1.1 Scope and field of application

This International Standard specifies a method of liquid flow-rate measurement in closed conduits by measuring the mass of liquid delivered into a weighing 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 uncertainties associated with the measurement.

The method described may be applied to any liquid provided that its vapour pressure is such that any escape of liquid from the weighing tank by vaporization is not sufficient to affect the required measurement accuracy. Closed weighing tanks and their application to the flow measurement of liquids of high vapour pressure are not considered in this International Standard.

This International Standard does not cover the cases of corrosive or toxic liquids.

Theoretically, there is no limit to the application of this method which is used generally in fixed laboratory installations only. However, for economic reasons, usual hydraulic laboratories using this method can produce flow-rates of 1.5 m^3/s or less.

Owing to its high potential accuracy, this method is often used as a primary method for calibration of other methods or devices for mass flow-rate measurement or volume flow-rate measurement provided that the density of the liquid is known accurately.

It must be ensured that the pipeline is running full with no air or vapour pockets present in the measuring section.

1.2 References

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

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

OIML, Recommendations Nos. 1, 2, 3, 20, 28, 33.

1.3 Definitions

Only terms which are used in a special sense or the meaning of which merits restatement are defined below.

1.3.1 static weighing : The method in which the net mass of liquid collected is deduced from tare and gross weighings made respectively before and after the liquid has been diverted for a measured time interval into the weighing tank.

1.3.2 dynamic weighing : The method in which the net mass of liquid collected is deduced from weighings made while fluid flow is being delivered into the weighing tank. (A diverter is not required with this method.)

1.3.3 diverter : A device which diverts the flow either to the weighing tank or to its by-pass without changing the flow-rate during the measurement interval.

1.3.4 flow stabilizer : A structure forming part of the measuring system, ensuring a stable flow-rate in the conduit being supplied with liquid; for example, a constant level head tank, the level of liquid in which is controlled by a weir of sufficient length.

1.3.5 buoyancy correction : The correction to be made to the readings of a weighing machine to take account of the difference between the upward thrust exerted by the atmosphere, on the liquid being weighed and on the reference weights used during the calibration of the weighing machine.

1.4 Units

The units used in this International Standard are the SI units, metre, kilogram, and second; the degree Celsius is used for convenience instead of the kelvin.