Engineering Standard

M-SPE-STD-006

Bulk Supply Meters for Potable Water

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SOURCE STORE SUPPLY

Version History

Rev	Date	Description	Author	SME	Owner	Approver
4	19/01/2022	Minor Review	Greg Field	Santhosh Jambagi	Geoff Simmers	Matthew McCahon
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1 Purpose

Seqwater Engineering Standards 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 and safe.

This Engineering Standard 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 Engineering Standard is not intended to be relied upon 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 *M-SPE-STD-009* and M-SPE-STD-007 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*, shall take precedence over M-SPE-STD-009, 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 *X-LST-STD-001, Seqwater Preferred Equipment List*. Seqwater's Commercial Manager approved the recommended preferred equipment that resulted from the open market procurement process.

2 Application of Engineering Standard

This Engineering Standard applies to all Seqwater employees, suppliers, contractors 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 Asset Standards and project specific documents to define the technical requirements for infrastructure design and construction.

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, at all times the designer remains responsible for ensuring infrastructure designed is fit for purpose and safe to construct, operate, maintain, and demolish. In doing so 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 WSAA). 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 the requirements in this standard requires written agreement from Seqwater as per the deviation process detailed in Procedure X-PRO-STD-008 Asset Standards Management and Application. This process includes completion of an Asset Standards Deviation Request Form and submission via the Seqwater Project Representative (for external parties) or via Seqwater's Engineering Mailbox (engineering@seqwater.com.au) (for internal parties).

Where noted in this Engineering Standard that Seqwater approval or acceptance shall/must be sought, approval or acceptance must be gained through the Seqwater Asset Standard Deviation process, as identified 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 assets. This includes modifications to the functional design of the asset including technical changes made which would extend an asset outside of its design operating envelope and/or approved operation and maintenance practices.

In the case that it is identified that a specific requirement within this Engineering Standard does not meet the requirements of project specific documents, another Seqwater Asset Standard or Australian Legislation, Standards, Codes or Guidelines, the conflict must be brought to the attention of the Seqwater Principal Engineering Standards and Assurance (or their delegate) via the Engineering Mailbox, and written agreement must be gained prior to application of the requirement.

Advice must be sought from Seqwater to clarify any ambiguities regarding this Engineering Standard.

Seqwater undertakes regular updates of Asset Standards. Before utilising this Engineering Standard, the complete list of Seqwater Asset Standards should be reviewed, to ensure currency and applicability of standards applied to the works.

3 Definitions

The following definitions (Table 3-1) apply to this Engineering Standard.

Table 3-1 – 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 and 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.
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.

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)
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., 21XX) and transmitter, only differing in size.
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 / Acceptance	Written sign-off gained via the deviation process, as detailed in X-PRO-STD-008 Asset Standards Management and Application.
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
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.

4 Abbreviations

The following abbreviations (Table 4-1) apply to this Engineering Standard.

Table 4-1 – Abbreviations

Abbreviation	Description
AS	Australian Standard
DN	Nominal diameter
ILAC-MRA	International Laboratory Accreditation Cooperation – Mutual Recognition Arrangement
I/O	Input/output
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
UPS	Uninterruptable power supply
WSAA	Water Services Association of Australia

5 Reference Documents

The documents listed in Table 5-1 and Table 5-2, and the requirements therein, are relevant to this Engineering Standard. In their latest editions, these documents form a part of this Engineering Standard. Note that this is not an exhaustive list of documents relevant to the works.

Table 5-1 – Reference Seqwater Documentation

Asset Standard Document Number	Document Title	Seqwater Controlled Document Reference
E-SPE-STD-001	Electrical Design and Construction Engineering Standard	SPE-00352
E-SPE-STD-002	Instrumentation Engineering Standard	SPE-00353
I-SPE-STD-013	Control Systems Design and Construction	SPE-00361
M-PRO-STD-001	Commissioning of Electromagnetic Flow Meters for Potable Water Supply Procedure	PRO-01845
M-SPE-STD-001	General Mechanical Engineering Standard	SPE-00367
M-SPE-STD-009	Flow Meters Engineering Standard	SPE-00434
M-TMP-STD-003	Electromagnetic Flow Meter Commissioning ITP Template	TEM-00153
	Metering and Billing Management – Process Maps Procedure	PRO-02338
S-DWG-STD-001	Standard Drawing – Flowmeter Pit (DN 600 and Larger) General Arrangement	-
S-DWG-STD-005	Standard Drawing – Typical Pit Information	-
X-LST-STD-001	Seqwater Preferred Equipment List	REG-01074
X-PRO-STD-004	Development and Review of Asset Standards Procedure	PRO-01874
X-PRO-STD-008	Asset Standards Management & Application Procedure	PRO-02205
X-PRO-STD-009	Engineering Design, Review and Approval Procedure	PRO-01617
X-TMP-STD-022	Asset Standards Deviation Request Template	TEM-00224

Table 5-2 – Reference External Standards, Specifications and Codes

Standard/Specification	Document Title
AS 4020	Testing of products for use in contact with drinking water
AS 4087	Metallic flanges for waterworks purposes
AS 4312	Atmospheric corrosivity zones in Australia

Standard/Specification	Document Title
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories.
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.
OIML R 49-1	Water meters for cold potable water and hot water, Part 1: Metrological and technical requirements
-	QLD Bulk water supply code, Department of Regional Development, Manufacturing and Water
WSA 109	Industry standard for flanged gaskets and O-rings (Water Services Association of Australia)

6 Technical Requirements

6.1 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, $Q_2 \leq Q \leq Q_4$, 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, $Q_1 \leq Q < Q_2$, 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:

- Q_1
- Q_2
- $0.35 * (Q_2 + Q_3)$
- $0.7 * (Q_2 + Q_3)$
- Q_3

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 rounding up 2.5 m/sec calculated flow rate to the nearest flow rate specified in NMI/OMIL R49 section 4.1.3.

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.

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 falls outside the limits of NMI R49 testing limits 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.

6.2 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, must also be adhered to for existing infrastructure.

6.3 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 1% of 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 if necessary, and re calibrated in a suitable NATA / ILAC-MRA certified laboratory or replaced.

6.4 Contact with Potable Water

The internal liner to the flow meter shall have certification to the requirements of *AS/NZS 4020* or, with prior approval from Seqwater water quality team, an equivalent international standard.

6.5 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.

6.6 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.

6.7 Flanges & Gaskets

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

6.8 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.

6.9 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 where these are required as specified within M-SPE-STD-004, Protective Coatings.

6.10 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 Q_2 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 Q_1 and Q_2 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 Q_2 of the selected flow meter. Operating flow rate below Q_2 should be minimised as much as practicable. The estimated volume which will be transferred below Q_1 and Q_2 flows shall require the approval of Seqwater.
- For any installation, consideration must also 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 Q_3, except for short periods up to Q_4.

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 Q_2. 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 Q_2 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.

6.11 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 flow meter internal diameter shall be matched within ± 5mm of the internal diameter of the adjoining pipeline. This is particularly relevant to cement lined pipes. 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, pipe diameter reduced to match the selected flow meter diameter with a reducers and expander, approved by the flow meter

manufacturer, 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 predominantly downstream side.
The designer shall consider associated infrastructure disturbance on uniform flow generation. Disturbance generation include associated infrastructure, such as pumps, reducers, expanders, 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 will 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.

6.12 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:

- *S-DWG-STD-001, Flowmeter pit (DN 600 and larger) general arrangement*
- *S-DWG-STD-005, Typical pit information*

Generally, the requirements of *S-DWG-STD-001* 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 6-1.

Table 6-1 – Required accessible pipe length for clamp-on ultrasonic flow meter

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.

6.13 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.

Instantaneous flow 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. The cable length shall be no more 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:

- *E-SPE-STD-001, Electrical Design and Construction*
- *E-SPE-STD-002, Instrumentation*
- *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.

6.14 Commissioning

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

6.15 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 X-PRO-STD-010 Asset Information for Project Managers, Contractors and Suppliers.

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.

7 Changes from previous version

This Engineering Standard will be regularly reviewed and updated, including the consideration of requested alterations, in accordance with Seqwater Procedure *X-PRO-STD-004, Development and Review of Asset Standards*.

Table 7-1 – Changes from previous version

Section Number	Change
All	Specification format updated to the latest version.
All	Minor wording and grammar changes for clarity.
6.1	Calibration requirement redefined to suit manufacturers capabilities.
6.8	Minimum fluid conductivity requirement increased.
6.9	Corrosivity requirements referenced to M-SPE-STD-004 .
6.13	Electrical communications and cable length updated.

8 Verification

Compliance with this document may be verified by internal audit.

9 Further Information

For further information please contact the owner of this document.

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