Specification

Engineering Standard

M-SPE-STD-006

Bulk Supply Meters for Potable Water

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Contents

1. Purpose

This document is part of a suite of Seqwater Engineering Standards which are in alignment with the Seqwater Quality Management System. Their purpose is to provide a consistent approach to the development, modification, and management of Seqwater infrastructure that is fit for purpose, economic over the life of the asset, and meets Seqwater's Work Health and Safety obligations.

This Standard Specification provides the minimum requirements and recommendations for Seqwater works relating to the design, supply, and installation of all bulk supply flow meters for purified recycled water and potable water. 'Bulk supply' meters are those used for revenue / billing purposes. This document must be used in conjunction with the documents it references to assist in ensuring a fit for purpose asset.

This document must be used in conjunction with the documents it references to assist in ensuring fit for purpose infrastructure. This Standard Specification is not intended to be relied on solely for design, supply, and installation works; advice from specialist engineers and/or manufacturers may be required on a case-by-case basis.

Requirements under this Engineering Standard apply to:

- bulk supply meter installations on new infrastructure,
- bulk supply meter modifications on existing infrastructure,
- bulk supply meter replacement on existing infrastructure,

This Engineering Standard does not apply to process or non-urban flow meters, refer to *Engineering Standard M-SPE-STD-*009 *Flow Meters* and *Engineering Standard M-SPE-STD-007 Meters for Non-Urban Water Supply* respectively for these flow meter standards.

The requirements of *Engineering Standard M-SPE-STD-009 Flow Meters* apply to all flow meters, including bulk supply meters. However, for bulk supply meters, the requirements in this Engineering Standard, *M-SPE-STD-006 Bulk Supply Meters for Potable Water*, shall take precedence over *Engineering Standard M-SPE-STD-009 Flow Meters*, where there is a conflict.

This Engineering Standard forms the minimum requirements for the selection of preferred equipment for Bulk Supply Meters for use within Seqwater. The preferred equipment was developed through one or more open market procurement processes with the resultant selection listed in *Register X-LST-STD-001, Seqwater Preferred Equipment List*. Seqwater's Commercial Services Manager approved the recommended preferred equipment that resulted from the open market procurement process.

2. Scope

This Standard Specification applies to all Seqwater employees, contractors, suppliers, and consultants working for or on behalf of Seqwater unless otherwise stated. It applies to all new assets and to all existing assets undergoing refurbishment or modification. It must be used in conjunction with other relevant Seqwater Engineering Standards and project specific documents to define the technical requirements for infrastructure design and construction.

Where single or discrete components of an existing non-compliant system are to be replaced, refurbished, or modified, this standard should not automatically be applied to the entire system retrospectively, however

consideration should be given, in consultation with relevant stakeholders, to the extent of the application of the standard outside of the components requiring replacement, refurbishment or modification, to ensure safe, economic, and fit for purpose infrastructure.

Seqwater Engineering Standards detail Seqwater's minimum requirements and recommendations to provide infrastructure that will be fit for purpose, and safe to operate and maintain. However, compliance with these requirements and recommendations does not remove, and cannot be relied on as meeting, the designer's overarching responsibility for ensuring infrastructure designed is fit for purpose and safe to construct, operate, maintain, and demolish. The designer must exercise appropriate due diligence to identify and manage hazards so far as is reasonably practicable.

Designers must also ensure compliance with relevant Australian Legislation, Standards, Codes and Guidelines (including those produced by Water Services Association of Australia). Where no Australian Standard exists for a particular application, work must conform to the most current version of an industry accepted international standard.

Deviation from meeting the minimum requirements in this Standard Specification requires written agreement from Seqwater as per the deviation process detailed in *Procedure X-PRO-STD-008 Asset Standards Management and Application*. That process includes completion of an *X-TMP-STD-022 Asset Standards Deviation Request Form* and submission by the Seqwater Project Representative to the Seqwater Engineering Mailbox. Where noted in this Standard Specification that Seqwater approval, agreement, or acceptance shall/must be sought, such approval, agreement or acceptance must be gained through the Seqwater Asset Standard Deviation process, as outlined above.

Responsibility for ensuring compliance with Seqwater Engineering Standards lies with those engaged in the management and execution of design, construction, and modification of Seqwater infrastructure. This includes modifications to the functional design of the infrastructure including technical changes made which would extend an asset outside of its design operating envelope and/or approved operation and maintenance practices.

Any ambiguities or conflicts identified between specific requirements within this Standard and project documents, another Seqwater Engineering Standard or Australian Legislation, Standards, Codes or Guidelines, these must be brought to the attention of the Seqwater Document Owner, via the Engineering Mailbox, for clarification. Where it is proposed to proceed without meeting the requirements of this standard, agreement must be obtained via the Deviation Process, as outlined above.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this Engineering Standard, the complete list of Seqwater Engineering Standards should be reviewed to ensure currency and applicability of standards to be applied to the works. These can be accessed on the Waternet Engineering and Asset Standards page or using the REX Saved Search "Engineering Stds Controlled Documents by CD Owner".

3. Technical Requirements

3.1. Meter Accuracy and Pattern Approval

The calibration performance of each flow meter shall be defined and documented on an individual calibration certificate, in accordance with NMI R49 Class 1 and AS ISO/IEC 17025. The calibration certificate shall be supplied to and verified by the Seqwater project manager prior to the flow meter being dispatched. The calibration facility shall be accredited by NATA, or an equivalent accreditation body recognized by the ILAC-MRA.

All flow meters shall be pattern approved in accordance with NMI R 49 or OIML R 49 class 1 where the MPE, including the all-test uncertainties (i.e. error of indication plus test uncertainty) is specified as:

- the MPE for the upper flow rate zone, Q2 ≤ Q ≤ Q4, is ±1 %, for temperatures from 0.1 °C to 30 °C, and ±2 % for temperatures greater than 30 °C.
- the MPE for the lower flow rate zone, Q1 ≤ Q < Q2, is ±3 % regardless of the temperature range.

Refer to NMI R 49 for full definitions of the flow rate zones and various flow designations. The specific flow rates corresponding to the flow designations are provided by the flow meter NMI R49 pattern approval.

Flow meters ≤DN300 will be calibrated to the manufacturer's standard factory calibration and number of calibration points. Flow meters greater than DN300 and will be calibrated to the following a 5-point calibration.

The 5-point test points for calibration will be:

- Point 1: Q1
- Point 2: Q2
- Point 3: 0.3 * (Q2 + Q3)
- Point 4: 0.7 * (Q2 + Q3)
- Point 5: Q3

Where Q3 equals the equivalent flow rate through the test meter at a fluid velocity of 2.5 m/sec. The test Q3 value shall be determined by selecting the 2.5 m/sec calculated flow rate to the nearest flow rate and within the Q3/Q1 ratio specified in NMI/OMIL R49 pattern approval for the specific flow meter.

The Q3/Q1 ratio is ≥ 40 in accordance with NMI/OMIL R49 section 4.1.4 and Q2 equals 1.6xQ1 but less than the equivalent flow rate through the test meter at a fluid velocity of 0.5 m/sec.

For clarity and to avoid misinterpretation of the flow meter 5-point calibration flow rates above, the flow rates specified in Table 1, ± 10%, shall be applied for each flow meter size greater than DN300, unless otherwise approved by Seqwater.

Table 1 Flow Meter Calibration Flow Rates (±10%)

Flow Meter size (mm)	Point 1 (m^3/h)	Point 2 (m^3/h)	Point 3 (m^3/h)	Point 4 (m^3/h)	Point 5 (m^3/h)
DN 350	12.5	20	306	714	1000
DN 375	12.5	20	306	714	1000
DN 400	12.5	20	306	714	1000
DN 450	20	32	489.6	1142.4	1600
DN 500	20	32	489.6	1142.4	1600
DN 600	62.5	100	780	1820	2500
DN 650	100	160	1248	2912	4000
DN 700	157.5	252	1965.6	4586.4	6300
DN 750	157.5	252	1965.6	4586.4	6300
DN 800	157.5	252	1965.6	4586.4	6300

Flow Meter size (mm)	Point 1 (m^3/h)	Point 2 (m^3/h)	Point 3 (m^3/h)	Point 4 (m^3/h)	Point 5 (m^3/h)
DN 900	250	400	3120	7280	10000
DN 1000	250	400	3120	7280	10000
DN 1050	250	400	3120	7280	10000
DN 1100	250	400	3120	7280	10000
DN 1200	250	400	3120	7280	10000
DN 1300	400	640	4992	11648	16000
DN 1400	400	640	4992	11648	16000
DN 1500	400	640	4992	11648	16000
DN 1600	400	640	4992	11648	16000

The calibration test parameters, ambient and fluid conditions shall be in accordance with those specified in NMI/OMIL R49 and reported on the Certification certificate.

Where a meter is installed in a system where the process flow is bi-directional, not including inadvertent back flow, meters greater than DN300 will be calibrated in both flow directions as specified above, unless documented evidence can be provided for that series of meters that proves that the calibration results in both flow directions is equal.

All flow meters shall be capable of measuring bi-directional flow and designed, manufactured, and installed such that its errors in either direction do not exceed the maximum permissible error (MPE) as defined by NMI / OIML R 49 Class 1, under all specified operating conditions. Reverse flow totalisation must be recorded separately and not automatically subtracted from the forward flow totalisation.

Where a flow meter size is not included in the NMI / OMIL R49 pattern approval for size or pressure, the flow meter, including the sensor and transmitter, will be from a series of flow meters that are NMI/OIML R49 pattern approved.

Flow meters without pattern approval to NMI / OIML R 49 may be accepted if the flow meter meets the requirements of NMI / OIML R 49 Class 1 and the flow meter is calibrated, inspected, and tested in accordance with that standard.

3.2. Existing Infrastructure

For bulk supply meters modified or replaced on existing infrastructure, the requirements of this Engineering Standard shall be considered to describe the preferred equipment and installation to be adhered to as far as practicable. It is important to note that modifying existing infrastructure to meet all requirements within this document may not be practicable. As such, the assessed benefit derived from a cost benefit analysis for each requirement must be demonstrated to outweigh the cost to implement the requirement. For example, the cost benefit analysis may include the derived long-term financial improvement from improved accuracy vs the cost to implement. Notwithstanding this, the requirements of the *QLD Bulk Water Supply Code*, section 23, shall be adhered to for existing infrastructure.

3.3. Meter Verification

The flow meter shall be capable of in-situ verification with the flow meter manufacturers third party certified verification tool to ensure the flow meter's assessable parameters, including the flow meters coils and electronic circuitry, are performing within the manufacturers allowed deviation from their initial calibration / set values.

Annual verification is required with a verification certificate provided stating the initial calibration value, the verified value and percentage change from the initial calibration value for each parameter. If the verification is outside the acceptable limit, then the flow meter must be removed, repaired, and re calibrated in a suitable NATA / ILAC-MRA certified laboratory or replaced.

3.4. Drinking Water Compatibility

All components of the flow meter that may come into contact with drinking water or subsequently enter the treatment process must comply with the Potable Water Compatibility requirements of *Engineering Standard M-SPE-STD-001 General Mechanical.*

3.5. Pressure Class

The pressure class of the flow meter shall be equivalent to, or greater than, the design rated pressure class of the associated infrastructure. A reduced pressure class based on site operating pressures will not be accepted.

3.6. Structural Stresses

The flow meter installation shall be designed such that pipe expansion and contraction stresses transferred to the flow meter are minimised as far as practicable and are within the manufacturers specified limits. In vertical installations, direct inline compressive stresses resulting from the flow meter supporting the pipe above the flow meter are acceptable if within the flow meter's manufacturers approved limits. Any torsional stresses transmitted to the flow meter are not acceptable. Notwithstanding the above, the flow meter installation shall be designed to withstand all potential residual pipeline loads, including, but not limited to, thermal expansion.

It is not permitted to install thrust restraining devices surrounding the flow meter.

3.7. Flanges & Gaskets

The end connection flanges shall comply with flange requirements specified in *Engineering Standard M-SPE-STD-001 General Mechanical* and flange gaskets shall comply with *WSA 109*.

3.8. Process Conditions

The flow meter shall be rated to operate within the following process conditions:

Process temperature: 0.1 to 30℃ (T30 temperature class)

Fluid conductivity: > 20 µS/cm

Flow meters approved with a T30 temperature class shall also comply with a limiting condition of 50 °C as per NMI R 49.

3.9. Environmental conditions

The flow meter shall be rated to the following environmental conditions:

Ambient temperature: - 5 to 50℃

Fluid Temperature: 5 – 40℃

Electromagnetic environment: E2 (industrial)

A minimum of C3-Medium corrosivity category, as per *AS 4312*, will apply for all external surface protection requirements. A C4-high or C5-very high corrosivity category shall be assigned to equipment that will be installed in the specific locations requiring these categories as specified within *Engineering Standard M-SPE-STD-004, Protective Coatings*.

3.10. Meter Sizing

The project specific documentation for the supply and installation of new or replacement bulk water meters must specify the minimum, maximum, and normal operating flow rates, the normal operating system pressure, and the system design pressure, including any hydraulic transient pressures. The system flow rates, for new off takes, will be the best estimates agreed between the utility and Seqwater, and for replacement flow meters, the flow rates will be determined from the historical records with all seasonal variations and long-term population growth predictions taken into consideration.

The designer shall consider these operating flow ranges when selecting the size of the flow meter so the accuracy of the flow meter can be maximised as much as practicable.

The flow meter diameter shall be selected to ensure that the flow rate through the flow meter during operation is as follows:

- Pumped system: flow rate shall always be above the Q2 of the selected flow meter except during start-up and shutdown. If not possible for a specific application, the estimated volume which will be transferred below Q1 and Q2 flows shall require the approval of Seqwater.
- Gravity / demand driven system: for the majority, greater than 50% of the operating time, and volume transfer, the flow rate shall be above the Q2 of the selected flow meter. Operating flow rate below Q2 should be minimised as much as practicable. The estimated volume which will be transferred below Q1 and Q2 flows shall require the approval of Seqwater.
- For any installation, consideration must be given to the maximum flow rate in order to ensure the flow meter is appropriately sized. The maximum allowable operating flow cannot be above Q3, except for short periods up to, but not exceeding Q4.

Note: The specific flow rates corresponding to the various flow designations are provided by the flow meter manufacturer. A smaller diameter flow meter will generally have a lower Q2. Refer to NMI R 49 for full definitions of the various flow designations.

In the case that a flow meter does not have a nominated Q2 value, the following conditions shall be met during operation:

- Pumped system: velocity shall always be above 0.5 m/s except during start-up and shutdown. Velocity shall be between 0.5 m/s and 5 m/s for the majority of the operating time and volume transfer.

- Gravity / demand driven system: velocity shall be no less than 0.5 m/s for the majority of operating time and volume transfer. Operating velocity below 0.5 m/s should be minimised as much as practicable. The estimated volume which will be transferred below 0.5 m/s flows shall require the approval of Seqwater.

It shall be brought to Seqwater's attention if a single flow meter is not suitable for the range of system operating flow conditions. In such cases an alternative metering installation may need to be considered and shall require approval from Seqwater.

3.11. Meter Installation

The designer shall consider all relevant operating, safety and environmental conditions/requirements when specifying the flow meter and installation.

As a minimum, the flow meter will be installed with a minimum straight pipe length of 20 x pipe diameters upstream and 10 x pipe diameters downstream of the flow meter. If the installation requirements/recommendations of the flow meter manufacturer and/or NMI/OMIL R49 certification are greater than 20 x pipe diameters upstream and 10 x pipe diameters downstream, then the greater requirement/recommendation will apply. Flow meters required to measure operational bi-directional flow shall have the minimum specified upstream straight pipe length on both sides of the flow meter. Where a flow meter is installed in line with a pump, there shall be a minimum of 40 x straight pipe diameters between the pump and the flow meter.

The required straight pipe lengths internal diameter shall be matched within +/- 5% of the internal diameter of the flow meter internal diameter. If there is a miss match between the pipe and flow meter, then either the flow meter will have to be specifically designed and manufactured to match the pipe diameter, or the pipe diameter reduced to match the selected flow meter diameter. Where reducers are required the wall angle must not be greater than 4 degrees, and they shall be installed upstream and downstream of the required straight pipe lengths. Installing a reducer and/or expander directly upstream and downstream the flow meter is not acceptable.

There shall be no branches or fittings placed within the straight pipe lengths except for a dismantling / coupling joint, if required, on the downstream side of the flow meter. In the case of operational bi-directional flow meter installations, such fittings shall be on the predominant flow downstream side.

The designer shall consider associated infrastructure disturbance on uniform flow generation. Disturbance generation include associated infrastructure, such as pumps, reducers, valves, pressure regulating valves, mixers, bends, branch lines, etc. The disturbances generated may require additional straight pipe length added to the installation to enable a uniform flow to be generated prior to the flow meter. The designer shall ensure the installation meets the flow meter manufacturer's requirements for uniform flow profile. It is strongly recommended that CFD analysis be conducted, by a suitably specialised flow meter manufacturer, on all installations, DN 900 and greater. The CFD analysis will access and suggest optimisation of the proposed design to achieve the required MPE under all operating conditions. A full engineering report shall be supplied detailing all flow conditions, pipe configurations and flow meter positions considered with the predicted accuracy for each case and a recommended design for the optimum installation.

The flow meter shall be installed upstream of chemical dosing points. If unable to install the flow meter upstream of a dosing point, the flow meter shall be no less than 50 x diameter downstream of the dosing point and the fluid shall be well mixed.

The designer shall consider potential influences of electromagnetic interference in the design of the flow meter installation. In general, ferrous metal structures shall not be installed within close proximity of an electromagnetic

flow meter due to the potential to influence measurement. Other than those approved by the flow meter manufacturer, nearby structures, wiring and other items that may affect the flow meters performance shall meet the manufacturers segregation requirements.

Flow meters installed in parallel or in series shall meet the flow meter manufacturer's segregation requirements.

The flow meter and its associated components must be electrically isolated and grounded in accordance with regulations, the flow meter manufacturer's requirements for the specific installation, and as specified in *E-SPE-STD-001* to protect personnel against electric shocks.

Where the flow meter is installed on a pipeline with cathodic protection, ensure that the manufactures requirements are followed to ensure that the cathodic protection does not affect flow meter integrity or accuracy. Additionally, it must be ensured that the flow meter installation does not adversely affect the effectiveness of the cathodic protection of the pipeline.

The sensor shall be rated to IP68, and the terminal box fully potted with re -enterable type potting compound if the terminal box may be submerged for any reason.

The transmitter shall be rated to IP67 minimum.

The transmitter shall not be installed within a confined space or at a location susceptible to immersion.

The flow meter manufacturer's installation requirements shall be met, or exceeded, for all aspects. Items to consider, in addition to the above, include, but are not limited to, location of nearest pipe supports, flow meter orientation, allowable vibrations, vacuum avoidance etc.

Site assessment shall be undertaken prior to flow meter selection and installation design. This shall include assessment of mechanical, electrical and control constraints.

3.12. Operations and Maintenance Considerations

All flow meters associated with buried pipelines shall be installed within a pit to facilitate ongoing maintenance and flow meter replacement.

Pits for flow meters shall comply with the following standard drawings:

- *Standard Drawing D-DWG-STD-029, Flowmeter pit (DN 600 and larger) general arrangement*
- *Standard Drawing D-DWG-STD-033, Typical pit information*

Generally, the requirements of *D-DWG-STD-029* shall also apply to flow meters < DN 600, however modifications to this pit arrangement may be considered, subject to acceptance by Seqwater.

The pit shall be appropriately sized and configured to facilitate temporary installation of a clamp-on ultrasonic flow meter downstream of the billing flow meter. Seqwater may nominate the requirement for a permanent ultrasonic flow meter as a reference meter in the Scope of Works, subject to site metering requirements. Note that ultrasonic flow meters are not intended to be used as in-situ validation; instead, they may be used as a backup flow meter if the permanent flow meter fails.

Minimum requirements for accessible pipe lengths within the pit for a clamp-on ultrasonic flow meter are nominated in Table 2.

Table 2 Required accessible pipe length for clamp-on ultrasonic flow meters.

Pipe size range	Required accessible pipe length (mm)
< DN 600	600
⩾ DN 600 to ⩽ DN 1200	1200
> DN 1200	1500

The flow meter installation shall include a permanent stainless-steel nameplate on the wall of the pit, or other approved location, that provides the details necessary for ultrasonic flow meter installation and configuration, e.g. pipe I.D., pipe wall thickness, cement lining thickness etc.

The flow meter installation shall include a means of flow meter removal, e.g. dismantling joint, as well as all necessary infrastructure to facilitate flow meter isolation, drain down and re-charge of the pipeline for flow meter maintenance or replacement. Existing network infrastructure such as isolation valves, air valves and scour valves may be utilised for this function, subject to acceptance by Seqwater.

3.13. Electrical & Control

Flow meters shall operate from a 24VDC power supply and be supported by a 24VDC uninterruptable power supply (UPS).

All flow totalisations must use the flowmeter to perform totalisation and achieve a maximum transmission error of ± 0.5% between the transmitter and the facilities PLC and/or SCADA system. The use of a PLC or other devices to perform flow totalisation by means of flow integration or pulse quantity totalisation is not acceptable for billing purposes.

The flow meter transmitter shall communicate to the control system via suitable RS485 Modbus, Profibus or Ethernet digital communications for the purposes of operations display, alarming & revenue billing. Ethernet may only be used as an option for standalone billing meters with no plant control functions.

At a minimum, the following values shall be communicated from the flowmeter's transmitter without manipulation:

- Instantaneous Forward Flow
- Instantaneous Reverse Flow
- Forward Volume Total
- Reverse Volume Total
- Instrument Fault

When flowmeter signals are used additionally for non-billing purposes, hardwired signals to a PLC shall be used. Hardwired signals are as follows and should be selected as fit for purpose for the application, as required:

- Instantaneous Forward Flow (Analogue 4-20mA)
- Instantaneous Reverse Flow (Analogue 4-20mA)
- Instantaneous Forward/Reverse Flow (Analogue 4-20mA)
- Forward/Reverse Flow Direction Indication (Digital 24VDC)
- Instrument Fault (Digital 24VDC)

Where any flow meter is not installed in accordance with this specification, only manual totalisation readings, taken directly from the flow meter display, may be used for billing purposes.

For bi-directional meters, instantaneous flow and totalisation reporting may be achieved by assigning a polarity to each flow direction with the normal flow direction being positive. Where the installation's flow direction is operationally selectable (reverse flow is not abnormal), the northerly flow in a predominantly north-south line or the easterly flow in a predominantly east – west line will be assigned as +ve flow.

The sensor cable length between the electromagnetic sensor and the remote mounted transmitter shall be as short as practicable and no greater than 50m. A deviation for increased cable length will be considered where the actual absolute minimum water conductivity, from historical records, is known.

Electrical and control works shall comply with the following Seqwater Engineering Standards:

- *Engineering Standard E-SPE-STD-001 Electrical Design and Construction*
- *Engineering Standard E-SPE-STD-002, Instrumentation*
- *Engineering Standard I-SPE-STD-013, Control System Design and Construction*

Where a requirement under this Engineering Standard conflicts with a requirement from a specification in the above list, the requirement within this Engineering Standard shall apply.

3.14. Commissioning

The flow meter shall be commissioned in accordance with the Seqwater *Procedure M-PRO-STD-001, Commissioning of Electromagnetic Flow Meters for Potable Water*. Commissioning tasks shall be documented in accordance with *Template M-TMP-STD-003, Electromagnetic Flow Meter Commissioning ITP Template*.

3.15. Operation and Maintenance Documentation

Configuration software backup or configuration details for the flow meter shall be provided to Seqwater.

Asset details shall be submitted in accordance with *Procedure X-PRO-STD-010 Asset Information Requirements.*

Billing meter Point Change Request form shall be submitted in accordance with PRO-02338 Metering and Billing Management Process Maps Procedure.

An operation and maintenance manual shall be supplied for all equipment.

4. Definitions & Abbreviations

Table 3 Definitions

Term	Definitions
Bulk Supply meter	A water meter nominated as a revenue meter for bulk water.
Calibrated Accuracy	The worst-case accuracy over the specified flow range, measured under optimum factory laboratory conditions, with respect to a value measured using approved calibration techniques.
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract with a defined scope of work.
Design Life	The design life of equipment is the period of time during which the item is expected by its designers to provide the required functionality and availability, for the specific operating conditions.

Term	Definitions
Flow meter	An instrument intended to measure, memorise, and display volume of water passing through the measurement element or transducer at metering conditions. In this Engineering Standard, a flow meter is also referred to as a water meter.
Flow meter series	A group of flow meter having the same meter product prefix number (e.g., 23XX) and transmitter, only differing in size.
Limiting Condition	An extreme condition, such as flow rate, temperature, pressure, humidity, or electromagnetic interference, that a water meter is required to withstand without damage, and without degradation of its error of indication, when it is subsequently operated within its rated operating conditions.
Seqwater Engineering Standard	Includes Standard Procedures and Standard Specifications and associated supporting documents such as Standard Drawings, Guidelines, Lists, Datasheets, Manuals, Registers, and Templates.
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufacturers or supplies equipment to meet the specifications of the Contractor.
Maximum Permissible Error (MPE)	The extreme value of measurement error, with respect to a known reference quantity value, permitted under NMI R 49 / OIML R 49 for a given meter during pattern approval testing. (Sum of the indicated error and all test uncertainties)
Owner / Principal / Seqwater	The entity that engages the Contractor to undertake the work and takes custody of the outcome. The Owner may delegate responsibilities to other entities to act on its behalf (e.g. a consultant).
REX	Seqwater Electronic Document and Records Management System.
Scope of Works	The scope of works document forming part of the contract, including supporting design documentation.
Seqwater Approval / Agreement / Acceptance	Written sign-off gained via the deviation process, as detailed in *Procedure X-PRO-STD-008 Asset Standards Management and Application.*
Seqwater Engineering Standard	Includes Standard Procedures and Standard Specifications and associated supporting documents such as Standard Drawings, Guidelines, Lists, Datasheets, Manuals, Registers, and Templates.
shall / must	Indicates a mandatory requirement.
should	Indicates a recommendation.
This Engineering Standard	Engineering Standard *M-SPE-STD-006 Bulk Supply Meters for Potable Water (SPE-00322)*
Verification	A check that the flow meter's coils, communications, and other accessible parameters are still operating within +/- 1% the original factory setpoints by the flow meter's manufacturers, third party certified, verification tool.

The following abbreviations (Table 4) apply to this Engineering Standard.

Table 4 – Abbreviations

Abbreviation	Description
AS/NZS	Australian/New Zealand Standard
CFD	Computational Fluid Dynamics
DN	Nominal diameter
ILAC-MRA	International Laboratory Accreditation Cooperation – Mutual Recognition Arrangement
I/O	Input/output
I.D.	Internal Diameter
MPE	Maximum Permissible Error
NATA	National Association of Testing Authorities, Australia
NMI	National Measurement Institute, Australia
OMIL	International Organization of Legal Metrology
PLC	Programmable logic controller
QLD	Queensland
UPS	Uninterruptable power supply
WSA	Water Services Association
WSAA	Water Services Association of Australia

5. Roles and Responsibilities

Table 5 Roles and Responsibilities

Role	Responsibility
Leaders	In addition to the responsibilities of a worker, ensure compliance with this Standard Specification by those they lead.
Workers / Employees	Be aware of and comply with this Standard Specification
Principal Engineering Standards and Assurance – P6255	Responsible for implementation and management of this Standard. Accountable and responsible for receipt and management of drawings.
General Manager Engineering Standards and Assurance - P7990	Accountable for implementation and management of this Standard.
Seqwater Project Manager	Accountable and responsible for implementation of this Standard as a whole. Some works may be delegated as appropriate.

6. References and Related Materials

The documents listed in Table 6 below, and the requirements therein, are relevant to this Standard Specification In their latest editions, these documents form a part of this document. Note that this is not an exhaustive list of documents relevant to the works.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this document, the complete list of Seqwater Engineering Standards should be reviewed to ensure currency and applicability for the proposed works.

Table 6 - References and Related Material

Description	Location
D-DWG-STD-029 Standard Drawing - Flowmeter Pit (DN 600 and Larger) General Arrangement	REX & Waternet
D-DWG-STD-033 Standard Drawing - Typical Pit Information	REX & Waternet
PRO-01617 Procedure X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance	REX & Waternet
PRO-01845 Procedure M-PRO-STD-001 Commissioning of Electromagnetic Flow Meters for Potable Water Supply	REX & Waternet
PRO-01872 Procedure X-PRO-STD-002 Engineering Drawing Numbers	REX & Waternet
PRO-01873 Procedure X-PRO-STD-001 Asset Standards Documentation Classification and Naming Structure	REX & Waternet
PRO-01874 Procedure X-PRO-STD-004 Development and Review of Asset Standards	REX & Waternet
PRO-02140 Procedure X-PRO-STD-013 Engineering Technical Hazard Study	REX & Waternet
PRO-02187 Procedure X-PRO-STD-007 Drawing and Spatial Data Standards	REX & Waternet
PRO-02190 Procedure X-PRO-STD-006 Equipment Numbering and Naming Convention	REX & Waternet
PRO-02205 Procedure X-PRO-STD-008 Asset Standards Management and Application	REX & Waternet
PRO-02234 Procedure X-PRO-STD-015 Management of Change – Technical	REX & Waternet
PRO-02338 Metering and Billing Management – Process Maps Procedure	REX & Waternet
REG-01074 Register X-LST-STD-001 Seqwater Preferred Equipment List	REX & Waternet
SPE-00352 Engineering Standard E-SPE-STD-001 Electrical Design and Construction	REX & Waternet
SPE-00353 Engineering Standard E-SPE-STD-002 Instrumentation	REX & Waternet
SPE-00361 Engineering Standard I-SPE-STD-013 Control Systems Design and Construction	REX & Waternet
SPE-00367 Engineering Standard M-SPE-STD-001 General Mechanical	REX & Waternet
SPE-00434 Engineering Standard M-SPE-STD-009 Flow Meters	REX & Waternet
TEM-00153 Template M-TMP-STD-003 Electromagnetic Flow Meter Commissioning ITP	REX & Waternet
TEM-00224 Template X-TMP-STD-022 Asset Standards Deviation Request	REX & Waternet

Description	Location
AS 4020 Testing of products for use in contact with drinking water Australian and International Standards Web Service	SAI Global
AS 4087 Metallic flanges for waterworks purposes Australian and International Standards Web Service	SAI Global
AS 4312 Atmospheric corrosivity zones in Australia Australian and International Standards Web Service	SAI Global
AS 60529 Degrees of protection provided by enclosures (IP Code) Australian and International Standards Web Service	SAI Global
AS ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories. Australian and International Standards Web Service	SAI Global
NMI R 49-1 Water meters for cold potable water and hot water, Part 1: Metrological and technical requirements Note: NMI R 49-1 is adapted by the Australian National Meter Institute (NMI) from OIML R 49-1, published by the International Organisation of Legal Metrology.	National Measurement Institute (Australia)
OIML R 49-1 Water meters for cold potable water and hot water, Part 1: Metrological and technical requirements	International Organisation of Legal Metrology
Queensland - Bulk Water Supply Code - 1 January 2013	REX
WSA 109 Industry standard for flanged gaskets and O-rings (Water Services Association of Australia)	Water Services Association of Australia

7. Changes from previous version

This Standard Specification will be regularly reviewed in accordance with the requirements of the Seqwater Controlled Document Management Procedure. Reviews will include consideration of suggestions for alteration or improvement made in accordance with Seqwater *Procedure X-PRO-STD-004 Development and Review of Asset Standards*. Changes made from the previous version are summarised in Table 7 below.

Table 7 Changes from previous version

Section Number	Change
3.1	Table 1 and prior paragraph added for clarity of calibration flow points
3.11 (paragraph 3)	Allowable bore mismatch corrected to +/- 5% (previously incorrectly listed as +/- 5mm.)
3.11 (paragraph 3)	Reducer wall angle 4 deg maximum added. (As per flow meter manufacturers specification)
3.12	Standard drawing number references updated.
Table 6	Standard drawing number references updated.
All	Document format updated to the latest version.