

Comparison of current Australian Standard with updated ISO standard

Current Australian Standard	AS 3778.3.7 (2007)	Measurement of water flow in open channels- Part 3.7 Velocity-area methods- Measurement by ultrasonic (acoustic) method
Updated ISO Standard	ISO 6416 (2017)	Hydrometry- Measurement of discharge by the ultrasonic transit time (time of flight) method

High-level comment on differences

The new ISO is much the same as the 2004 ISO (ie the 2007 AS).

The subcommittee who reviewed the previous ISO 6416 update to ISO 6416(2004) did not include any hydrometric representatives. This document (which was the basis of the old AS3778.3.7(2007) tended to have an electrical and instrumentation focus, and not so much on the site hydraulics and hydrometric influences, so, the makeup of the subcommittee is understandable. The new ISO seems to have an even greater focus on electrical engineering and instrumentation matters, and a further reduction in hydraulic and hydrometric aspects.

Considering that there are a growing number of “billing meter” transit time installations in the Australian irrigation industry, and also considering the likely future assessment work of certified practicing hydrographers on new open channel billing meter installations in the irrigation industry- a greater input from a hydraulics and AHA perspective is important.

One example of this in the new ISO is the apparently glancing reference to what standards to use to take check calibration gaugings, despite strong recommendations in sections 9 and 13 for the necessity of such gaugings. Ideally, the National guidelines should be added to our new AS bibliography, as well as adding Part 8 of National guidelines, as well as ISO 748 to it’s normative references.

Reviewer recommendation

I recommend that the technical committee

- *accept the updated ISO in full to replace current AS.*

(This recommendation was reached following further discussion with Working Group members)

The following material from AS 3778.3.7 (1992) should be raised for incorporation into the WaMSTeC National Industry Guidelines for Hydrometric Monitoring:

- Include the two paragraphs in the old AS “General” 7.1.2, which discuss the need for a level sensor, and to consider site conditions, and how these considerations can change the system design- as this is practical hydrometric advice;
- Include Table 4 from the old AS, as this generic vertical velocity distribution is a useful reference, from a hydraulics perspective;

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
Title of standard	Significant change	The new ISO has updated to use the word “Hydrometry” as the first word in it’s new title. It also is explicit in stating that in stating that this ultrasonic standard is for the transit time method, noting that the old AS was not explicit in stating this in the title, implying that it might possibly be covering both doppler and transit time.
The AS subcommittee who reviewed the previous ISO6416 (2004) for its adoption as an AS- as listed on page 2 of the AS	Significant change	<p>The old AS subcommittee did not include any Hydrographers, but did cover a broad range of interests:-</p> <p style="background-color: black; color: black;">[REDACTED]</p> <p>Noting that our new subcommittee will be entirely hydrographers. Not sure what we should do to broaden our committee, or if we should?</p> <p>One point to note about the old committee is that it is loaded with “clients” for buying transit time, and “electrical and SCADA engineers” for installing and electrically calibrating the gear. Notably absent from normative references are standards dealing with how to calibrate (eg ISO 748) the installations- which would be a given if there were hydrographers on the committee.</p>
Preface	Minor change	The old AS includes a Preface which explains that it is based on the ISO. It also lists any changes made from the ISO. The only change being our preferred use of a decimal dot rather than a comma to indicate a decimal number.
Foreword	Significant difference	The new ISO includes a Foreword, explaining how ISO’s are put together, and some qualifying “legal” aspects. It identifies that this ISO6416(2017) is the updated version of ISO6416(2004)- which the old AS was based upon. It also lists the main changes made by the new ISO.
1. Scope	Minor change	Both standards say that they cover open channels and closed conduits. But the new ISO adds a note stating that for closed conduits running full, see IEC 60041 for more detail.
2. Normative references	Minor change	Both standards refer to ISO’s 772 and 4373, but the new ISO also now includes the new uncertainty ISO/TS 25377

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3. Terms and Definitions	Minor change	Both standards state to refer to ISO 772, but the new ISO adds web links to terminological databases maintained by ISO and IEC
4. Applications	Minor change	Both standards cover the three types of channel applications (open, multiple, and closed conduits), but the new ISO arranges the subject matter differently. The old standard has three subsections, one for each type of channel. The new ISO only has two subsections, but arranged differently as :- Types of applications, and; Attributes and limitations.
5. Method of measurement	Minor change	Both standards cover the same subsection topics. The new ISO adds explicit statement of the continuity equation ($Q=vA$) in its section 5.1, as well as eliminating subclause 5.2.1 from the older standard, which referred to the treatment of velocity in subsequent discharge calculations, as being analogous to the current meter method.
6. Flow velocity determination by the ultrasonic (transit-time) method	No change	Both standards have the same subsections and Figures and Tables
7. Gauge configuration	Significant change	Both standards are the same for subsections 7.2 to 7.6. Subsections 7.7 and 7.8 in the old standard are also the same as subsections 7.8 and 7.9 in the new standard. The old AS includes two paragraphs in its "General" 7.1.2, which discuss the need for a level sensor, and to consider site conditions, and how these considerations can change the system design. These paragraphs have been deleted from the new ISO. The new ISO has an additional subsection "7.7 Wireless systems", which describe two types of wireless systems (ie no need to run power and cables from the other bank)
8. Calculation of Discharge	Minor change	The new ISO renames this section as "Determination of Discharge". Both standards have the same three subsections:- 8.1 Single Path systems; 8.2 Multi-path systems, and; 8.3 In channel systems. The content of subsections 8.2 and 8.3 is virtually identical. Subsection 8.1 has been expanded in the new ISO, and is longer and has been broken into 7 sub-subsections, including a description of the detailed steps required to calibrate a velocity index factor for single path systems. This detailed description seems to have replaced the generic velocity index factors which were provided in the old AS as Table 4.

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		The new ISO in its section 8.1 specifically references ISO 1100-2 (to decide on number of gaugings to use), and ISO 15769 for how to define the velocity index.
9. System Calibration	Minor change	The new ISO refers back to the more detailed explanation it gives for calibrating single path system in section 8.1, and emphasises that the more paths there are, the less the need for calibration. The older AS does give more guidance, based on a standard vertical velocity distribution being a maximum a little below the surface and dropping in a logarithmic manner to zero at the bed, and suggesting that this generic distribution could be used in the absence of gaugings, to select the best height to put the transducers at (for single path systems). The new ISO does not give such guidance.
10. Site Selection	Significant change	The old AS breaks into 3 subsections, while the new ISO has only one section of text. The old AS is longer and covers more practical detail. The new ISO provides a table for minimum depth required to transducers at different frequencies, which is easier to use than the formula which is given in the old AS.
11. Site Survey- Before design and construction	Significant change	There is less practical advice and detail in the new ISO versus the older AS. One comment here is that the subcommittee for the new standard would appear to be more focused on the electronic survey and calibration, and less on the hydrographic and hydraulic aspects of site survey. For example the section 11.4 on velocity distribution survey is relatively short in the new ISO, and advocates use of the ADCP, whereas in the older AS it mentions ISO 748 and current meter gaugings as a viable method, along with suggesting the use of transit-time cross path temporary setups as a means of velocity distribution survey. Also noting that Section 11.6 (Other survey activities- such as temperature, salinity and suspended solids surveys) has been deleted completely.
12. Operational Measurement Requirements	Significant change	The first three subsections are largely the same (ie 12.1, 12.2, and 12.3). Differences in approach are notable in section 12.4 (Determination of water stage..), but the ultimate reference is still the same, as being ISO 4373. The new ISO has a large new section 12.5 (Determination of mean bed level), which was not included in the older AS. This is a detailed section of advice on how to do this for a typical site. Channel width is the last subsection (12.5 in the older AS, and section 12.6 in the new ISO), and has much the same content

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13. Gauging station equipment	Minor change	This is a large section, with 14 subsections. All of the subsection names are the same, and their content is nearly exactly the same, with a few minor formatting or text re-arrangements.
14. Measurement Uncertainties	Minor change	The names of subsections and the number of subsections is the same in both standards. The content is largely the same, except for:- The general subsection 14.1 now refers to the newer ISO/TS 25377 (which has not previously had an AS equivalent!), and; the section on defining uncertainty (14.2) now has slightly different wording, and refers the reader to new Annexe A, which gives a more detailed description of the Type A and Type B methods of uncertainty determination. The two examples given are still the same
Bibliography	Minor change	The new standard has an updated and expanded bibliography.
Annex A – Principle of measurement uncertainty	Significant addition	New annex, supporting section 14
Annex B- Performance guide for hydrometric equipment for use in technical standard examples	Significant addition	New annex- giving practical guidance as to the application of other velocity measurement methods