water
NEW ZEALAND
The New Zealand Water & Wastes Association Wai ora Aotearoa

WATER NEW ZEALAND
Good Practice Guide

WATER METERING OF CUSTOMERS ON RETICULATED SUPPLIES

May 2017

Acknowledgements

The first edition of this document, titled “Water Meter: Code of Practice”, was developed by the New Zealand Water and Wastes Association in 2003, with input from Lewis Jaine, Craig Ramsay, Brian Humphrey, Rob Lorden, Jeanette Harris, Terry Collins, The Ministry of Consumer Affairs, and the Water Supply Managers Group.

The revision of this document has been undertaken on behalf of the Water Services Managers Group. We wish to thank the following members who have contributed to the document’s revision: Steve Hancock, Deeco Services Ltd; Kevin Head, AD Riley; Mark Drew, DataCol; Peter Bahrs, Tauranga City Council; Martyn Cole, Kapiti Coast District Council; Jean de Villiers, Watercare; Kevin Carlyle, Hynds; and Sarah Boone of the Ministry of the Environment. Input has been co-ordinated by Lesley Smith of Water New Zealand.

Further copies are available online at www.waternz.org.nz

ISBN: 978-0-473-39954-2

Published by:
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Foreword

The job of distributing and making water clean and safe to drink involves sophisticated technology and extensive capital infrastructure. Many councils are faced with an increasing demand for water, future population growth, and high costs for implementing new supplies. This combination of issues leads to a choice: to either invest in new infrastructure, reduce demand, or both. Water metering is an effective tool for reducing demand.

Water metering is needed to provide accurate information on water use - a critical building block in establishing a water management system in which water is efficiently used. Essentially, we cannot manage what we don't measure.

Universal metering reduces (generally discretionary) water use by:

- improving customers' awareness of their water use;
- identifying customer water loss, particularly from private laterals; and
- improving understanding of the overall network water balance which can enable water suppliers to reduce water losses in their network.

In particular, water metering can help to reduce peak demand during summer months when water resources are most stretched. Reduced demand can defer the need for network upgrades and/or new supply sources, leading to both capital and operational savings. This is particularly relevant where the development of new water supplies is considered costly, or applying for and obtaining a resource consent is challenging.

Water metering is also an essential enabler for volumetric-based charging regimes, which provide a fair and equitable approach to water pricing. Volumetric charging can further improve water efficiency by providing consumers with a financial driver to be conscious of wasting water.

Already, consumption on the basis of water meter readings in New Zealand directly results in customer invoicing in the order of hundreds of millions of dollars each year. To ensure meter reading achieves aforementioned goals, it is important that meters are accurate, and the process for accessing information on their use is transparent to consumers.

This Guide is intended to prescribe good practices for the supply, use, and operation of water meters throughout the country by a company, authority, or organisation. It refers specifically to the delivery of potable water to residential, commercial, and industrial customers.

John Pfahlert

CEO

Water New Zealand

Contents

1. Statement of Purpose and Background

The objective of *Water Metering of Customers on Reticulated Supplies, Good Practice Guide* (the Guide) is to prescribe industry good practice for the supply, use, and operation of water meters used for the sale of water by an organisation to its commercial and domestic customers. It refers to the delivery of potable water, usually by local and regional councils and their agents, to individual residential, commercial, and industrial customers.

The use of water meters for individual households or businesses connected to reticulated supply in New Zealand is increasing as volumetric charging for water infrastructure provision (and in some cases wastewater) becomes a more prevalent demand management tool. Pressure on water supply infrastructure and supplies, rising treatment costs, and environmental legislation are likely to drive further uptake in the years to come.

Metered water consumption in New Zealand already results in customer invoicing in the order of hundreds of millions of dollars each year. It is therefore important that meters are accurate, and accessing information on their use is transparent to consumers.

Currently there are no New Zealand standards covering the accuracy and use of water meters and associated matters, as water meters are currently exempted from the Weights and Measures Act 1987.

In the absence of any legal requirements, the former Ministry of Consumer Affairs recommended a voluntary Code of Practice be developed by the industry. The first edition of this document was developed in 2003 as the *Water Meter Code of Practice* (the Code) (New Zealand Water and Wastes Association, 2003) to address this gap. The Code has since been referenced in a number of local council bylaws, and used to assist in the development of metering programs.

Since 2003 there has been a gradual increase in the number of water supplies being metered. There have also been changes in technology, standards, drivers, and legislation associated with water metering. In 2016 the Water Services Managers Group, recognising these changes, allocated funding to undertake an update of the Code into a contemporary Good Practice Guide.

The role of metering, and the need to improve the management and measurement of New Zealand's water supplies, was recognised by the introduction of *the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010* (New Zealand Government, 2010). These regulations require the measurement and reporting of water takes with water permits (resources consents) of five litres per second or more.

Individual households or businesses that take water from a reticulated supply are not covered by regulations, and metering of these users is addressed by this Guide. This revision of the Guide incorporates new legislation and standards, new technologies, and experiences of those who have been involved in the management and installation of meters.

It is intended that the Guide will be used by all those with an interest in the metering of reticulated water supplies, including meter suppliers, water suppliers, and their customers.

2. Principles

The use of water meters needs to be subject to practices that ensure fairness and equity for both the customer and the water supplier. Both parties must understand their rights and responsibilities.

The water supplier must have clear terms of supply that are easily understood by its customers.

All information given to customers relating to their water consumption must be accurate, clearly presented, easily obtainable, and up to date.

Meters and their installation must be practical and, where appropriate, consistent with international standards, particularly with the requirements of the International Organization of Legal Metrology (OIML).

Customers' complaints must be handled promptly, fully, and fairly.

The water supplier shall adhere to the provisions of the *Privacy Act 1993* (New Zealand Government, 2017) when collecting and using customer data on customers' water supplies. Water meter data must not be used for personal gain or profit.

The provisions of this Guide do not override the provisions contained within a water supplier's customer agreement or stated policies and procedures. This could include customer charters, customer agreements, bylaws, codes of practice, terms of agreement, etc.

The Guide is not a standard. Reference to relevant standards is contained in the document. Some parts of relevant standards are reproduced in the Guide to assist with understanding the context of a particular statement.

The contents of the Guide do not take precedence over any legislative requirements.

All new water meters shall comply with the requirements of *OIML R49 Water meters intended for the metering of cold potable water* (International Organisation of Legal Metrology, 2013), the Standard on which much of this Guide is based.

Comment

This document previously referred to both ISO 4064 and OIML R49 Standards. The most recent revisions of these documents (current at time of publishing of the Guide) are now identical. Only the OIML R49 Standards series is referred to throughout the remainder of this document, however in practice the OIML R 49-1:2013 and ISO 4064-1:2014 Standards may be used interchangeably.

3. Implementation

Meter supplier, water supplier, and customer responsibilities are addressed within this Guide.

The Guide provides information to assist water suppliers to:

- develop **engineering standards**;
- inform **meter renewal programs**;
- develop **metering policies or bylaws**; and
- meet **customer information** requirements.

Engineering standards are contained in *Section 7. Standards and Procedures*. This section will assist water suppliers specify relevant standards for the purchase, maintenance, and replacement of water meters. Water suppliers may choose to specify metering requirements in material specifications, infrastructure development codes, or water supply by-laws.

Meter Renewal Programmes development and supporting information is addressed in *Section 8. Water Meter Calibration.*

Development of metering policies or bylaws **should address aforementioned standards, as well as:**

- who will be metered;
- meter installation location (addressed in *Section 9.2 Meter Location*);
- ownership of meters and associated pipework (addressed in *Section 6.2* and *Section 9.1 Meter Ownership*);
- right of access to the meter (addressed in *Section 6.4 Customer Responsibilities* and *Section 6.2*);
- fire protection metering (addressed in *Section 7.3*);
- meter performance including accuracy, serviceability, and durability (addressed in *Section 8. Water Meter Calibration*);
- meter replacement cycle (addressed in *Section 8.3 Meter Renewals Programming)*;
- estimating consumption due to meter faults (addressed in *Section 10.3 Estimated Reads*);
- dealing with incorrect accounts (addressed in *Section 10.4 Adjustments to the Customer's Invoice)*;
- change of ownership (addressed in *Section 6.5)*; and
- offences relating to water meters (addressed in *Section 6.7 Damage and Tampering*).

Customer information **should be provided by water suppliers on the following matters associated with water meter installation and use:**

- how to read a meter;
- how to check for leaks;
- what to do if you think your water bill/consumption is too high;
- advice on whom to contact for historical consumption advice;
- what services customers have to pay for, and what services are provided free by the water supplier;
- current standard costs;
- how to get meters checked, and what options are available (addressed in *Section 6.9 Requests for Water Meter Tests*);
- how to apply for a special meter reading (addressed in *Section 10.1 Special Meter Readings)*; and
- dispute resolution procedures (addressed in *Section 6.8 Disputes Resolution).*

Information may be included as public handouts available from the water supplier's office(s) and other suitable facilities, on bills, or on the water supplier's website. Water suppliers may additionally wish to make available information on where to obtain copies of this Guide.

4. Definitions

Actual volume (V_a) is the total volume of water passing through the water meter, disregarding the time taken.

Adjustment refers to the practice of adjusting the volume as indicated by the meter to another value, primarily for the purpose of charging, usually where specific circumstances exist, and the **indicated volume** is not fairly indicative of the **actual volume**.

Advanced Metering Infrastructure (AMI) refers to a fixed wireless collection network and the backhaul of metering data to a metering data management (MDM) system.

Approved test house means a meter testing laboratory approved by the **water supplier**. All **approved test houses** shall be ISO 17025 accredited for the purpose of testing **water meters** of a specific type within a particular nominal diameter range.

Automated Meter Reading (AMR) is the automated collection of meter reads, but still requiring a meter reader to visit the property or be nearby.

Calculator is part of the meter that transforms the output signals from the measurement transducer(s) and, possibly, from associated measuring instruments, and, if appropriate, stores the results in memory until they are used. The gearing is considered to be the calculator in a mechanical meter. The calculator may be capable of communicating both ways with ancillary devices.

Calibration means a set of operations that are used to establish, under specified conditions, the relationship between values of quantities indicated by a meter or measuring system to realise the corresponding values set by standards.

Combination meters comprise one larger meter, one small meter, and a changeover device that, depending on the magnitude of the flow rate passing through the meter, automatically directs the flow through either the small or the large meter, or both. Note that the meter reading is obtained from two independent totalisers, or from one totaliser which adds up the value from both water meters.

Customer refers to the party responsible for purchasing of water supplied. In general, this will be the property owner or rate payer. In some instances, such as company share/block schemes or unit title schemes, a body corporate may undertake the functions of the customer on behalf of multiple water consumers.

Indicated volume (V_i) is the volume of water indicated by the meter, corresponding to the actual volume.

Intelligent Water Network (IWN) is the integration of intelligent devices, including water meters, pressure sensors, and meter data, into all relevant business processes and systems, and using this information to guide strategy and investment.

Meter Installation means the meter, associated fittings, and meter box connected from the public mains up to the property boundary.

The Measuring Instruments Directive (MID), issued by the European Union, prescribes conformity assessment activities relating to the market of measuring instruments in Europe. It is commonly adopted in New Zealand as a mechanism for ensuring meters meet the requirements of the OIML standard.

Measurement transducer is the part of a water meter that transforms the flow rate or volume of water to be measured into signals which are passed to the calculator, and includes the sensor. The measurement transducer may function autonomously, or use an external power source, and may be based on a mechanical, electrical, or electronic principle.

OIML is the acronym for the International Organization of Legal Metrology, an intergovernmental treaty organisation of which New Zealand is a member, established to promote the global harmonisation of legal metrology procedures.

Percentage error is the difference between the meter **indicated volume** and the **actual volume**, expressed as a percentage of the **actual volume**.

Q_1 is the lowest flow rate as defined by OIML R49-1 (International Organisation of Legal Metrology, 2013).

Q_2 is the transitional flow rate as defined by OIML R49-1 (International Organisation of Legal Metrology, 2013).

Q_3 is the permanent flow rate as defined by OIML R49-1 (International Organisation of Legal Metrology, 2013).

Q_4 is the overload flow rate as defined by OIML R49-1 (International Organisation of Legal Metrology, 2013).

Smart metering is the integration of meter data into business systems (e.g. billing systems), and the sharing of information with customers (e.g. through web based customer portals).

Water meter is an instrument intended to measure continuously, memorise, and display the volume of water passing through the **measurement transducer** at metering conditions. A water meter includes at least a **measurement transducer**, a **calculator** (including adjustment or correction devices if present), and an indicating device. These three devices may be in different housings. A water meter may be a **combination meter**.

Water supplier means any organisation that supplies water to another organisation or individual **customer**.

Working days refers to the ordinary days of work for the general community, and excludes weekends and public holidays.

5. Scope

This Good Practice Guide (the Guide) covers water meters that measure cold potable water supplied to customers through reticulated networks.

The Guide principally provides information to assist water suppliers in the management of water meters. *Section 3. Implementation* provides details on how the Guide can be used by water suppliers.

The Guide may additionally be used by customers to understand their rights and responsibilities, and by meter suppliers to ensure products meet appropriate manufacturing, testing, and record keeping requirements.

The following is not covered by this Guide:

- Water quality issues. It is assumed that water generally complies with the *Drinking-Water Standards for New Zealand 2005* (Revised 2008) (Ministry of Health, 2008).
- The decision of whether to adopt metering and/or volumetric pricing.
- Billing and pricing issues.
- Disconnection of meters or restriction of supply.
- High pressure water meters (>1,000kPa).
- Metering of hot water (>30°C) or other liquids.
- Specific backflow requirements. These are subject to the Boundary Backflow Prevention for Drinking Water Supplies 2nd edition (Water New Zealand, 2013).
- Check metering within private premises.
- Metering requirements for holders of water permits (resource consents) which allow fresh water to be taken at a rate of five litres per second or more. These are specified in the *Resource Management (Measurement and Reporting of Water Takes) Regulations 2010*. The *New Zealand Water Measurement Code of Practice* (Irrigation New Zealand, 2015) outlines requirements and good industry practice for the selection, installation, verification, and validation of water measurement devices for water permit holders to meet regulatory obligations.

6. Customer Issues

6.1 Application for a Meter

Where water is available from water supply mains near a customer's property, the customer can request to be connected to the water supply. Where the proposed connection is not contrary to the water supplier's policies, the supplier provides the customer with a metered connection based on the provisions of this Guide and local conditions.

Where the trunk or bulk distribution main passes near a customer's property, direct connections are unlikely to be permitted unless specifically approved by the water supplier. The water supplier shall determine what mains are bulk distribution mains.

Comment

Connections to bulk distribution mains are generally not allowed for operational reasons.

Where the water supply mains are not near a customer's property, the water supplier may consider the provision of a meter connection, subject to specific conditions.

Typically, one meter per property served is permitted unless specifically authorised by the water supplier. Additional guidance on management of shared supplies is addressed in *Section 6.2* .

For a meter supplying premises other than a single residential rateable unit, the applicant shall supply the following information, used by the water supplier to determine the appropriate meter size and location:

- normal flow patterns;
- minimum and maximum flow rates;
- expected minimum and maximum daily volumes;
- what the water will be used for;
- suggested meter location to ensure ease of access; and
- details of any onsite water storage.

Comment

Flow information is needed in order to select an appropriate meter or combination meter to cover the expected flow rate. The water supplier needs to know the use to which the water will be put in order to decide what backflow prevention measures may be required. Trade waste consents may also be necessary.

The water supplier shall either:

a) publish a list of standard connection charges, or
b) publish a list of contractors approved to make connections to the water supply system, and make this available to customers to select their preferred meter installer.

6.2 Management of Shared Water Meters

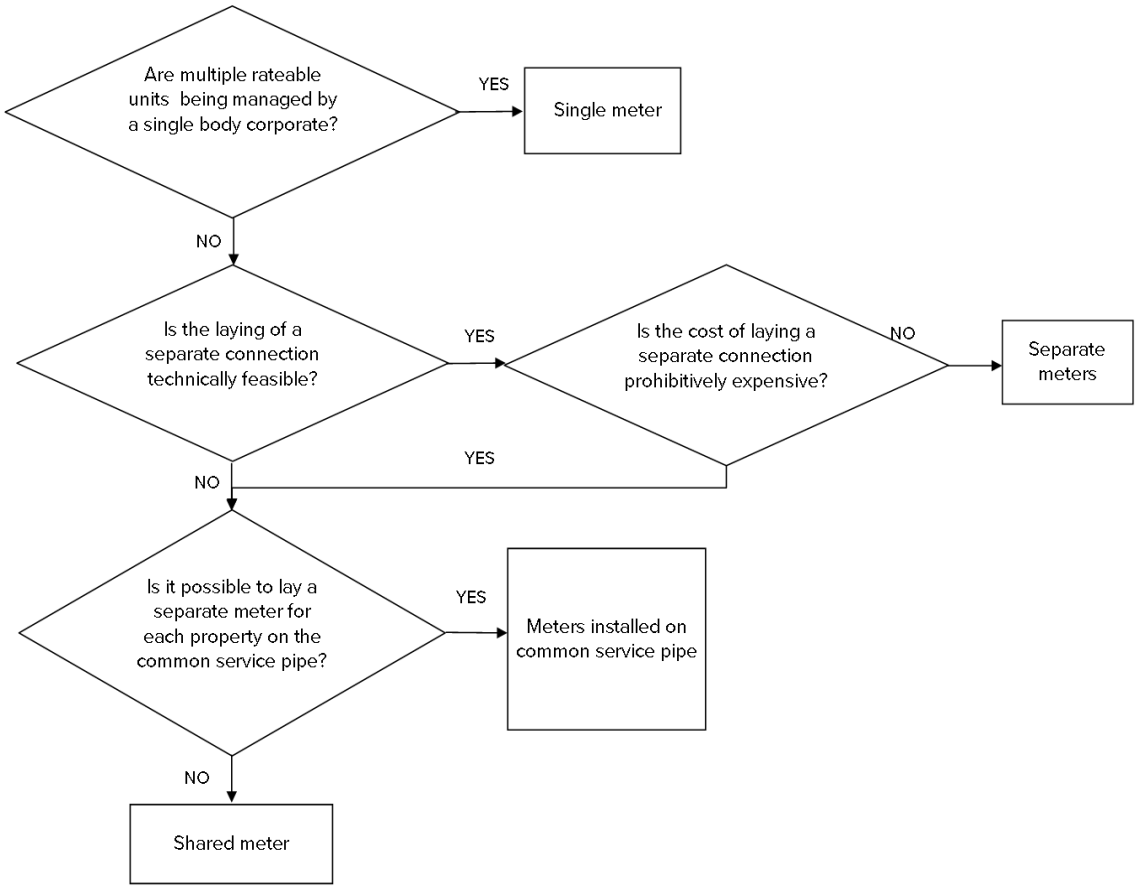
In cases where a water meter is shared with multiple rateable units, conflict can result when one party uses, or is perceived to use, considerably more water than another, or where leakage and associated costs of repairs need to be shared. Historically, resolving shared meter disputes has been a significant problem for water suppliers.

A number of situations exist where multiple separate rateable units share a single water supply connection. These include company share/block schemes (body corporate), leasehold/tenancy in common schemes (cross lease), strata title, unit title (body corporate), and other forms of multiple ownership.

Some problems associated with shared metering can be overcome by installing only one meter on the point of supply when a body corporate exists. In such cases, the body corporate may act as the water supplier's customer or customer liaison, and assume responsibility for apportioning bills and resolving disputes between individual rateable units. Suggested locations for metering such properties are outlined in *Section 9.2Meter Location.*

Water suppliers operating under a CCO arrangement are able to directly bill the body corporate. Requirements of the rating act may limit local authorities from billing body corporates directly, however in such instances the body corporate still provides a vehicle for all rating unit owners to discuss and agree on apportionment of use. The body corporate will subsequently either collect payment from the individual owners and pay the supplier on their behalf, or provide owners with documentation of their portion for payment direct to the supplier.

Where meters are shared but no overarching body corporate exists, disputes over leakage management and apportioning of water-related costs often occur. Such disputes can be reduced during the roll-out of water metering programmes by avoiding installation where multiple rateable units are serviced by a single shared meter. Below is an example of a decision-making process that seeks to avoid shared meter arrangements:

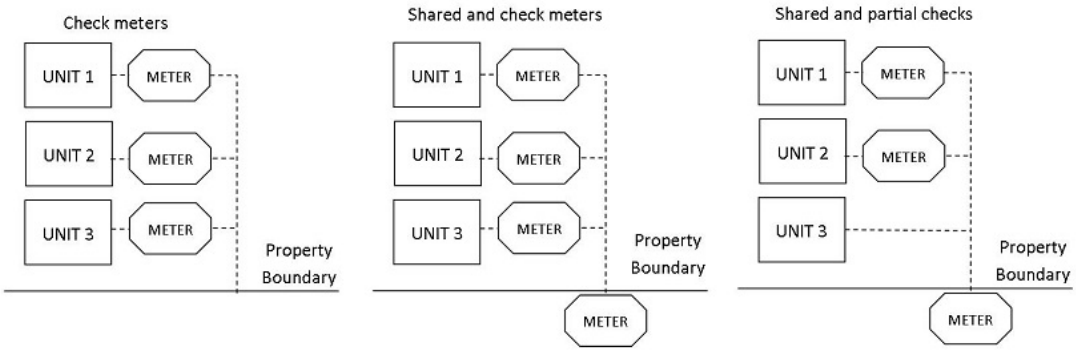


The following table outlines the main options, and their pros and cons, for installation of water meters on properties serviced by a common water supply pipe.

<table>
<tr><th colspan="2"></th><th colspan="2">PROs</th><th colspan="2">CONs</th></tr>
<tr><td colspan="2">Separate meters (Install a separate service connection for each property)</td><td colspan="2">• Alleviates customer disputes and dissatisfaction
• All meters are situated on public property, and are readily accessible
• All leaks on private property are captured by meter, and are easier to control
• If one party refuses to pay, it is easier to disconnect or restrict only that party</td><td colspan="2">• Cost may be prohibitively expensive
• Feasibility of installation may be limited by accessibility
• Duplication of excessively long laterals may result in increased water losses as pipes age</td></tr>
<tr><td rowspan="3">Meters installed on common service pipe (possible arrangements outlined in figure overleaf)</td><td>Shared and checks</td><td rowspan="3">• Alleviates customer disputes and dissatisfaction</td><td>• Captures all use at shared point of supply</td><td rowspan="3">• Feasibility of installation may be limited by pipe work configuration and/or accessibility
• Meters are located on private property
• Meters may not be as readily accessible</td><td>• Requires an additional meter compared to other check metering options which may be prohibitively expensive</td></tr>
<tr><td>Shared and partial checks</td><td></td><td>• All leakage on common pipes allocated to those without check meters with no driver to fix for those on check meters</td></tr>
<tr><td>Check only (not recommended)</td><td></td><td>• Does not address water leaks and related disputes on the common service line
• Does not give full backflow protection to the water supply system
• Does not clearly delineate the point of supply</td></tr>
<tr><td colspan="2">Shared meter</td><td colspan="2">• Low cost
• Low installation complexity</td><td colspan="2">• Water supplier resources are likely to be consumed by customer disputes over consumption and leakage (despite this not being the supplier’s responsibility)
• Leakage is shared, but getting agreement on costs of repairs can be difficult
• If one party refuses to pay, it is difficult to disconnect or restrict supply to only that party</td></tr>
</table>

Meters installed on common service pipe

The following figure depicts the three possible configurations for installing check meters on a single point of supply included in the pros and cons table.



The option of only check meters is not recommended as (amongst other draw backs) it does not provide sufficient backflow protection.

The meter installation arrangement will dictate the approach for charging:
Shared and check meters: readings are taken off the primary meter, then allocated by check meter ratios (shared).
Shared and partial check meters: meters are used to allocate charges for units 1 and 2, and the charge at unit 3 is determined by deducting charges from unit 3 (option 3).

When a number of meters are installed on a common service pipe, the water supplier may elect to take over ownership of the common service pipe if it is laid in the right of way, and/or require that this is covered by an easement owned by the water supplier. This split ownership arrangement needs to be clearly spelled out in the water suppliers bylaw and/or metering policy, and in any other relevant information shared with customers.

Shared metering arrangements

In instances where meters are shared, water suppliers will need to develop an approach to manage:

- how charges are apportioned amongst properties (most water suppliers elect to split charges equally);
- how leaks on the shared service are captured and billed;
- how unpaid bills will be managed; and
- if some, but not all, have a check meter, how billing and leaks will be managed between those with and without check meters.

6.3 Installation of Additional Equipment on Meter

Customers may not install additional equipment on the meter without the consent of the water supplier. Such equipment includes data loggers to monitor instantaneous peak flows and pressures, and similar equipment.

Consent shall not be unreasonably withheld.

The water supplier may require the equipment to be installed by itself or an approved agent at the expense of the customer.

6.4 Customer Responsibilities

The customer has a number of responsibilities, outlined below. Customers shall be made aware of their responsibilities and those of the water supplier.

Customer refers to the party responsible for payment of water rates. In most instances, this will be the property owner, however in some cases a body corporate may take on this function on behalf of multiple tenancies. In other cases, landlords may delegate tasks to tenants, however ultimate accountability for fulfilling the customer responsibilities outlined below rests with the property owner.

Customers shall ensure that the water meter is accessible at all times for reading and maintenance purposes. Factors that can make meters inaccessible include weeds, hedges, dogs, fences, and gates. The water supplier reserves the right to charge customers for time spent making a meter accessible.

Where properties, such as those on rights of way, are set back from street frontages, the water supplier shall have a clear and easily obtainable policy covering the location of water meters and the use of common meter chambers.

The customer shall not interfere with the meter in any way. Penalties for damaging or tampering with meters are addressed in *Section 6.7 Damage and Tampering*.

The customer is responsible for any leaks and repairs occurring on their private water supply pipes. Customers should be encouraged to check their water supply system for leaks by reading their meters. Customers are encouraged to report suspected leaks, seepage, or breaks in the water supplier's system as soon as they become evident.

In the case of a change of ownership, the outgoing customer shall notify the water supplier to arrange a final meter reading within the notification period specified by the water supplier (*Section 6.5* contains further detail on notification periods).

The customer shall advise the water supplier of any planned significant change in usage or activity at the earliest opportunity. A change in consumption may require a different meter arrangement.

Comment

A change in usage may require a change in the level of backflow protection immediately downstream of the meter, and may require a trade waste consent if trade wastes are to be generated.

6.5 Change of Ownership

In the event of a water supplier receiving notification of a premises changing ownership, the water supplier shall arrange a final meter reading and note the change of postal address for billing of the final meter reading. The water supplier shall record the new property owner and/or occupier as being the customer at that premises.

The water supplier shall specify the notice required to arrange a final meter reading. As a general rule, water suppliers have adopted five working days as the required notification period.

Where properties are provided with drinking water, water suppliers are required to include on the Land Information Memorandum any conditions that are applicable to that supply. This should include advice about the presence of a water meter, as well as the size and nature of a water connection (whether this is shared or standard), and any restrictions that apply to the supply.

Additional information that should be provided to customers is outlined in *Section 3. Implementation*.

6.6 Meter Relocation

The customer may request that the meter be moved if it is located in a position that is contrary to the requirements of *Section 9.2 Meter Location*. The water supplier shall approve the new location of the meter and carry out the work, or contract a water supplier-approved contractor to complete the work.

Where the meter is relocated at the customer's request, the customer shall bear the costs of the relocation. Where there is mutual benefit for meter relocation in the opinion of the water supplier, the costs may be shared. Where the meter is relocated at the water supplier's request, the water supplier shall bear the costs of the relocation.

The water supplier shall develop a policy to determine whether meter relocation work includes re-connection to the customer supply pipe. Some water suppliers require a customer to employ a registered plumber to re-connect the supply on the downstream side of the meter at their cost. This removes any liability from the water supplier if, for instance, a tap is left open and the property is flooded.

6.7 Damage and Tampering

The only persons authorised to carry out work on a water meter are the water supplier's staff and those persons specifically authorised by the water supplier.

Customers shall not touch or tamper with a water meter or its fittings other than for the purpose of reading the meter or turning off the private supply from the meter stopcock. This includes the unauthorised removal of meter seals.

Seals shall not be able to be opened without being clearly broken.

Offences relating to water meters may be penalised by the *Local Government Act 2002* (New Zealand Government, 2017).

Local Government Act, Section 227: Offences relating to water meters

Every person commits an offence and is liable on summary conviction to the penalty set out in section 242(1) who, without the prior written authorisation of the local authority,-

(a) alters the index of, or in any other manner tampers with, a water meter being used in association with the water services of a local government organisation; or

(b) alters the position of such a water meter

6.8 Disputes Resolution

The water supplier shall have a published and readily available disputes resolution process for handling disputes between the customer and the water supplier.
Customers should be encouraged to put their complaints in writing, and have the letter/email acknowledged with an interim reply period, typically within three to five working days, and a full response within 10 to 20 working days.

The water supplier should have a senior position within the organisation specifically tasked with receiving and resolution of customer complaints.

Comment

In July 2003 the *Fair Trading Act 1986* (New Zealand Government, 2017) and *Consumers Guarantees Act 1993* (New Zealand Government, 2017) were amended to include water supply as a service covered by these Acts. This Guide does not take precedence over any legislation or any rights that customers may have under that legislation.

To enable compliance, each water supplier shall have a published and readily available customer complaint resolution process. Water suppliers will ensure that internal disputes resolution processes are free, accessible, fair, and effective.

Water suppliers must:

- provide customers with information about how their complaints will be dealt with, and by when; and
- provide written information about their customer complaints handling process.

Water suppliers should:

- train their staff about their customer complaints handling process;
- use processes that are easy to understand, easy to use, and free to customers;
- provide adequate resources for their customer complaints handling processes; and
- review their customer complaints handling processes regularly.

Other Forms of Legal Redress

In cases where the water supplier cannot reach agreement with a customer, a customer may have the legal right to refer a problem to the Courts or arbitration for determination. In such cases, the water supplier will ensure it notifies the customer of the customer's right to refer the matter to another party.

6.9 Requests for Water Meter Tests

Customers may request a meter accuracy test at any time.

On receiving a customer's request, the water supplier shall firstly discuss options for self-assessment of water usage with the customer. If, in the opinion of the water supplier, the customer's circumstances suggest that an accuracy test is not warranted, the customer shall be advised accordingly, and given the option of going ahead with the accuracy test.

Before the water supplier agrees to carry out the test, the customer shall be advised, in writing, of any costs they will be expected to meet in relation to the test, and accept, in writing, meeting those costs.

The water supplier shall have a schedule of costs for water meter tests.

If an off-site test is required, the tests shall be carried out at an approved test house or, where onsite testing is appropriate, by a person approved by an approved test house *Appendix I: Procedures for On-Site Testing of Water Meters* provides a model procedure for onsite testing. *Section 7.5 Approved Test House Requirements* provides further detail on test house requirements.

Comment

Water meters very rarely become erroneous with an increase volume measurement, i.e. to the disadvantage of the customer. An assessment of the customer's historical usage and self-assessment is encouraged before resorting to laboratory testing.

Customers shall be formally advised in writing of the test result, and the water supplier shall keep the records of the test for no less than three years.

Information on meter testing options could be provided on the back of the customer's bill, or via the water supplier's website.

Unless otherwise stated in other documents specific to the individual water supplier, on-site tests shall be carried out within five working days of receipt of the request.

Where an off-site test is required, the testing house should complete the tests within five working days of receiving the meter. The total time to complete the tests will be dependent on the time taken for meter removal and transport to and from the test house, and should be agreed to by both water supplier and customer.

Unless otherwise agreed or specified by the water supplier, the customer shall meet the full cost of the test should the meter prove to be operating below the acceptable maximum accuracy limit. Should the meter prove to be reading at levels above the acceptable maximum accuracy limits, the water supplier shall pay for the testing costs and any meter replacement/repair costs, i.e. the water supplier will only be required to cover testing charges where customers are being over- billed.

7. Standards and Procedures

Meters that are allowed for use by water suppliers should form part of the approved material and/or fittings listing in the water supplier's material standards, development code of practice, bylaw, or equivalent document.

7.1 Manufacturing Standards

Only meters that have been pattern-approved to the requirements of OIML R 49-1, 2, and 3 shall be installed.

OIML R49 - 1 Water meters intended for the metering of cold potable water
Part 1: Metrological and technical requirements

OIML R49 - 2 Water meters intended for the metering of cold potable water
Part 2: Test methods

OIML R49 - 3 Water meters intended for the metering of cold potable water
Part 3: Test report format

The International Organization of Legal Metrology (OIML) is an intergovernmental treaty organisation, of which New Zealand is a member, established to promote the global harmonisation of legal metrology procedures.

OIML R49 was legally adopted for metering of cold potable water, and represents a blend of BS5728, ISO 4064, EN 14154, and many other standards from around the world encompassing regulations for water metering, and thus supersedes other aforementioned standards.

Other Meter Manufacturing Standards

ISO 4064

While ISO 4064 was once the most widely referenced Standard, it has now been superseded by the OIML Standard. With the introduction of electronic water metering, the principle of measurement caused problems within older versions of the Standard. The 2014 revision of the ISO 4064:2014 aligned the content exactly to the OIML R49: 2013 Standard. In practice, the two documents may now be referred to interchangeably.

Measuring Instruments Directive (MID) 2014/32/EU

The Measuring Instruments Directive (MID), issued by the European Union, prescribes conformity assessment activities relating to the market of measuring instruments. Meters tested for conformity with OIML R49 Standards are issued with a MID pattern approval assessment certificate. The 2014/32/EU MID repeals the 2004/22/EC MID directive as of April 2016.

EEC/EN Standards

Approval standards emanating from the European Union, including EN and EEC standards, have been incorporated into the OIML. The standards were formerly developed as a means to sell into respective territories in the EU, and are no longer legally acceptable.

AWWA

The United States employ different measuring principles from most other countries, and consequently apply the American Water Works Association (AWWA) Standards, additional to the OIML.

Australian Standards AS3565.1-2010, Meters for cold and heated drinking and non-drinking water supplies, Part 1: Technical requirements

This Standard specifies dimensions and connection requirements for meters that were not addressed in the previous issue of the OIML. Meter threads manufactured against this Standard are generally manufactured differently from elsewhere in the world. These standards are not currently in use in New Zealand, and are not recommended for use by New Zealand water suppliers.

The length of water meters currently in use in the New Zealand market are outlined in *Section 9.7 Meter Sizing and Selection*, and *Appendix II: Inline meter specifications typically used in New Zealand*.

Meters must be pre-equipped or capable of an electronic and/or pulse output specified within the meter's MID OIML R49 pattern approval certificate to enable remote reading/recording devices to be installed. If the meter does not have a reverse flow preventer, then the output must be capable of indicating a reverse/backflow event through the meter.

Where remote reading devices, such as pulsing units and pulsing totalisers are installed, the remote reading shall be checked with the meter reading at least annually.

All meters shall record the volume consumed in cubic meters in accordance with OIML R 49-1 (International Organisation of Legal Metrology, 2013).

Comment

One cubic meter equals one kilolitre (or 1,000 litres). Kilolitres may be a preferable unit for communicating water consumption to customers.

Water meters shall be constructed so that they will be easily readable, including being able to be read by torchlight. The design shall not prevent the reading of the meter register over the installed life of the meter.

Comment

Historically, there have been problems with meters being unable to be read because of fogging, particularly with register casings. Fogging of some meters tends to increase with age.

Water meters shall be provided with protective covers and seals to prevent tampering. Care should be taken with protective covers, which can be easily damaged, especially when installing logging equipment.

7.2 Additional Requirements for Properties Requiring Large Meters

This section applies to large meters, which shall have a Q_3 (permanent flow rate) value of not less than those shown in the following table.

Meter Size	Minimum Q_3
DN40	16
DN50	25
DN65	40
DN80	63
DN100	100
DN150	250

The meter's pattern approval certificate must clearly specify the meter's upstream and downstream straight pipe requirement in achieving the stated Q_1/Q_3 (minimum flow rate versus permanent flow rate) pattern approval ratio.

Meters with minimal or no straight pipe requirements are preferable.

Meters with lower starting flows are preferable. Meters should have a Q_3/Q_1 ratio of no less than 125, and a higher Q_3 value is preferable.

The meter must be suitable for vertical and horizontal installation. Unless the meter is a BSP threaded meter, it should also be capable of accepting a pre-calibrated measuring element without affecting its metrological performance.

Unless approved otherwise by the water supplier, the meter register shall be designed for outdoor and flooded pit application.

The meter register should be free of moisture within its mineral glass and copper can, or be fully self-contained and liquid-filled, so that the totaliser can be clearly read throughout the life of the meter.

A combination meter should be installed where flow conditions are not able to be satisfactorily measured by a single meter, or where the flow and minimum flow cannot be determined.

The maximum working pressure rating of a combination meter should be not less than pressure class PN16. All combination meter flanges shall meet the requirements of *AS/NZS 4087 Metallic flanges for waterworks purposes*.

Combination meters shall be serviceable without removing the body from the pipeline. The meter must be capable of accepting pre-calibrated measuring elements without affecting its metrological performance.

The water supplier shall determine the flow characteristics of the water supply requiring a combination meter, and provide the following information, at a minimum, to the metering supplier to determine an appropriate meter:

- Q_3 (permanent flow rate)
- Q_1 (minimum flow rate)
- Service connection size

7.3 Fire Protection Systems

Where a fire connection has been installed or located so that it is likely or possible that water may be drawn from it for purposes other than firefighting, the water supplier may require the supply to be metered. It is important that the meter selected is of a type that does not impede or restrict flow for fire-fighting.

Where the fire supply to a premises is metered, the water supplier may allow the supply of water to be made in a manner that bypasses the meter, provided that:

a) water drawn from the fire supply is sounded with an automatic fire alarm, or provides an automated notification to the fire brigade; or

b) the water supplier-approved detector check valve has been fitted with a bypass meter to detect low-flow leakage.

An unmetered connection provided to supply water for fire protection shall not be used for any purpose other than fire-fighting and testing.

Where the supply of water to any premises is metered, fire hose reels shall be connected only to the metered supply, not to the fire protection system.

7.4 Documentation Requirements

A water meter shall be clearly and indelibly marked with the information requirements of *Section 6.6.2* of the OIML R49-1 Standard (International Organisation of Legal Metrology, 2013). The MID pattern approval certificate should also be included.

The water supplier shall be supplied with an MID pattern approval certificate certifying that meters are manufactured and batch tested in accordance with OIML R49 Standards. This shall include the relevant ISO 9000 certification number of the manufacturer.

The meter supplier shall keep records of all meters supplied for 10 years from the time of supply. Records are to include the make, model, size, serial number, and calibration records from the original factory test.

The water supplier shall keep records of the location of the installed meter, and details of the meter including type/model, size, serial number, initial reading, meter manufacture date, meter installation date, and any other relevant information deemed necessary for ongoing management.

Information records standards are being developed as part of the New Zealand Asset Metadata Standards. At the time of publishing, draft standards for collecting asset information related to water meters are outlined in *NZAMS Potable Water As-constructed/As-built (Volume 1).*

7.5 Approved Test House Requirements

Approved test houses measure and certify the accuracy of water meters. Test methods and reporting formats are to conform to standards outlined in *OIML R49-2 (Part 2: Test methods)* and *OIML R49-3 (Part 3: Test Report format)*, or the relevant standard if testing older meters that have not been manufactured against an alternative standard.

Approved test house volume recording devices shall be certified at no more than 12 monthly intervals. Flow measuring equipment shall be checked and calibrated at not more than 12 monthly intervals by the test house. This certification shall be made freely available to those requesting tests.

Approved test houses are required to have achieved *ISO 17025 General Requirements for the Competence of Testing and Calibration Laboratories*. New Zealand laboratories are to be accredited under IANZ.

Accuracy tests should be based on flows specified within the meter manufacturer's pattern approval certification for the meter under test. For meters manufactured against OIML R-49, this will require individual flow tests at Q_1 (lowest flow rate), Q_2 (transitional flow rate), and Q_3 (permanent flow rate) meeting the required accuracies.

Water Meter Test Certificates shall be issued for all meters tested. The certificates shall meet the requirements of MID, the pattern approval for the meters under test (in general OIML R49), and have as a minimum:

- approved test house name, address, and contact phone numbers;
- unique certificate number;
- date tested;
- meter serial number;
- make and model;
- customer information and details as agreed with water supplier;

- circumstances under which meter is being tested;
- flow rate tested and individual accuracies for each flow;
- conformation of whether meter complies with accuracy standards to which it was originally manufactured;
- confirmation that volume measuring equipment is currently certified, and is available on request;
- space for any additional comments, e.g. mode of failure;
- the signature of the tester, who shall be certified by the test house as having been trained and approved to carry out the type of testing being conducted.

The test certificates are not required to display initial and final test readings, however this information should be retained by the testing authority, and made available on request.

8. Water Meter Calibration

8.1 Levels of Accuracy

Water meters currently supplied into the New Zealand market must meet specifications outlined for accuracy class 2 meters in OIML R49.

As mechanical water meters age, wear of mechanical components leads to increasing under-registration of the water volumes passing through the meter. Changes in flow measurement accuracy over time vary based on exposure to particles in the distribution system as well as other degradation factors. *Accuracy of In-Service Water Meters at Low and High Flow Rates* (Steven L. Barfuss, 2011) quantifies degradation rates for a range of meter types.

Meter error typically develops at lower operating flow rates. It may be most relevant, therefore, to consider acceptable error limits at the lower flow band.

Meter inaccuracy is more likely to under-register volumes, which will negatively impact water supplier revenue rather than cause disadvantage to a customer. Accordingly, water suppliers may elect to permit larger accuracy bands than the requirements outlined in the OIML R49 when determining whether meters pass or fail accuracy tests.

The water supplier should document acceptable accuracy limits, and ensure these are made known to the customer.

8.2 Verification

New water meters shall be tested, calibrated, and certified in accordance with OIML R49 pursuant to the standards requirements outlined in *Section 7. Standards and Procedures.* This information shall be made available to the water supplier upon purchase.

The water supplier shall provide customers with copies of meter certificates on request.

8.3 Meter Renewals Programming

The water supplier shall have a meter renewals programme comprising replacement or refurbishment/recalibration of meters to ensure they remain within their required accuracy limits. This programme shall include systems to monitor the age, type, and throughput of all meters.

Meter renewals shall be at the water supplier's cost.

Meters are used to generate revenue, and aged mechanical components result in a negative financial impact on water suppliers. Renewal programmes need to balance the financial costs of under-recording against the capital costs of meter replacement.

A statistically and scientifically based meter testing and replacement programme should take into account:

- trends in meter reading and consumption data;
- total volume measured by the meter;
- exposure to high flows (Q_4) through the meter;
- the age of the meter;
- quality of water passed through the meter;
- results of sampling and testing programmes;

- replacement cost of the meter and associated installation and fittings;
- lost revenue through meter error; and
- expected life of the meter.

The expected life of the meter will depend on a number of factors, including meter type, throughput, and water quality. Water suppliers will need to develop a statically robust sampling programme to determine the expected life of meters under local conditions.

It is good practice to physically inspect meters for signs of external deterioration at intervals of no more than three years.

Comment

Meters, typically 25 mm nominal diameter and below, are commonly replaced rather than repaired because of overall cost considerations.

8.4 Recalibration and Inspection

Recalibration and inspection of meters may result in supply disruption issues for some customers. Consideration should be given to alternative ways of meter checking without meter removal and testing at an approved meter test house. *Section 8.5 Preliminary Accuracy Assessments* outlines a suggested approach.

If a measuring element is to be replaced, it shall meet all relevant requirements outlined in *Section 7.1 Manufacturing Standards*. Where the meter has met these standards, an existing meter installation can have the body fitted in the field with a new or refurbished "measuring element". This is an acceptable alternative method of verifying that an existing meter installation is correctly calibrated. All measuring elements must comply with the same requirements as new meters.

Water meters that require testing and recalibration should have this done by an approved test house meeting the requirements outlined in *Section 7.5 Approved Test House Requirements*.

Refurbished and/or recalibrated meters or new pattern-approved measuring elements shall be issued with a new test certificate meeting the information requirements outlined in *Section 7.4* .

This information shall be made available to customers on request.

8.5 Preliminary Accuracy Assessments

Preliminary accuracy assessments, or field tests, normally apply to standard residential connections up to DN25. *Appendix I: Procedures for On-Site Testing of Water Meters* outlines minimum requirements for preliminary testing. Alternatively, a test measure may be used to compare the indicated volume to a known reference volume.

Comment

On-site preliminary assessments check for gross inaccuracies. This is simpler and cheaper for the customer than removing a meter for testing and replacing it with a new meter, which is considerably more expensive and involves additional administration costs.

The results of preliminary accuracy assessments should not be used in a statistical sampling programme.

9. Metering Installations

9.1 Meter Ownership

The meter is usually the property of the water supplier.

Ownership of connecting pipework in shared metering situations is addressed in *Section 6.2*.

9.2 Meter Location

The water supplier shall determine the appropriate location of meters at its discretion. Water meters should typically be:

a) located so as to be safely and easily accessed for reading, maintenance, and removal;
b) located in areas not susceptible to ponding;
c) orientated horizontally, unless designed to operate otherwise;
d) positioned immediately downstream of the meter-isolating valve; and
e) located in areas where they are unlikely to be subject to heavy vehicular or other loads, or other causes of mechanical damage.

Where meter boxes are likely to be subject to mechanical damage, water meters shall be protected.

Water meters and meter assemblies located in frost-prone areas shall be protected against damage caused by freezing of water. Possible solutions include in-ground installation, or installation in insulated enclosures.

All possible steps should be taken to avoid meter installation in positions where the reader needs to enter a confined space. In these cases, only persons trained in the appropriate health and safety requirements shall have access to read, repair, or replace the meter.

Where remote meters are installed, they should be located so as to minimise interference. Further guidance on sources of remote meter reader interference is provided in *Section 10.5 Remote Readers.*

In general, meters and restrictors should be located as close as practicable to the water supplier side of the point of supply. However, in cases where a point of supply provides water to more than one premises, the water supplier may, by special agreement, agree to a check meter being located on each of the private supplies. Further guidance on managing shared supplies is contained in *Section 6.2*.

The point of supply will be determined at the water supplier's discretion.

The water supplier should locate any new point of supply outside but as close as practicable to the customer's property boundary. If it is not possible to locate the meter on public property, alternative locations will require the water supplier's specific approval. In such instances meters should be located to ensure:

(a) the shortest possible pipe length inside the property;
(b) the meter is readily accessible for reading, maintenance, or replacement;
(c) the meter is not located inside units/apartments or within ceiling cavities; and
(d) integrated remote reading devices are installed when a meter is located behind a door, gate (locked or unlocked), or fence, or within an area protected by security systems, and are easily accessible to a meter reader.

Suggested locations for new points of supply for the following forms of multiple ownership of premises and/or land are as follows:

Company share/block schemes (body corporate) The point of supply should be located on public land, but as close as practicable to the boundary of the fee simple title.

Leasehold/tenancy in common scheme (cross lease) The point of supply should be located on public land, but as close as practicable to the boundary of the underlying fee simple title, and there will typically be a single point of supply for each customer. In cases where the point of supply is shared, further advice on managing installations is provided in *Section 6.2*.

Strata title, unit title (body corporate), and any other form of multiple ownership The point of supply should be located on public land but as close as is practicable to the boundary of the underlying fee simple estate for the strata title or unit titled land, and a single point of supply will typically be shared by customers.

9.3 Installation Requirements

The water supplier shall be responsible for the location, geometry, and size of all water meter installations. Meter installations are to meet the conditions outlined in *Section 6.3* of OIML R49-1 (International Organisation of Legal Metrology, 2013).

Prior to physically installing the meter, the connection to the water supplier's system shall be purged of air and debris.

Meters shall be installed so that they are completely filled with water, and will remain so under normal operating conditions.

Meters shall be installed in accordance with the manufacturer's recommendations, paying particular attention to the installation of fittings close to the meter that could create turbulence in the flow and lead to inaccurate readings.

Comment

It is particularly important for electronic meters to comply with the manufacturer's recommendations on earthing, running cables alongside other cables, proximity to high tension power lines, and other matters. Qualified advice specific to individual installations may be required in order to install an electronic meter and to ensure its accuracy. Historically, problems have resulted from a failure to take the manufacturer's recommendations into account.

Meters shall be installed with a stop valve on the water supplier's side of the meter, and a non-testable dual check valve or testable double check valve as part of the meter assembly immediately downstream of the meter as a minimum requirement, or within the body of the manifold for manifold meters. Backflow prevention level must be determined on a case-by case basis, and a higher level of protection may be required.

Filters should be installed upstream of the meter where there could be particulate matter in the water supply that could interfere with accurate reading or the life of the meter. If installed on a fire line, filter design should be considered to ensure the fire line is still fit for purpose.

The water supplier shall determine what other fittings need to be installed on each meter installation. This may include a flow control valve.

Meter installations 32 mm nominal diameter and above shall be designed with consideration of the impact of flow disruptions to the premises when the meter is removed for accuracy testing. For customers who are likely to experience significant disruption from short water supply outputs, consultation should be undertaken with customers to determine whether a by-pass line is needed to feed the premises when the meter is removed.

Comment

Customers, particularly large-volume customers, may need water on a continuous basis, and stopping the supply of water for more than a few minutes for meter testing could have a significant effect on their operations. In such cases, customers should have contingency plans in place. The water supplier and customer should discuss contingency options, which could include a meter bypass or an alternative feed arrangement.

9.4 Meter Box Requirements

Meter boxes, or meter pits, should be of an appropriate size to allow future maintenance and meter replacement. *ASNZ3500.1-2015: Plumbing and Drainage, Part 1: Water services* specifies that all meter boxes have:

a) a cover that can be removed; and
b) a base that enables drainage.

The water supplier may additionally choose to specify that the box is sufficiently large to accommodate retrofitting of an automatic meter reader.

In heavily trafficked areas or shared spaces, the water supplier may choose to stipulate specific requirements to ensure that meters are robust and surfaces are slip proof.

Some water suppliers may also elect to have the words “WATER METER”, “WATER”, or “METER” embossed on the lid.

Water suppliers may also elect to specify material requirements for water meter boxes to ensure they are fit for purpose.

9.5 Backflow Considerations

At the time of meter installation, the meter supplier shall ensure that appropriate backflow prevention requirements are in place.

Section 69ZZZ of the *Health (Drinking Water) Amendment Act 2007* outlines requirements for protecting water supplies from risk of backflow.

Boundary Backflow Prevention for Drinking Water Supplies 2nd ed (Water New Zealand, 2013) provides guidance to assist water suppliers to meet their regulatory obligations and achieve good practices in implementation of backflow policies, practices, and programmes.

9.6 Application of Seals

All meters shall be sealed. Seals shall not be broken unless specifically authorised by the water supplier or its agents. If a seal is found to be broken, the water supplier shall investigate the reason for the break, and have the seal replaced. The water supplier must be satisfied that the meter is accurate before replacing the seal. Seals help prevent damage and tampering. Refer to *Section 6.7 Damage and Tampering* for further guidance.

9.7 Meter Sizing and Selection

All meters should meet the standards and documentation requirements outlined in *Section 7.1 Manufacturing Standards, Section 7.2*, and *Section 7.4*.

Domestic meters typically have a nominal diameter of 15 mm or 20 mm. Additional sizing and selection considerations for larger meters are included in *Section 9.7 Meter Sizing and Selection*.

Comment

Threaded meters range in size up to 50 mm diameter. Flange meters commence at 40 mm diameter.

The size and type of the water meter shall be chosen by the water supplier based on information supplied by the customer, and having due regard for:

- its pattern approval operational parameters;
- the anticipated:
  - permanent flow rate (Q_3);
  - overload flow rate (Q_4);
  - transitional flow rate (Q_2); and
  - minimum flow rate (Q_1);
- the organisation's water conservation policies;
- intended water use;
- fire-fighting and/or sprinkler requirements;
- overall cost;
- the quality/abrasiveness of the water;
- overall head loss through the meter assembly; and
- expected meter life.

A water supplier may install a flow control valve to limit maximum flow rates.

The water supplier may elect to use manifold or inline meters. *Appendix II: Inline meter specifications typically used in New Zealand* outlines the known sizes of inline meters available in New Zealand at the time of this Guide's publication.

Manifold meters allow for easier maintenance and renewal than inline meters, as they can be screwed out and replaced without the need for uncoupling from reticulation. A standard specification for manifold meters, in use at Tauranga City Council (Tauranga City Council, 2014), is shown below. Manifold meters must have a reverse flow preventer or, if not, the output must be capable of indicating a reverse/backflow event through the meter.

Manifold meter specification from the Tauranga City Council Development Code

Meters must be rated Q_3 = 2.5m^3/hr and must have a minimum R value (Q_3/Q_1) of 160.

Meters must be capable of transmitting a pulse output (for the purposes of data logging or remote reading).

Construction shall be dezincification-resistant (DR) brass to NZS/AS 3688

or

Construction of composite materials subject to approval of material specification.

9.8 Smart Metering

In a water supply context, the term 'smart metering' is broadly used to refer to a range of metering technologies. The Water Services Association of Australia has defined smart water metering as "the integration of meter data into business systems (e.g. Billing System) and the sharing of information with customers (e.g. Customer Portal/Web)". Other definitions commonly used in a smart metering context are (Beal, 2013):

Automated Meter Reading (AMR) The automated collection of meter reads, but still requiring a meter reader to visit the property or be nearby.

Advanced Metering Infrastructure (AMI) Installation of fixed wireless collection network, and the backhaul of metering data to a metering data management (MDM) system.

Intelligent Water Network (IWN) The integration of intelligent devices including water meters, pressure sensors, and meter data into all relevant business processes and systems, and using this information to guide strategy and investment.

A range of metering technologies enabling AMR is currently employed in the New Zealand market, and pilot trials of AMI have commenced.

The Smart Water Research Centre has undertaken a review of 48 water suppliers in Australia and New Zealand, 80% of which were actively pursuing smart metering or intelligent water network projects. The report documents the business cases justifying investment, and the challenges faced by these water suppliers (Beal, 2013).

The study found that improving infrastructure planning and deferring infrastructure augmentation by extending the life of assets through better peak demand management was the single most frequently-cited business case driver for smart metering. For water suppliers who had progressed to operational rollout, business case benefits being achieved included water demand reductions, long term CAPEX savings (e.g. deferring augmentation of networks and associated capital expenditure), improved meter reading accuracy, and improved customer engagement (including complaints reduction, and timely signals to customers for leak detection).

The Beal study suggests there is uncertainty around the choice of communication systems, and water suppliers surveyed consistently mentioned technological difficulties concerning the incompatibilities of meter, data storage, and communication systems.

The Water Services Association of Australia has published *Domestic Smart Water Meter Specifications* (Water Services Association of Australia, 2010) and *Domestic Smart Water Meter Business Requirements* (Water Services Association of Australia, 2010). These documents build on work done by the Australian water industry in determining minimum standards for smart meter specifications, communications, and business requirements. This does not preclude or restrict vendors from providing additional functionality above the minimum.

10. Meter Reading

Meter reading is the responsibility of the water supplier unless alternative arrangements are specifically made.

Information on meter reading should be provided to customers, along with other relevant information, when new accounts are established.

The frequency of manual meter reads will often be dictated by billing cycles. Where smart meters have been installed, meter read frequency will need to factor in technology costs and desired levels of customer information.

The determination of meter reading frequency and associated billing cycles requires the balancing of issues such as meter reading costs, information requirements, and customer behaviour influences. A considerable body of academic literature assesses the impact of billing cycles on customer behaviour and associated demand, with more frequent communication with users generally promoting better resource use.

The weighting of each of these issues will be water supplier dependent, and guidance is beyond the scope of this document. Good practices associated with billing cycles (and Watercare's progress towards achieving these) are reported on in *Watercare Services Limited: review of service performance* (Office of the Auditor-General, 2014).

10.1 Special Meter Readings

Customers can request a special meter reading for a given date at their cost.

Customers should give the water supplier notice of at least five working days. Shorter periods of notice may be accepted by the water supplier.

Comment

Special meter readings would normally be charged at a standard rate, irrespective of meter size. Usually, organisations would set and publish their charges on an annual basis.

The water supplier may elect to charge more for special readings at shorter periods of notice.

10.2 Using Meter Reads for Billing

This guide only covers billing information related to water metering. However, from a customer's perspective, it is important that the water supplier's invoice contains all relevant information, and is easy to understand.

The *Customer Services Code for Urban Water Businesses* (Essential Services Commission, 2014) provides a list of all information that should be contained on a water bill. The code also addresses mechanisms for issuing bills, presentation of charges, and billing cycles.

If billing is based on water meter reads, the bill should contain:

- the date on which the meter was read or, if the reading is an estimation, a clear statement that the reading is an estimation; and
- the average daily rate of water usage at the property for the current billing period.

To the extent the data is available, other useful billing information included on a customer invoice could include:

- a graphic illustration of the customer's current water and recycled water usage;
- the customer's usage for each billing period over the past 12 months; and
- a comparison of the customer's usage with the customer's usage for the same period the previous year.

10.3 Estimated Reads

Estimated reads may be required in instances where a meter is broken, unreadable, found to be inaccurate, or where meter access is an issue. Water suppliers may also elect to calculate estimated reads where customer billing cycles are short.

From a customer service perspective, it is important that invoices based on estimated meter readings be very close to actual usage for the estimated month, so that a customer is not under- or over-billed to any significant extent.

Estimates should be based on consumption during previous billing periods. The water supplier should make available information for determining estimates, and customer processes for disputing estimated reads. Watercare's processes for estimating water usage and their accuracy are outlined in *Watercare Services Limited: review of service performance* (Office of the Auditor-General, 2014).

10.4 Adjustments to the Customer's Invoice

Where a meter is under-reading by more than 20% or has stopped, the water supplier reserves the right to charge for the amount of water assessed as having been used over the past billing period, and taking into account any seasonal variations in demand.

Where a meter is over-reading, the water supplier shall make appropriate adjustments to the customer's invoice(s) based on a period of similar use, and backdated to when it is agreed between supplier and customer that the over-reading is likely to have occurred.

10.5 Remote Readers

A testing regime should be implemented to ensure that no discrepancy exists between the remote reader and the meter counter. Remote readers used for charging purposes shall be checked at least annually against the meter counter. The water supplier shall keep this information for a minimum of three years.

The device on which consumption is measured shall be indicated on the invoice.

If remote readers are retrofitted to meter installations (i.e. not installed as part of the original installation), the installation date shall be separately recorded.

Comment

Meters with remote reading capability can be connected to remote reading totaliser units near the meter assembly to enable water suppliers to read their consumption where the meter is installed in an unideal location.

In some instances, a property owner may wish to attach logging or remote telemetry to their own water meter to assess their consumption patterns or manage water use. In these situations, written approval by the water supplier is required. *Section 6.3 Installation of Additional Equipment on Meter* specifies requirements for customers wishing to install additional equipment on their meters.

Where meters have been equipped with remote meter reading capabilities, they should be located to minimise interference of data transfer. The nature of interference will be impacted by the spectrum on which the remote reader is transmitting. Manufacturer's installation requirements should be consulted in selecting an appropriate meter to minimise noise from the surrounding environment.

Comment

Remote readers may be influenced by stray electrical fields, poor earthing contacts, proximity to power cables, and other factors.

There are a number of international remote reading devices that do not match New Zealand's radio spectrum requirements, which are managed by Radio Spectrum Management, a business unit of the Ministry of Business, Innovation and Employment. Rights for use of the radio spectrum and product compliance standards can be obtained from their website: www.rsm.govt.nz.

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Appendix I: Procedures for On-Site Testing of Water Meters

The following criteria are regarded as minimum requirements.

Before carrying out a preliminary accuracy assessment, water shall be flowed for at least one minute from the connected test apparatus to remove any air from the test system. Occupants of the house shall be advised not to use any water until further notice.

Before the assessment commences, the operator shall observe the meter twice over a period of not less than three minutes to look for any leakage in the private system. Should the meter remain on the initial reading for the duration of the observation, the system is deemed to be free of significant leaks, and the customer's system is assumed to be closed.

Where the meter indicates signs of leakage, the test should not proceed and the water supplier and customer be advised accordingly.

Where leakage in the customer's system is observed at the meter, the water supplier may elect to record the meter accuracy by disconnecting the customer's system and connecting the test apparatus directly to the meter.

The standard assessment shall be carried out using a fully opened tap, limited, if necessary, to a maximum flow of 35 litres per minute. The assessment shall be undertaken over not less than a three minute period.

The assessment meter shall have been calibrated within the past 12 months, or after no more than every 200 tests, whichever is the lesser. Assessment results shall include an accuracy curve over the range of the meter derived from the testing procedures. The meter shall be certified as being accurate in accordance with the accuracy standards required by OIML R49, and test records kept. The accuracy curve shall be used to convert measured volume of the test meter to a corrected actual volume. The corrected reading shall be compared to the observed customer-measured volume, and percentage error determined by direct reference to volume standards with appropriate calibration.

Customers shall be clearly advised of the result and any appropriate subsequent actions, and an On-site Water Meter Preliminary Accuracy Assessment Certificate shall be issued. The certificate shall have, as a minimum:

- tester's organisation and name, address, and contact phone numbers;
- unique certificate number;
- date assessed;
- meter serial number;
- make and model;
- customer information, property address, and details as agreed with water supplier;
- circumstances under which meter is being tested;
- initial customer meter reading;
- test flow rate;
- static test pressure;
- percentage error at test flow rate;
- confirmation whether meter complies with the appropriate standard to which the meter was manufactured;
- confirmation that the on-site meter is currently certified (details available on request);
- space for any additional comments; and
- the name and signature of the tester.

Appendix II: Inline meter specifications typically used in New Zealand

Meter Size	Meter Length (mm)	Thread Fitting/Flange	Ratings	Coupling
DN15	134	AS 1722.2-1992 and ISO 7.	<0.004m^3/hr Q_{start} Q_3 = 2.5m^3/hr	½" BSP
DN20	165	1" BSP	Complies with OIML R49.1 Q_3 = 4.0m^3/hr	¾" BSP
DN25	178	1¼" BSP	Complies with OIML R49.1 Q_3 = 6.3m^3/hr	1" BSP
DN32	260	1¼" BSP 1½" BSP	Complies with OIML R49.1 Q_3=10m^3/hr	1¼" BSP
DN40	300	1½" BSP 2" BSP	Complies with OIML R49.1 Q_3=16m^3/hr	1½" BSP
DN50	300	2" BSP & AS/NZS4087 Flange	Complies with OIML R49.1 Q_3=25m^3/hr	
DN80	350	AS/NZS4087 Flange	Complies with OIML R49.1 Q_3=120m^3/hr	
DN100	350	AS/NZS4087 Flange	Complies with OIML R49.1 Q_3=120m^3/hr	
DN150	500	AS/NZS4087 Flange	Complies with OIML R49.1 Q_3=450m^3/hr	
DN200	350 520	AS/NZS4087 Flange	Complies with OIML R49.1 Q_3=700m^3/hr	
DN300	500	AS/NZS4087 Flange	Complies with OIML R49.1 Q_3=1500m^3/hr	

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