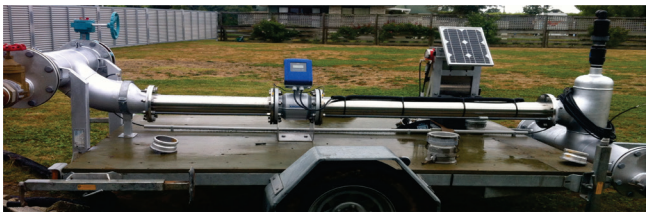
Verification of Water Measuring Devices (Water meters)

This Environment Topic provides information about verification of a water measuring device (water meter).

Verification of the meter can be done in a number of ways, but essentially involves measuring the water flowing through the service meter with another measurement device.

This Environment Topic describes techniques that can be used for onsite verification in Hawke's Bay and for acceptance by Hawke's Bay Regional Council (HBRC).



Why is verification needed?

An 2010 amendment to the Resource Management Act (RMA) requires, over time, all consent holders with takes of 5 litres/second or greater to measure their water use. All water meters must also be verified to prove that the measurement of water used is accurate to within +/- 5%.

Most water measurement devices can produce accuracies of +/-5 %, and some devices are capable of better than +/-1 %.

A national agreement between regional councils has determined that only verification methods that have a calculated uncertainly of less than 3% can be used.

To achieve this level of accuracy, the correct verification method must be selected for each installation.

If the verification method used cannot be demonstrated to be less than 3%, the verification will NOT be accepted by HBRC.

For some types of meter, errors occur as components wear and the accuracy decreases.

If an initial verification is made on location when the meter is installed, a record of service meter accuracy can be established which will be a benefit for subsequent verifications.

What are the different verification methods?

The techniques for in situ, closed conduit (piped) water meter installations are:

- Reference meters flow rigs, and
- Ultra-sonic clamp on method.

For a verification to be accepted by HBRC, the verifier and method must be approved by HBRC.

Reference Meter (flow-rig)

A flow-rig is where the check meter is installed in its own pipe work. The measurement error of the pipe work needs to have been tested and proven to be less than the 3% permissible error. It must be connected via a specific outlet through which all the pumped water can pass.

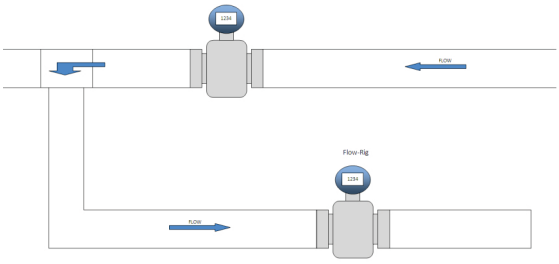


Diagram 1: Flow rig reference meter

A reference meter placed in series with a service flow meter or used within a flow-rig is potentially an effective and cost effective in-situ verification method.

With this technique, a reference meter or flow-rig is brought to site and fitted to the service meter installation pipe work. The reference meter can also be located somewhere in the pipe system where hydraulic conditions are favourable. It is important to ensure no losses/leaks can occur between the service and reference meter.

Verification procedures must be done carefully and with attention to detail with special attention to handling and installation configuration disturbances.

Accuracy

Accuracies for reference meters in series typically range from 0.05 to 1.5%.

Ultrasonic Clamp-On Meter

The ultrasonic clamp-on flow meter is a non-invasive device used to measure full pipe flow in closed conduits. These meters are considered to be unique in their ability to measure flow with little or no modification to existing pipe configuration; however, the higher number of uncertainties associated with this method generally make it less viable.

HBRC does not recommend the use of this method unless the use of a reference rig is not a viable option. To get a valid and accurate assessment of the accuracy using a clamp on ultrasonic meter, the uncertainly of the measurement must be calculated, and this is complicated and time-consuming so can be expensive.

When not to use - Clamp-on ultrasonic meters should not be used on downward flowing vertical pipes. This can introduce uncertainties in the flow profile and the possibility of a loss of signal due to the pipe wall interior not being wetted by the fluid.

These should also not be used where the uncertainty cannot be calculated as less than +/-3%.

How to use

The method works by two transducers acting alternately as transmitter and receiver as two paths of sonic beams travel back and forth across the pipe. One beam travels downstream while the other moves upstream (see diagram 1). The motion of the fluid causes a frequency shift in both waves that is related to the velocity of the fluid.

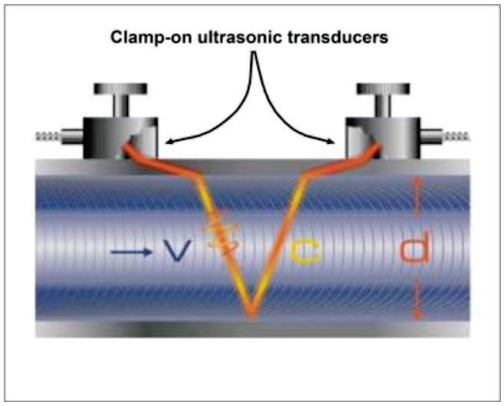


Diagram 3: Transit-time ultrasonic flow meters

Correct installation requires more than 10 straight diameters of pipe (D) that is free of obstructions upstream, and at least one straight D free of obstructions downstream from the meter. See Table 1.

A common problem found in irrigation meter installations is that an upstream, unobstructed, straight pipe length cannot be achieved.

Measurement errors

These can be caused by non-uniform pipe thickness, differing water temperature, air bubbles, oval pipe, proper contact between transducers and pipe work, low signal strength caused by pipe makeup, pipe scale build up etc. These errors are difficult to factor and so make it difficult to produce a measurement error less than 3%.

Given the importance of set-up requirements for the meter and the need for proper knowledge of the conditions, comprehensive data recording will need to be done initially and maintained during subsequent flow measurement events.

To do this, record site details will need to be kept on dimensional characteristics of the pipe, set-up parameters, diagnostics parameters and relevant observations. This data can then be used to verify or confirm measurements made on site and reduce the potential for human error.

To get Accuracy

To achieve a low uncertainty of < 3% make sure that:

- the pipe is in good condition externally and internally
- the site where the transducers are installed is free of welds and joints and is situated well downstream of any disturbing pipe components, such as bends or valves.

Disturbance	Number of Diameters required to reduce error to less than +/- 2%
Conical Contraction	4
Conical Expansion	18
Single 90° bend	30
Two bends 90° in'U'	22
Two 900 bends in perpindicular planes	47
Butterfly valve 2/3 open	18
Globe valve 2/3 open	15
Gate Valve 2/3 open	20

Table 1, Upstream length requirements to achieve an uncertainty of less than ±2% for different disturbances, Sanderson and Yeung (2002)

References

Water Measurement Manual - A Water Resources Technical Publication. U.S. Dep. Of Interior, Bureau of Reclamation. (2001)

Measured in-situ Verification of Meters for Non-Urban Water Supply, CRC for Irrigation Futures Technical Report 10/08 December (2008)

Guidelines for the use of ultrasonic non-invasive metering techniques. Sanderson and Yeung (2002)