Draft Water Metering Code

April 2022, Version 1.2

D2022/19016

PowerWater

Foreword

The Water Metering Code (the Code) sets out the rights and responsibilities of customers and Power and Water Corporation (Power and Water) in relation to the metering of potable water, non-potable water and effluent reuse.

The Code implements the requirements of Power and Water's license under the Water Supply and Sewerage Services Act, 2000 (the Act) and must be approved by the Utilities Commission.

The Code applies to all meters used to measure potable water, non-potable water or effluent reuse used for trade (e.g. retail sale). As all the aspects relating to metering and associated metering systems cannot be detailed in a single Code, a generic framework is provided in order to facilitate managing future changes in metering technologies.

Sections of the Code may be amended from time to time following specific requests from a customer, the Utilities Commission, or as deemed appropriate by Power and Water. The Utilities Commission must approve all amendments and revisions to the Metering Code.

The Code provides customers with confidence that they are being fairly and equitably charged for potable water, non-potable water and/or effluent reuse purchased from Power and Water.

Rev	Date	General Description	Prepared	Reviewed	Endorsed
1	13/01/22	Draft Water Metering Code	F Richards, J Ciarla	D Chin	N Islam, M McGregor
1.1	4/03/22	Final Water Metering Code	F Richards, J Ciarla	D Chin	N Islam, M McGregor
1.2	4/04/22	Template updated	F Richards, J Ciarla	D Chin	N Islam, M McGregor
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Contents

1 Definitions

Term	Definition
The Act	The Water Supply and Sewerage Services Act, 2000.
The Code	Power and Water Corporation's Water Metering Code – this document.
Customer Contract	Power and Water Corporation's Customer Contract, 2020.
Error curve	A relationship that represents the relative measurement error of the meter over its flow range.
Error decay	A relationship that represents the relative measurement error over time.
Measuring Instruments Directive	A directive by the European Union (EU), which seeks to harmonise many aspects of legal metrology across all member states of the EU.
Mechanical meters	A meter technology that extracts energy from the flowing water in order to achieve a measurement such as piston/volumetric, single-jet, multi-jet and turbine/Woltman/inferential meters.
Metrological Quality Description Ratio (R)	A metrological classification that describes the flow range capability of the meter as a ratio (R) which is the permanent flowrate (Q_3) divided by the minimum flow rate (Q_1) (e.g. $R= Q_3 / Q_1$).
National Measurement Institute (NMI)	The Australian Government's national authority on measurement that: • Develop and maintain national measurement standards that are recognised internationally; • Deliver world-class measurement products, advice and client services; and • Administer the regulatory framework for measurement.
Non-registration	The volumetric proportion of flow that is not measured by the meter occurring between zero flow and the starting flow rate of a meter
Pattern approval	Documented approval granted by a National Service of Legal Metrology confirming that a water meter design and associated performance complies with the mandatory requirements of the relevant international or equivalent national standard for that type of water meter.
Permanent flowrate (Q_3) -	Highest flowrate within the rated operating conditions, at which the water meter is required to operate in a satisfactory manner within maximum permissible error.

Term	Definition
Solid state electronic meters (smart meters)	A meter technology that adds energy to the flowing water in order to achieve a measurement such as ultrasonics (e.g. Doppler and time-of-flight), electromagnetic (pulsed direct current and alternating-current) and remnant magnetic field meters.
Starting flow rate (Q_{start})	The lowest flow rate at which the meter is able to register a flow passing through it.
Under-registration	The volumetric proportion of flow that is registered by the meter with a negative measurement error.
Used for trade	As defined by the National Measurement Act 1960, used for trade means the use of a measuring instrument for either: a) Determining the consideration in respect of a transaction; or b) Determining the amount of a tax
Weighted relative error	The relative error (of indication) weighted in accordance with usage (demand) patterns.

2 Introduction

2.1 Background

Power and Water provides water and sewerage services to 19 Urban and 72 Remote centres across the Northern Territory. In order to be economically sustainable and support future growth, a water utility provider must charge for the services supplied in a fair and equitable way, commonly through metering. As a result, Power and Water has developed this Code.

2.2 Purpose

The primary purpose of the Code is to set out the rights and obligations of customers and Power and Water in relation to metering of water services in the Northern Territory. The Code applies to all users where potable water, non-potable water and/or effluent reuse is metered for billing purposes. The secondary purpose of the Code is to comply with legislative requirements for license holders under the Act.

2.3 Legal basis

2.3.1 Australian metrological requirements

Meters that are 'used for trade' shall comply with the provisions and requirements of the National Measurement Act (1960), as administered by the National Measurement Institute (NMI-R 49-1, 49-2 and 49-3, 2015) specifications and codes, in conjunction with Australian Standards AS 3565. Exemptions for certain classes of meters from pattern approval requirements shall be in accordance with the National Trade Measurement Regulations 2009.

2.3.2 Water Supply and Sewerage Services Act

Power and Water is licensed by the Utilities Commission under the Act, to provide services in the Northern Territory. Section 72 of the Act states:

> (1) A licensee must develop and publish a code setting out the arrangements and conditions for installing, testing, verifying and replacing meters owned by the licensee;
>
> (2) A metering code must be approved by the Utilities Commission; and
>
> (3) A metering code must be in accordance with guidelines published by the National Standards Commission.

2.3.3 Guidelines and codes

Guidelines and codes whilst not necessarily mandatory can assist in facilitating a standardised approach to metering. Water Services Association of Australia (WSAA) Codes of Practice and Publications for metering are examples of these non-mandatory guidelines and codes.

2.4 Scope

2.4.1 Approach

This document identifies national standards and requirements for water meters, addresses Power and Water's installation requirements and specifies it's testing and meter replacement requirements. The Code also outlines the responsibilities of Power and Water and its customers in relation to the supply, installation and maintenance of equipment, and Power and Water's rights of unfettered access to metering points. The Code also promotes consistency between the Customer Contract, Customer Charter, metrological regulations, installation standards and meter procurement requirements.

The Code applies to all meters used to measure potable water, non-potable water and effluent reuse used for trade (e.g. retail sale). As all the aspects relating to these meters and associated metering systems cannot be detailed in a single Code, a generic guide is provided in order to facilitate managing future changes in metering technologies.

2.4.2 Limitations in current regulations

The Code is guided by the core concepts of a metrological assurance framework and consideration of the pathway along which the data progresses, from capture through to its ultimate use. This approach provides a generic guide that facilitates identification of and addressing potential anomalies and limitations in the current regulatory framework and practices. Examples of these related limitations that are addressed by this Code include the following:

a. In-service compliance requirement for the 'four-flow' testing method specified in AS 3565.4 is less accurate in estimating the weighted relative error than the WSAA Compliance Testing of In-Service Water Meters code of Practice (WSA 11) 'six-flow' testing method for DN 20 meters that gives a more accurate estimate of weighted relative error;
b. AS 3565.4 and WSA 11 require data logging end-use surveys to establish the water demand (usage) patterns for the larger meters in order to correctly determine the weighted relative error;
c. The methodologies adopted to estimate the error degradation/decay relationship of the sample of meters removed and tested in accordance with AS 3565.4 as well as establishing its statistical significance are not detailed in the Standards;
d. Metrological compliance and certification of the measuring device itself does not necessarily imply that the data conversion and transfer system will achieve the specified level of accuracy;
e. Typical planning requirements for selecting and sizing meters based on the maximum flow rates does not necessarily select the optimal meter resulting in increased under-registration. Over sizing meters also increases the potential for corrosion and water quality issues related to stagnant water;

f. Pattern approval is an essential requirement however, in itself this certification does not necessarily account for, nor convey all the benefits and limitations of a particular meter or its related systems; and

g. Australian pattern approval requirements refer to meters with $Q_3 \leq 16kL/h$ which means that different makes and types of meters could have the same diameter (DN) but due to improved performance of some types of meters it would exclude them from requiring local pattern approval.

2.5 Objectives

The objectives of the Code is to:

- Adopt consistent metering practices by Power and Water;
- Promote confidence in data obtained and used for billing & management purposes;
- Set out the responsibilities of Power and Water and its customers;
- Specify minimum technical, design, and operational requirements for metering and data management;
- Encourage best practice by Power and Water and its customers;
- Provide a sound metering foundation that encourages fair and equitable billing practices; and
- Allow for advances in metering technology that clearly demonstrate compliance with this Code, improvements in environmental protection and water efficiency as well as health and safety.

3 Quality assurance approach

3.1 Metrological Assurance Framework (MAF)

The Metrological Assurance Framework (MAF), as a quality assurance approach, shall be applied such that each process within the meter's lifecycle is to be scrutinised and purposely managed to ensure that confidence is maintained throughout the meter's design life. Records shall be kept of all assessments completed with inclusions and exclusions related to each process stage of the MAF listed in Table 1. The assessment is to include consideration of risks associated with in-service compliance, revenue losses and apparent water losses.

Table 1: Metrological Assurance Framework (MAF) stages

Stage	Description	Assessment process & minimum records	Relevant sections
Stage 1	Lifecycle Assessment	Benefit cost analysis and NPV analysis.	Section 3.1.1
Stage 2	Sizing and Selection	The largest Metrological Quality Description Ratio (R); The meter size compared to the pipe size.	Section 3.1.2
Stage 3	Procurement	Standardised tender response criteria	Section 3.1.3
Stage 4	Installation	Minimisation of the installation's footprint & head loss.	Section 3.1.4
Stage 5	Operations, Maintenance & Testing	In-service compliance testing.	Section 3.1.5
Stage 6	Decommissioning	Safe battery disposal plan and meter disposal.	Section 3.1.6

3.1.1 Meter lifecycle assessment

As lifecycle assessment also facilitates the selection of the optimal meter for a particular application, records relating to certifications and approvals from national and international metrological organisations are to be obtained and copies kept. Financial assessment techniques such as benefit cost analysis and Net Present Value (NPV) analysis are to be undertaken for new meter types with the objectives of apparent loss minimisation, revenue maximisation, in-service compliance and lifecycle cost minimisation.

3.1.2 Meter selection and sizing

This quality assurance approach is to be adopted to facilitate the correct selection of meters for a particular application and to ensure they operate within their specified error limits. Risk assessments of the meter's

product supply chains as well as of the metering technologies are to be undertaken to minimise the potential of meter failures and data errors.

The commonly adopted method of meter sizing based on loading units for different types of terminal plumbing fixtures generally estimates peak flows and does not consider the lower flows. This may result in the over-sizing of meters for customers with irregular water usage. End-use logging exercises can be carried out for large customers or customers with unusual demand patterns. The sizing of larger (commercial) meters according to terminal plumbing fixture's loading shall include consideration for the uncertainty associated with on-site flow conditions as follows:

- Select the metering technology with the largest Metrological Quality Description Ratio (R);
- Where low flow conditions are anticipated, down-size the meter by a standard size from the pipe design sized according to loading units (e.g. DN 100 down to DN 50, etc.); and
- Considerations for firefighting and domestic metering separation.

3.1.3 Procurement

Tender documentation is to include a standardised response questionnaire as part of the mandatory requirement for all meter vendors to complete for each meter type, model and size offered. This facilitates the adjudication process and minimises ambiguities that can occur with the large variety of documentation that can be submitted by tenderers.

3.1.4 Installation

The meter installation is not to adversely affect the meters performance and service life, leading to under-registration and/or failure of the meter. Installations are required to include the correct orientation, ensuring stable hydraulic conditions, allowance for isolation valves (both before and after the meter), provision for backflow prevention and protection of the installation. The location, installation and protection of water meters are to be generally in accordance with AS/NZS 3500 and specifically to the standard drawings available from Power and Water.

Notwithstanding these requirements the installation is to be designed to achieve minimisation of hydraulic head (pressure) loss through the installation.

A typical DN100 and DN150 meter arrangement can be found in Attachment A.

3.1.5 Operations and maintenance

Water meter installations are required to be inspected and maintained that includes, cleaning of strainers, repairing leaks, replacing register covers, exercising of air and isolation valves and backflow prevention

devices. During the manual reading of meters, meter readers are to note any faults on the metering installation requiring further action.

A sample size will be taken as part of an annual audit of large meter installations (DN50 to DN200) to determine the condition of the installations and inform the scheduling of routine maintenance (including valve operations and flushing). In-service requirements are described in detail in Section 7.1

3.1.6 Decommissioning

All meters decommissioned are to be recorded, made in-operable and disposed of in a compliant and environmentally beneficial manner. Decommissioning compliancy includes batteries in battery powered meters. All other water meters are to be disposed of as scrap metal with the intent to recycle.

3.2 Data chain/pathway assessment

Errors are introduced through the various stages of the data pathway from its capture, transmission, conversion, manipulation and reporting. Technologies required to convey and convert this data are to be assessed to the degree with which they introduce anomalies and uncertainties in the resultant customer accounts.

Emphasis should be placed on systems that ensure data integrity.

Meters and metering systems that rely on electronic adjustment of the measured volumetric amounts displayed or transmitted using algorithms that contradicts the metrological certification requirements are not permitted as they do not encourage fair and equitable billing practices.

The following are recommended to encourage best practice in this regard:

- Use of integrated solid state meters to avoid conversion errors;
- Conversion of mechanical totaliser to an electronic signal shall be with an inductive emitter or a fully electronic encoder; and
- Post-measurement adjustments to volumetric amounts to compensate for errors associated with a particular type of meter shall not be permitted.

4 Code compliance

4.1 Meter standards

Materials, techniques, testing, workmanship and finish throughout shall comply with the provisions and requirements of the Australian Standards, AS 3565.4. Where no Australian Standard exists, materials, testing, techniques, workmanship and finish throughout shall comply with the provisions and requirements of:

- International Standards Organisation (ISO);
- Organisation International of Legal Metrology (OIML); and
- International Electrotechnical Commission (IEC).

4.2 Compliant installations

An individual metering installation is compliant with this Code when it meets all of the following requirements:

- The installed meter(s) are pattern approved and verified in accordance with the requirements of the National Measurement Institute (NMI) for meters with $Q_3 \leq 16$kL/h (refer to Table 2);
- Meters and ancillary equipment are approved and installed in accordance with the relevant Power and Water specifications and standard drawings;
- Access to the metering installation is readily available to authorised Power and Water officers and contractors; and
- The installation is maintained and meters are tested in accordance with Table 2.

Metering points installed prior to the introduction of the Code shall be deemed compliant, provided they fully comply with the requirements of the day. However, any new or upgrades to an existing installation must be fully compliant to the Code.

Meter replacement is not considered a new installation or upgrade.

4.3 Non-compliant installations

Where an installation is found to be non-compliant with the Code and that non-compliance is the responsibility of Power and Water, the installation will be made compliant within 90 days.

Where the non-compliance is the responsibility of the customer, the customer will be advised in writing and required to rectify the non-compliance within 90 days. Failure to do so may result in restriction of supply.

Power and Water will make appropriate adjustments to customers' accounts to take account of any metering data errors resulting from non-compliance.

Where meter installation standards change, existing installations shall be deemed compliant with the Code provided they fully comply with the requirements of the day.

Where in-service compliance testing results in a population of meters failing replacement criterion in Section 7, Power and Water will program replacement of that population.

5 Metrological requirements

The following are applicable to the implementation of Australian Metrological Requirements:

- All cold water meters installed on or after 1 July 2004 with $Q_3 \leq 4$ kL/h shall be pattern approved and verified;
- All cold water meters installed on or after 1 July 2014 with $Q_3 \leq 16$ kL/h shall be pattern approved and verified; and
- All new cold water meters with a $Q_3 > 16$ kL/h will remain exempt from pattern approved and verification in terms of Australian metrological requirements but shall be OIML R49 pattern approved in terms of one or more the following organisations as from the published date of this Code:
    - European Measuring Instruments Directive (MID)
    - National Measurement Office, UK

6 Metering installation arrangements

No water may be taken from Power and Water's infrastructure unless it has been measured by an appropriate meter as the basis for an account. Water may only be taken from designated network connection points and in compliance with backflow prevention requirements (Section 8.3). This does not apply to Fire and Emergency Services and related emergency events.

The following are the approved metering installations to take water from Power and Water's water supply network.

6.1 Standard meter types

Each meter will be capable of measuring and displaying the flow of potable water, non-potable water or effluent reuse in kilolitres. The size and type of meter will be appropriate for the individual customer's overall average consumption as well as minimum and maximum flow rates.

Meter technology will determine the optimal meter for a particular application. Guided by the Metrology Assurance Framework, new meter types will be subject to lifecycle assessment before being adopted.

Power and Water's current policy is to use positive displacement or solid state electronic type meters for DN20 to DN40, and turbine type or solid state electronic meters for larger sizes.

With the advancement of solid state electronic metering technologies, Power and Water will be moving to increase the use of this technology in its metering fleet to improve metering services to its customers, in step with other water utilities across Australia.

6.2 Metered filling points

Power and Water has a number of card operated water filling stations for use by water truck operators and other users taking bulk water supplies from Power and Water's reticulation systems. Locations of Power and Water's water filling stations is available online.

6.3 Portable meters

Portable meters may be issued by Power and Water to approved customers whose consumption is intermittent and occurs at a number of locations over time, in accordance with the Power and Water's "*Issue and Use of Portable Water Meters Procedure*" (internal document ref: CONTROL0830).

6.4 Ancillary components

All meters shall have a stop valve on the supply side of the meters, for the purpose of isolation and maintenance of the meter. It is the customer's responsibility to isolate flow on their side of the meter.

Depending on the size and type of installation, metering points may also include:

- Manifolds for servicing more than one metering point or customer;
- Backflow prevention devices including strainers;
- Non-return valves;
- Isolation valves downstream of meter (Customer's Responsibility);
- Air valves;
- Remote read-out displays and electronic outputs;
- Protective meter covers;
- Meter boxes or pits (no longer approved for new installations); and
- Protective barriers

6.5 Fire fighting

All fire services must be metered and appropriate backflow installed. The type of meter used is dependent on the type of fire service being installed and the Australian Standard design applicable to each installation. Power and Water is responsible for supplying the meter/s.

6.6 Special requirements

6.6.1 Meters for effluent reuse and non-potable water

Metering installations for non-potable or effluent reuse have a number of additional requirements than the potable supply including:

- The need for signage indicating that the installation is for effluent reuse or non-potable water;
- Painting of meters lilac in colour, not darker than P24 Jacaranda or P12 Purple and not lighter than P23 lilac as per AS/NZS 3500.1, Clause 9.6.1; and
- The inclusion of a dirt box in the installation to protect the mechanical components of the meter. These dirt boxes also need routine inspection, maintenance and cleaning.

6.6.2 Life support customers

Power and Water defines life support customers as customers who may have medical conditions that requires ongoing water supply to their property. All life support customers must be registered with Power and Water and the water meter supplying the property be painted Royal Blue B12 as per AS 2700.

7 Meter testing and replacement

Power and Water recognises the need for accurate and reliable metering to ensure customers are charged in an equitable way for the service they receive. As a result, Power and Water only uses meters approved by NMI to ensure regulatory in-service requirements are achieved. The objective of Power and Water's meter testing and replacement program is to ensure that accuracy of meters are maintained while simultaneously ensuring its implementation remains cost effective.

7.1 In-service compliance testing

7.1.1 Mechanical meters

7.1.1.1 Small mechanical meters ($Q_3 \leq 16$ kL/h)

All populations of small mechanical meters that are placed into service shall undergo compliance testing within 3 years of being placed into service. Mechanical meters shall be removed and tested in accordance with the AS 3565.4, 2007 in-service compliance testing requirements with exception that weighted relative error shall be based on WSA 11 'six flow' testing method.

The result of the 'six-flow' test to WSA 11 standards will underpin Power and Water's decisions for meter replacement programs, meter testing periods and the trial for new metering technology. Power and Water adopts Table 3 in AS 3565.4 for in-service compliance periods of DN 20 water meters. AS 3565.4 identifies the volumetric throughput based on average annual usage of a particular population and its equivalent age based on 240 kL/annum. Where the average annual usage of a particular population exceeds 240 kL/annum then a revised compliance testing period is to be determined from the increased error degradation resulting from this increased throughput. The criteria for DN 20 meters are detailed in Table 2.

Table 2: In-service compliance criteria for water meters ($Q_3 \leq 16$ kL/h)

DN20 - Criterion								
1			2			3		
Upper & lower error of sample	Compliance testing period		Upper & lower error of sample	Compliance testing period		Upper & lower error of sample	Compliance testing period	
	> 240 kL/yr	≤ 240 kL/yr		> 240 kL/yr	≤ 240 kL/yr		> 240 kL/yr	≤ 240 kL/yr
≤ ± 2.0%	1,920 kL	8 yrs	≤ ± 3.0%	1,440 kL	6 yrs	≤ ± 4.0%	960 kL	4 yrs

DN25 - Criterion								
1			2			3		
Upper & lower error of sample	Compliance testing period		Upper & lower error of sample	Compliance testing period		Upper & lower error of sample	Compliance testing period	
	> 800 kL/yr	≤ 800 kL/yr		> 800 kL/yr	≤ 800 kL/yr		> 800 kL/yr	≤ 800 kL/yr

≤ ± 2.0%	8,400 kL	8 yrs	≤ ± 3.0%	4,800 kL	6 yrs	≤ ± 4.0%	3,200 kL	4 yrs

An example is that if the 'six flow' tests for the sample of DN 20 meters pass Criteria 1 (e.g. ≤ ± 2.0%) then the population will remain in service until the totalised (e.g. counter) reaches 1,920 kL if the average annual throughput volume for the population is greater than 240 kL per annum. In this example, if the average annual throughput volume for the population is equal to 480 kL per annum, then the population will remain in service for another 4 years before requiring sampling and testing. This logic will be also adopted for Criteria 2 and 3, such that the sample of meters that fail Criteria 1 but pass Criteria 2 (e.g. ≤ ± 3.0%) will remain in service until the totaliser reaches 1,440 kL if the average annual throughput volume for the population is greater than 240 kL per annum etc.

7.1.1.2 Large mechanical meters (Q_3 >16 kL/h)

All new cold water meters with a Q_3 > 16 kL/h are exempt from pattern approved and verification in terms of Australian metrological requirements, Power and Water still requires that the accuracy of these meters are also maintained within prescribed limits. Power and Water may replace the turbine mechanism of large mechanical meters (where possible) and leave the original meter body in place.

Larger mechanical meters (i.e. Q_3 > 16 kL/h), under this Code, will be replace as per Table 3.

Table 3: Larger mechanical meter replacement schedule

Meter size (mm)	Through put replacement reading (kL)
50	250,000
80	400,000
100	600,000
150	1,000,000

Note: Replacement schedules may change due to metering improvements.

Over through-put does not apply to Electronic Magflows which are annually checked for impedance in accordance with ISO20456 Measurement of Fluid Flow in Closed Conduits, 2017.

WSA 11 Table 3.4 shall be applied for the qualifying criteria for extension to the compliance period for relative weighted error and respective volumetric throughput of large mechanical meters.

7.1.2 Solid state electronic meters

Solid state electronic meters such as electromagnetic, remnant magnetic field and ultrasonic are not subject to measurement error decay due to the wear and tear characteristics of mechanical meters. Therefore, in-service requirements of AS 3565.4 are not applicable at this point in time.

7.1.2.1 Small solid state electronic meters ($Q_3 \leq 16$ kL/h)

Small solid state electronic meter's replacement cycle will be dictated by the life of their internal battery. Small electronic meters generally have an integral internal battery with some manufacturers having replaceable batteries. A battery life of 15 years is commonly quoted, with the actual life primarily impacted by the amount of operational meter communication.

However, some electronic meters are susceptible to ad hoc random shifts in bias (e.g. systematic) errors which are detected as a trend change in water usage pattern. Some advanced solid state electronic meters overcome this problem by having an integral internal reference that continually checks and re-adjusts for any bias errors. Solid state electronic meters that do not have this self-checking capability shall be sampled according to the AS 3565.4 methodology and tested within 8 years of installation. Meters achieving an error of less than or equal to ± 4% (relative weighted error) will allow for the DN20 and DN25 meter population to remain installed for the remainder of its expected battery life.

WSA 11, Table 3.4 shall be applied for the qualifying criteria for extension to the compliance period for relative weighted error and respective volumetric throughput of small electronic meters.

7.1.2.2 Large solid state electronic meters (Q_3 >16 kL/h)

Typical routine maintenance for large solid state electronic meters are detailed in Table 4.

Table 4: Large (Q_3 >16 kL/h) solid state electromagnetic meter (EM) maintenance activities

Description	Comments
1. Routine Maintenance – Site inspections.	Annual frequency - unless manufacturer specifies more frequent. This includes servicing and calibration adjustments.
2. Routine Maintenance – Electronic fingerprinting, alarm diagnostics and drift analysis.	EM meters with electronic fingerprinting should be undertaken at time of purchase. Subsequent testing is to refer back to this initial fingerprint for comparisons. EM meters that do not have electronic fingerprinting capabilities are to be monitored for long term drift through analysis of flow data (e.g. expected mean and/or expected slope method)
3. Routine Maintenance – Battery replacements.	Frequency - Internal and external batteries are typically replaced every 3-5 years. Depends on ambient temperature exposure.

If anomalies are identified then the meter is to be removed and tested with the 'six- flow' as per WSA 11. Meters achieving an error of greater than ± 4% (relative weighted error) are not to be re-installed after testing. (Noting that this is applicable to single meters as Table 3 is relevant to the maintenance of individual meters).

7.2 Customer requested meter tests

Power and Water's Customer Contract provides the right for a customer to request a meter to be tested if they dispute the meter accuracy or a meter reading.

Customers are highly encouraged to explore all other reasons for an anomaly in water consumption before requesting a meter test.

7.2.1 NATA accredited testing

Power and Water will arrange the test by an independent NATA accredited laboratory. The customer's meter will be replaced with a new meter during the process.

The customer is responsible for paying for this test. However, the fee is refundable if the meter is proven to be over registering (i.e. error > +4%).

7.2.2 On-site volumetric comparison testing

Power and Water will also undertake free-of-charge on-site volumetric tests of water meters (for DN20 and DN25 meters only) at the request of a customer. The test involves measuring the flow through the customer meter with an in-line calibrated flow meter to compare the measured volume. The customer is encouraged to be on site for the testing.

The customer can request a NATA accredited test if the result indicates the meter could be over recording. Power and Water will replace the meter if it is ±4% in error against the calibrated meter.

7.3 Meter error decay

Mechanical meters are subject to measurement error decay resulting in under-registration and non-registration. The typical error or signature curve common to all volumetric/piston meters is illustrated in Figure 1 and the shape of the curve is similar for water meters irrespective of the manufacturer. With accumulated throughput and over time the positive displacement meter is subject to wear which results in an inability to measure the original low flows specified for new meters. Therefore, degradation occurs in the measurement error of the meter resulting in an increase in under and non-registration of volumes (e.g. apparent losses), also illustrated in Figure 1.

While error decay is typical of in-service mechanical meters, solid state electronic meters are not influenced by meter decay over time but are influenced by under-registration dependent upon the particular type of meter's low flow measurement capabilities. As solid state electronic meters are adding energy to the flowing water to operate they require a power source such as mains supply or battery. The battery life is an important factor that underpins the maintenance and replacement strategy for these types of meters.

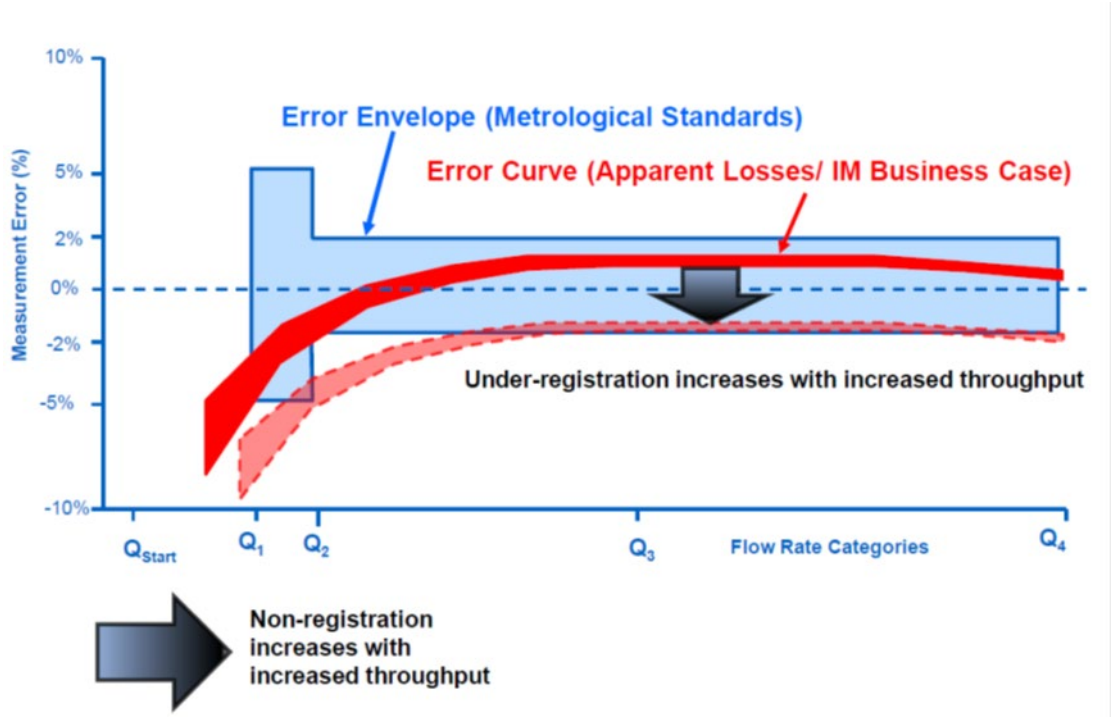


Figure 1: Mechanical meter measurement error envelope and curve

7.3.1 Relative error weightings

The accuracy of the weighted relative error estimates is dependent upon the accuracy of the typical customer's water demand (e.g. water usage) pattern. This is a weakness in the application of the current regulations in that the weightings are either assumed or unknown introducing errors into the estimates. Improved accuracies in demand profiles require an extensive end-use logging study for manually read meters and this will not necessarily produce a typical demand pattern that will represent a particular group of consumers such as commercial and industrial customers. The WSA 11 guidelines emphasise this through suggesting that weightings be adopted that better reflect the consumption profile for the specific meter population. Solid state electronic metering systems with integral data logging capabilities will provide a cost effective method of establishing demand profiles.

8 Metering installation responsibilities

8.1 New installations

Power and Water is responsible for the supply and installation of all water meters in new installations. Customers and property developers are responsible for supply and installation of all ancillary fittings and pipework beyond the meter as per Power and Water standard drawings. Customers and developers are also responsible for ensuring that both equipment and installation work meet all of the relevant requirements of this Code and AS/NZS 3500.1.

8.2 Existing installations

Power and Water is responsible for the maintenance and replacement of water meters and supply side isolation valves in existing installations, and for the supply side upstand. Customers are responsible for the maintenance and replacement of all other components including the upstand on the customer side of the meter, non-return valves and/or backflow prevention devices and isolation valves after the water meter.

8.3 Backflow prevention

Backflow prevention devices shall be installed downstream of the water meter in accordance with AS/NZS 3500.1 and maintained in accordance with AS/NZS 2845.3 by the customer. Power and Water's Backflow Prevention Manual outlines customer responsibilities and provides additional guidance on backflow prevention requirements

DN20 and DN25 water meters supplied with integral dual check valves must comply with AS/NZS 2845.1 and AS 3565.4 and are Power and Water's responsibility. They are suitable for installation on low hazard rated properties only. For services with a medium or high hazard rating, as well as those greater than DN25, a device commensurate with the hazard rating must be installed and maintained by the customer. A backflow accredited plumber is required to:

- Assess the hazard rating;
- Install an approved backflow prevention device; and
- Test annually and submit paperwork to Power and Water.

Backflow Prevention devices form an integral part of the metering assembly and in addition to preventing potential contamination, support metering accuracy by not allowing reverse flows through the meter.

8.4 Water meter ownership

Power and Water retains ownership of all water meters that it supplies.

8.5 Flow restrictor

The installation and removal of flow restrictors shall be undertaken in accordance with Power and Water's Customer Contract and Customer Charter.

9 Protection and security of metering installations

9.1 Protection of meters

Water meters are calibrated measurement devices and require some degree of protection against physical shock, maltreatment and tampering. In order to provide protection, Power and Water may require that one or more of the following measures be incorporated into the installation by the customer or property developer:

- Incorporation of protection barriers; and
- Enclosure of the installation in a meter box with a hinged lid.

9.2 Security of meters

In addition to physical protection, Power and Water may also require the following additional measures:

- Sealing and locking devices;
- Lockable covers; and
- Master keyed metering lock.

In the event Power and Water determines that unauthorised usage or tampering of water meters has occurred, the offending parties can be subjected to the penalties outlined under the 'Illegal use' of the Customer Contract.

9.3 Environmental/Operational conditions

Installations shall be designed and constructed such that they do not impose or create environmental and operating conditions that exceed the specified values for the following parameters relevant to the meter type's original pattern approval:

- Operating temperatures;
- Weathering and ultraviolet light exposure;
- Electromagnetic compatibility (EMC);
- Protection from ingress of dust and ability to be fully immersed in water;
- Vibration and shock;
- Pressure variations; and
- Damp and dry heat.

10 Metering installation access

Authorised Power and Water officers require unfettered access, at any reasonable time, to metering installations located on customer's premises for the purposes of reading, maintaining and replacing meters as per Section 74 (1) in the Act.

10.1 Personal identification

When entering a customer's property, authorised Power and Water officers will carry a current identification card at all times and are required to produce that card on request. For the purposes of this code, authorised contractors are also considered employees of Power and Water and are subject to the same requirements.

10.2 Locked premises

Where a customer wishes to lock a gateway or other means of access then that locking is to be done with a Power and Water metering master key locking system. These locks are available through Power and Water Retail offices on payment of a deposit.

10.3 Access to meters

Customers must provide Power and Water with easy access to any meter on their property. Customers are required to maintain access to the water meter so they do not become buried by garden dressing or fill, covered by concrete, paving, or inaccessible due to overgrown trees and plants.

Where any such obstruction prevents access to the meter, under Division 11 of the Act Power and Water may require the customer to remove the obstruction. Failure to remove such an obstruction may result in Power and Water undertaking the necessary work and billing the customer for the costs involved or prosecution.

10.4 Multi-unit developments

Where grouped water meters are to be located for multi-unit developments, the owner/owners' body corporate is responsible for identifying each meter with the corresponding unit as per Power and Water's requirements (meter isolation valve on assembly upstand on Power and Water's side to be clearly identified with unit number).

11 Customer complaints

Any complaint will be handled in line with the procedures set out in Power and Water's Customer Contract.

12 Application forms

Standard application forms pertaining to development activities, including request for new meters and connections, can be found on Power and Water's website or in the link below.

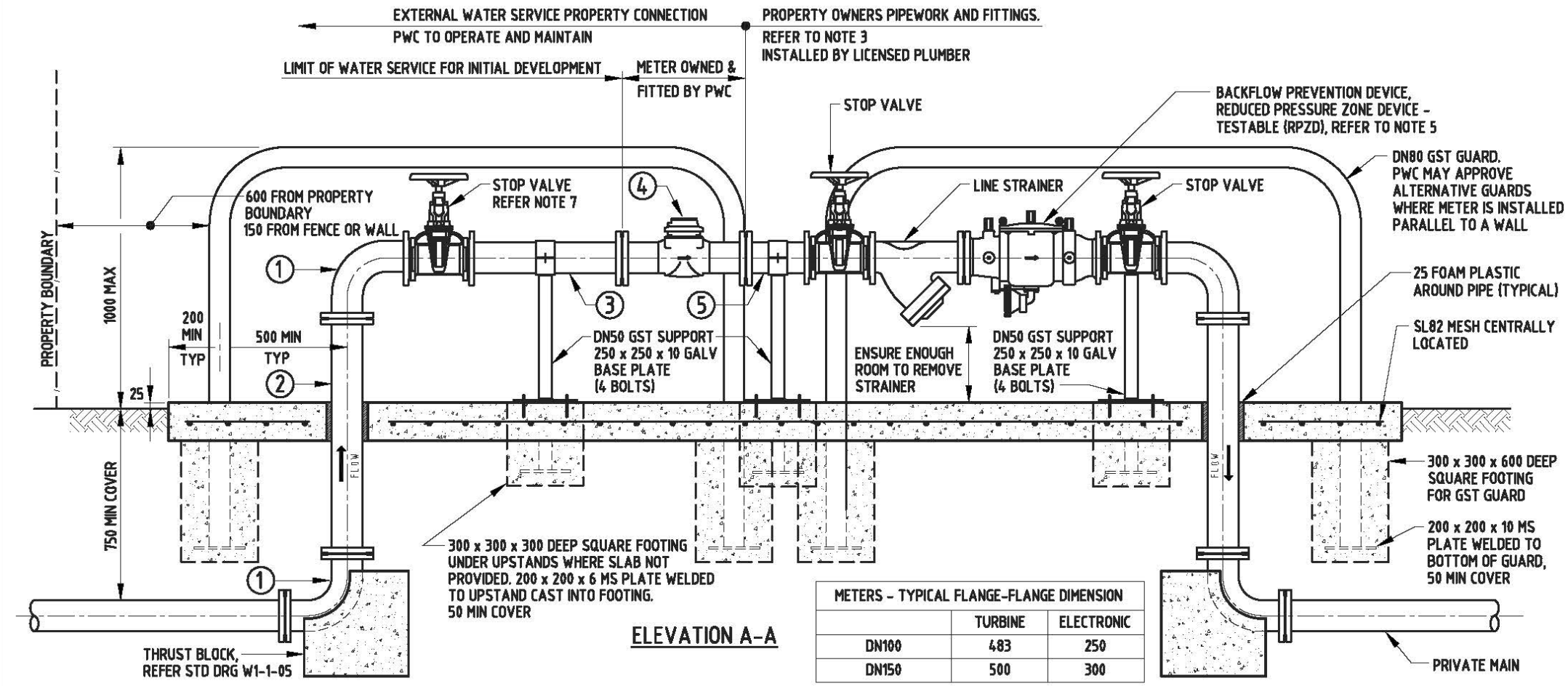
https://www.powerwater.com.au/developers/water-development/application-forms

13 References

Abbreviation	Resource
NMI-R 49-1 NMI-R 49-2 NMI-R 49-3	Australian Government – Water Meters Intended for the Metering of Cold Potable Water and Hot Water NMI R 49 (Second edition, September 2015) Part 1: Metrological and Technical Requirements Part 2: Test methods Part 3: Test Report Format
AS/NZS 3500.1	Australian/New Zealand Standard – Plumbing and Drainage, Part 1: Water Services (May 2021)
AS/NZS 2845.3	Australian Standard – Water Supply – Backflow Prevention Devices, Part 3: Field Testing and Maintenance of Testable Devices (February 2020)
AS 2700	Australian Standard – Colour Standard for General Purposes (May 2011)
AS 3565.1	Australian Standard – Meters for Cold and Heated Drinking and Non-drinking Water Supplies, Part 1: Technical Requirements (September 2010)
AS 3565.4	Australian Standard – Meters for Cold and Heated Drinking and Non-drinking Water Supplies, Part 4: In-service Compliance Testing (March 2007)
ISO20456	International Organization for Standardization, Measurement of fluid flow in closed conduits – guidance for the use of electromagnetic flow meters for conductive liquids (2017)
Backflow Prevention Policy	Power and Water – Backflow Prevention Policy – Domestic, Commercial and Industrial (2010) *Internal document ref: D2019/558047, D2019/558050*
Backflow Prevention Manual	Power and Water – Backflow Prevention Manual (2022)
Customer Charter	Power and Water – Customer Charter, Power and Water Corporation (November, 2018)
Customer Contract	Power and Water – Customer Contract, Power and Water Corporation (February, 2020)
Portable Water Meter Procedure	Power and Water – Issue and Use of Portable Water Meters Procedure, Power and Water Corporation (July 2021) *Internal document ref: CONTROL0830, D2021/79227*

Abbreviation	Resource
Trade Waste Code	Power and Water – Trade Waste Management System, Trade Waste Code, Power and Water corporation (2022)
WSA 10	Water Services Association of Australia – WSA 10 (2011) Sub-Metering Code of Practice. First Edition. Version 1.1
WSA 11	Water Services Association of Australia – WSA 11 (2012) Compliance Testing of In-Service Water Meters Code of Practice. First Edition. Version 1.1
WSA 14	Water Services Association of Australia – WSA 14 (2014) Meter Exchange Code of Practice. First Edition. Version 1.1
The Act	Water Supply and Sewerage Services Act, Northern Territory (November 2000)

Attachment A - Standard drawing for a DN100/150 water meter arrangement



METERS - TYPICAL FLANGE-FLANGE DIMENSION		
	TURBINE	ELECTRONIC
DN100	483	250
DN150	500	300

ITEM	DESCRIPTION	METER SIZE DN		NOTES	ITEM	DESCRIPTION	METER SIZE DN		NOTES
		100	150				100	150	
1	90° BEND DI FLANGE	2	2		4	METER (DN100)	1	-	METER SUPPLIED & FITTED BY PWC AFTER PAYMENT OF FEES
2	EXTENSION PIPE DI FLANGED	1	1	LENGTH DETERMINED ON SITE		METER (DN150)	-	1	
3	STRAIGHT PIPE DI FLANGED (DN100)	600mm	-		5	STRAIGHT PIPE FLANGED DN100 DI	N/A	-	DN100 TURBINE METER
	STRAIGHT PIPE DI FLANGED (DN150)	-	750mm			STRAIGHT PIPE FLANGED DN100 SS (SCH10) OR DI	230mm	-	DN100 ELECTRONIC METER
						STRAIGHT PIPE FLANGED DN150 DI	-	150mm	DN150 TURBINE METER
						STRAIGHT PIPE FLANGED DN150 SS (SCH10) OR DI	-	350	DN150 ELECTRONIC METER

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