

Comparison of current Australian Standard with updated ISO standard

Current Australian Standard	AS 3778.3.6-2001	Measurement of water flow in open channels. Part 3.6: Velocity-area methods-Measurement of flow in tidal channels
Updated ISO Standard	ISO 2425	Hydrometry – Measurement of liquid flow in open channels under tidal conditions

High-level comment on differences

The AS and ISO documents differ only slightly in most elements of the standards, with the exception of the addition of acoustic Doppler instrumentation methods in the ISO. I have marked these sections being minor changes through the review (with orange highlight to reflect significance), as they constitute an industry wide shift in practice which needs to be reflected in contemporary Standards. There were also some minor inconsistencies in equations between the two standards noted in the review, which may be typographical errors in one or another of the documents.

Reviewer recommendation

I recommend that the technical committee accept the updated ISO in full to replace current AS

Detailed summary of differences

The table below outlines in more detail a summary of the differences between the current Australian Standard under review and the relevant updated ISO standard and includes reviewer comment where relevant.

Column 1: Identifies the number and name of the section in the current Australian Standard

Column 2: Classification of the change for that section. Classified as either:

- **No change (green shading)** – The updated ISO is the same as the current Australian Standard.
- **Minor change (blue shading)** – Changes that have minimal impact on the outcome, including
 - minor format, style or heading changes
 - minor additions, removals or changes to a few words or clauses
 - addition or exclusion of more detailed explanation
 - very minor changes to steps or processes.
- **Significant change (orange shading)** – Changes that have a moderate to major impact on the outcome, such as
 - Changes to requirements
 - Significant changes to calculations, steps or processes.

Column 3: More detail to describe the change, and comment from the reviewer (enough detail for the consideration of AHA and WaMSTeC members in their review).

Text colour is used in this column as follows:

- **Black text** – More detailed explanation of the changes and reviewer comment. **Specific reviewer comment on the changes highlighted in yellow.**
- **Blue text** – reference to information included in the updated ISO that is not in the current Australian Standard
- **Red text** – reference to information included in the current Australian Standard that is not in the updated ISO.

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
1 Scope	Minor change	Slight changes to wording. <i>The ISO document makes reference to Annex D (determination of tidal flow using acoustic Doppler velocity meter).</i> This is not contained in the AS.
2 Normative references	Minor change	Slight changes to wording. Reference made to more numerous and contemporary standards in ISO document
3 Terms and definitions	Minor change	Slight changes to wording. <i>ISO document has section 4 (Abbreviated terms), listing terms associated with acoustic Doppler instruments</i>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
4 Principles of methods of measurement	Minor change	<p>4.1 General Slight changes to wording. Slight change to reference standards</p> <p>4.2 Single measurement methods</p> <p>4.2.1 Velocity-area method Minor change to wording <i>Reference to acoustic Doppler instruments in ISO</i></p> <p>4.2.2 Cubature method No change</p> <p>4.3 Continuous measurement methods</p> <p>4.3.1 Ultrasonic method (ISO 6416) Minor changes to wording. <i>The ISO document refers to computation of discharge from a knowledge of cross sectional area.</i> The AS only refers to velocity measurement in this section.</p> <p>4.3.2 Electromagnetic method (ISO 9213) No change</p> <p>4.3.3 Unsteady-flow models No change</p> <p><i>ISO document has section 5.3.3 Acoustic Doppler velocity method from a fixed station, which deals with this topic.</i> The AS does not contain this section.</p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
5 Special considerations and choice of method	Minor change	<p>5.1 Special considerations Minor changes to wording <i>Minor clarifications/additions in sub-section f)</i> <i>Addition of Acoustic Doppler to section k)</i> <i>Additional sub-section l) dealing with acoustic Doppler</i> <i>Addition of sub-section m) noting potential differences in flood and ebb tide flow dynamics</i></p> <p>5.2 Choice of method</p> <p>5.2.1 General Minor changes to wording Change to verb use from <i>'may not'</i> to <i>'shall not'</i></p> <p>5.2.2 Physical conditions Minor changes to wording, including movement of point p) in AS to be included in point f) in ISO Difference in references to annex/tables denoting selection of gauging methods</p> <p>5.2.3 Selection and demarcation of site</p> <p>5.2.3.1 General Minor changes to wording</p> <p>5.2.3.2 Preliminary reconnaissance surveys Minor changes to wording</p> <p>5.2.3.3 Survey of chosen site No change</p> <p><i>The ISO contains an additional section 6.2.3.4 Additional site selection criteria for ADVMS</i></p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
6 Measurement of tidal flow	Minor change	<p>6.1 Techniques for single measurements of tidal flow</p> <p>6.1.1 Measurement of tidal flow by velocity area methods</p> <p>6.1.1.1 Site requirements Difference in standards referenced providing details of methods Minor changes to wording <i>Reference to ADVMs</i></p> <p>6.1.1.2 Measurement of cross-sectional area No change</p> <p>6.1.1.3 Measurement of velocity by the fixed current-meter method</p> <p>6.1.1.3.1 Measurement procedure No change to standards referenced <i>ISO recommends use of an acoustic Doppler profiler for measurement at tidal sites</i> Slight changes to the wording and structure of information No change to the method</p> <p>6.1.1.3.2 Computation of discharge for fixed current-meter method Minor changes to wording/syntax No change to method</p> <p>6.1.2 Measurement of tidal flow by the moving boat method No change</p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
6 Measurement of tidal flow	Minor change	<p>6.2 Techniques appropriate for continuous measurement of tidal flow <i>ISO contains a section relating to the measurement of tidal flow by acoustic Doppler</i></p> <p>6.2.1 Measurement of tidal flow by the ultrasonic method <i>ISO includes “(acoustic)” in the title after ultrasonic</i> Minor changes to wording Both documents specify practical limits of 1000mg/L for suspended sediment concentrations. Point e) in the ISO specifies <i>limits</i> to sediment concentration in Annex B, whereas the AS presents this as a relationship. <i>AS specifies a non binding width : depth ratio of 50:1.</i> This is not included in the ISO</p> <p>6.2.2 Measurement of tidal flow by the electromagnetic method Minor changes to wording</p> <p>7.2.4 Computations Minor changes to wording In the footnote, the ISO specifies units for flow, whereas AS does not.</p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
7 Uncertainties in tidal flow measurement	Minor change	<p>7.1 General Minor changes to wording/references</p> <p>7.2 Uncertainties in measurement by velocity area method</p> <p>7.2.1 Sources of uncertainty Minor change to wording and references ISO gives definition to b_i, d_i and v_i in the equation</p> <p>7.2.2 Individual components of errors <i>ISO contains a reference to ISO 748:1979 indicating that, “the terms (defined as X’) were not used in ISO 748:2007. They represent individual components of uncertainty errors and not the uncertainty errors”</i> <i>The equation provided in point 2 in the AS is different to that provided in the ISO, the latter appears to be a typo?. All terms on the right hand side of the equation in the ISO are the square of a square root, whereas only the last term within the square root function appears to be squared in the AS.</i></p> <p>Otherwise no change</p> <p>7.2.3 Resultant random uncertainty in measurement of flow Some terms, eg the first term on the right hand side of the equation under the square root sign differs slightly between the two documents. As with the previous formula issue, this appears to be a formatting typo. Needs to be reviewed and corrected as appropriate.</p> <p>7.2.4 Resultant systematic uncertainty in measurement flow No change</p> <p>7.2.5 [REDACTED]</p> <p>7.2.6 Combined standard error in the determination of the tidal (ebb or flood) volume No change</p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
Annex A Measurement of tidal flow by the cubature method	Minor change	<p>A.1 Site requirements Minor changes to wording. Change to wording in second-last paragraph</p> <p>A.2 Field measurements No change</p> <p>A.3 Computation – Method I Minor changes to wording/layout</p> <p>A.4 Computation – Method II Minor changes/clarifications in wording in point g). Otherwise no change</p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
Annex B Flow measurement methods suitable for tidal conditions	Minor change	<p>Slight changes to introductory wording</p> <p>Table B.1 (Flow measurement methods) <i>This introductory table in the AS has been removed in the ISO</i></p> <p>Table B.2 (Guide to the selection of gauging method) <i>Columns 1 (current meter) and 2 (moving boat) in the AS have been combined in the ISO under the heading “Moving boat current meter”. The ISO selection guide for this column follows that of the “Current meter” column in the AS. The “Moving boat” column in the AS appears to have been dropped in the ISO.</i></p> <p><i>Column 3 (Ultrasonic) in the AS has been renamed “Ultrasonic velocity meter (UVM)” in the ISO and numerous selection parameters have been modified.</i></p> <p><i>Column 4 (Full-width electromagn.) in the AS has been moved to the final column in the ISO under the heading “Electromagnetic velocity meter (EVM)” and has changes to the parameters relating to the selection of Salt wedge, Temperature gradient and Wind seiches.</i></p> <p><i>The ISO includes a column detailing selection parameters for Acoustic Doppler current profilers (ADCPs). This is not included in the AS.</i></p> <p>Footnote 8) Minor change to wording Footnote 10) Minor change to wording Footnote 11) Significant change to footnote and cross-reference Table B.3 Estimates of tolerable sediment concentration for acoustic velocity meter systems Slight change in wording of title (replacement of ‘acoustic’ with ‘ultrasonic’) Otherwise no change</p>

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
Annex C Record of velocity measurement of a tidal river (see 6.1)	Minor change	<p>Slight change to introductory wording</p> <p>Table C.1</p> <p>Table heading has a description in the ISO (Example of computation of velocity for a single vertical)</p> <p>The first table footnote equation detailing the calculation for correction differs slightly between the AS and ISO. The AS contains an X instead of the multiplication symbol between the second and last terms of the equation. The ISO uses the “.” symbol for all multiplications.</p> <p>Figure C.1 Minor changes to layout of reference text</p>
Annex	Significant change	<p><i>The ISO contains an additional Annex (D) outlining measurement of tidal flow using an acoustic Doppler velocity meter.</i></p>