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Australian Standard®

Measurement of water flow in open channels

Part 4: Measurement using flow gauging structures

Method 4.1: Thin-plate weirs

[ISO title: Water flow measurement in open channels using weirs and venturi flumes—Part 1: Thin-plate weirs]

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Association of Consulting Engineers, Australia

Australian Water and Wastewater Association

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Engineering and Water Supply Department of South Australia

Forestry Commission, N.S.W

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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 1438/1—1980, *Water flow measurement in open channels using weirs and venturi flumes,* Part 1: *Thin-plate weirs.*

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

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:

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
4373	Measurement of liquid flow in open channels—Water level measuring devices	—	

Measurement of water flow in open channels

Part 4:
Measurement using flow gauging structures

Method 4.1:
Thin-plate weirs

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies methods for the measurement of water flow in open channels using rectangularand triangular-notch (V-notch) thin-plate weirs. The flow conditions considered are limited to steady, free and fully ventilated discharge. Recommended discharge coefficients are applicable to water only in the approximate range of temperatures from 5 to 30 °C. Using the coefficients for water temperatures several degrees outside this range will result in negligible error except at very small heads. Limitations of applicability related to weir and flow geometry are specified for the recommended formulae.

2 REFERENCES

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

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

3 DEFINITIONS

For the purpose of this International Standard the definitions given in ISO 772 shall apply. Terms which have special significance in this standard are defined where they first occur.

4 UNITS OF MEASUREMENT

Units used in this International Standard are SI units.

5 PRINCIPLE

The discharge over thin-plate weirs is a function of the head on the weir, the size and shape of the discharge area, and an experimentally determined coefficient which takes into account the head on the weir, the geometrical properties of the weir and approach channel and the dynamical properties of the water.

6 INSTALLATION

6.1 General

General requirements of weir installations are described in the following clauses. Special requirements of different types of weirs are described in clauses which deal with specific weirs (see clauses 9 and 10).

6.2 Selection of site

The type of weir to be used for discharge measurement is determined in part by the nature of the proposed measuring site. Under some conditions of design and use, weirs shall be located in rectangular flumes or in weir boxes which simulate flow conditions in rectangular flumes. Under other conditions, weirs may be located in natural channels as well as flumes or weir boxes, with no significant difference in measurement accuracy. Specific site-related requirements of the installation are described in 6.3.

6.3 Installation conditions

6.3.1 *General*

Weir discharge is critically influenced by the physical characteristics of the weir and the weir channel. Thin-plate weirs are especially dependent on installation features which control the velocity distribution in the approach channel and on the construction and maintenance of the weir crest in meticulous conformance with standard specifications.

6.3.2 *Weir*

Thin plate weirs shall be vertical and perpendicular to the walls of the channel. The intersection of the weir plate with the walls and floor of the channel shall be watertight and firm, and the weir shall be capable of withstanding the maximum flow without distortion or damage.

Stated practical limits associated with different discharge formulae such as minimum width, minimum weir height, minimum head, and maximum values of h/p and b/B (where h is the measured head, p is the height of crest relative to floor, b is the measured width of the notch and B is the width of the approach channel), are factors which influence both the selection of weir type and the installation.

6.3.3 *Approach channel*

For the purposes of this International Standard the approach channel is that portion of the weir channel which extends upstream from the weir a distance not less than