



Government of **Western Australia**
Department of **Water**



Looking after all our water needs

Guidelines for water meter installation 2009

Looking after all our water needs

Department of Water

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Department of Water
168 St Georges Terrace
Perth Western Australia 6000
Telephone +61 8 6364 7600
Facsimile +61 8 6364 7601
www.water.wa.gov.au

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For more information about this report, contact
Matthew Viskovich, Project Manager or Shae Bilston, Communications Officer

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1 Introduction

1.1 Intent

The intent of the guideline is to provide information on the Department of Water's requirements relating to installation of water meters. The guidelines have been developed to:

- provide a State-wide protocol for the installation of department approved water meters
- ensure water meters are correctly fitted to provide accurate water use information for water resource management and planning purposes
- provide information for water users and stakeholders of the department's legislation and standards relating to water meters
- assist in the investigative process for water licensing compliance and enforcement.

1.2 Governing legislation

The *Rights in Water and Irrigation Act 1914 (RIWI Act)* provides the legislative framework for the management and allocation of water resources in Western Australia. The *RIWI Act* describes provisions for the management, regulation, protection and use of the States water resources.

Schedule 1, Clause 46 of the *RIWI Act*, has provisions relating to powers to the installation, maintenance and testing of water meters.

For state owned meters the *RIWI Act* provisions need to be read in conjunction with the *Water Agencies (Powers) Act 1984 (WAP Act)*. Specifically, Section 82 which allows the department to carry out works for the purposes of this Act or any relevant Act that are related to the conservation, protection or management of water resources.

The *Rights in Water and Irrigation (Approved Meters) Order 2009* as published in the Government Gazette on 5 May 2009 specifies provisions relating to water meters approved by the department. (refer to Appendix A).

Under Regulations 42 - 46 of the *Rights in Water and Irrigation Regulations 2000*, there are provisions relating to damage and interference with water meters, objections to meter readings and estimation where a meter malfunctions.

1.3 Definitions

Under Schedule 1, Clause 46(5) of the *R/WI Act*, meters are defined as:

Water Meter: A device for measuring or estimating the volume, or flow of water that is approved under the Rights in Water and Irrigation (Approved Meters) Order 2009.

Remote Flow Display Unit (RFDU): A unit that is located away from the water meter and displays the measurement results.

2 Water meter installation requirements

Water meters must meet the department's requirements under *the Rights in Water and Irrigation (Approved Meters) Order of 2009*. As written in the order meters must be fitted in accordance with the manufacturer's installation specifications, failure to do so will mean that the meter will not be approved under the order as it will compromise accuracy standards and meter reliability.

The department does not recommend a preferred type, make, model, or water meter manufacturer over another. Selection of a water meter is based on a "fit for purpose" rule considering the local water and environmental conditions, cost effectiveness, maintenance and testing and the water delivery system's operational requirements. It is advisable that water users consult with a water professional prior to selection and purchase of an approved water meter.

2.1 Technical requirements

The department's minimum technical requirements for water meter installations are:

- 1 Water meters must be fitted in the right direction of flow and positioned to allow easy visibility for manually reading the meter and for viewing the serial number.
- 2 The length of pipe that accommodates the water meter must be completely filled with water immediately upstream and downstream of the meter under all operating conditions.
- 3 Water meters are to be located to avoid damage (eg. vehicles, livestock, vandalism, flooding) a protective box may be necessary in some situations.
- 4 Water meters are to be installed as close as practicable to the extraction point and **must** be located upstream of any valves (except air valves), tees, take-offs, diversions or branches.
- 5 Water meters are to be installed above ground if possible and located outside of wells to allow for safe and easy meter reading (eg. without the need to use ladder and/or mirror).
- 6 If a water meter is required to be located below ground, or down a well then it should not be deeper than 500mm below ground level. Where it is necessary for the water meter to be located deeper than 500mm, or if fitted down a well, then for occupational, health and safety reasons a remote flow display unit (RFDU) must be installed and located above ground for safe access and easy readability.
- 7 The RFDU must be resistant to corrosion and fogging and of a size and type that is easy to read. It must also have a cumulative flow totaliser with clearly specified units expressed in either kilolitres (kL) or cubic metres (m³).
- 8 All new water meters are to have pulse output capability which allows for connection of ancillary equipment (eg. RFDU, data logger, central control systems etc).

- 9 All new water meters are to have a local totalising display that indicates the water used in metric units. The display shall be digital and the preferred units are kilolitres (kL), however cubic metres (m³) is acceptable. For larger water meters (eg. >150mm), the scale of the display shall be kL x 10, or m³ x 10.
- 10 A water meter is designed to measure straight flowing water free of any disturbances (eg. elbow bends, filters, valves etc.). These disturbances can compromise water meter accuracy standards. Australian Technical Specification (ATS 4747) requires that water meters are to be fitted ensuring that there are 10 diameters of clear length of straight pipe¹ upstream of the meter and 5 diameters of clear straight pipe¹ downstream of the meter. (Refer to Appendix B).
- 11 In situations where there are space limitations (eg. inside pump sheds, cropped areas etc.) shorter pipework lengths may be utilised provided the water meter is certified for that purpose by the meter manufacturer and fitted in accordance with their specifications.
- 12 Angle type water meters may be used where there are space limitations provided the angle meter conforms to ATS 4747 and is fitted to the manufacturer specifications.
- 13 A water meter may be fitted onto vertical pipe-work (as usually found in wells), provided it is certified for that purpose by the meter manufacturer and fitted in accordance with their specifications, or a NATA report endorsing its installation within the configuration as it is tested on upward flowing vertical pipe.
- 14 It is recommended that a “loose ring” or expansion joint be installed into the pipe-work following the minimum lengths of straight pipe downstream of the water meter to provide for easy removal of the meter for servicing and testing.
- 15 Water meters fitted onto polyvinyl chloride pipe (PVC), or polyethylene pipeline must be adequately supported by a concrete thrust block, or fabricated steel bracing to ensure stability.
- 16 For future in-situ testing of a meter it is recommended that two testing tees be fitted downstream of the meter with a valve located between the first and second tee for isolation reasons. The purpose for the second testing tee is to allow water, once passed through a master meter (or reference flow meter) to be returned to the system to minimise wastage and possible erosion during discharge. An added benefit of returning water to the system is that it will allow a master meter to remain in-situ for extended periods to comprehensively test the existing meter to identify any intermittency of operation (Refer to Appendix D.)

¹ Reference to “x diameters of straight pipe” refer to a straight length of pipe that has the same internal diameter as the internal diameter of the meter and equivalent in length to at least x times the diameter.

3 Metering open channel and partially filled pipe systems

Specifications, installation and commissioning of meters used for non-urban water supply for open channel and partially-filled pipes are described in ATS 4747.3. The Table below is an extract taken from ATS 4747.3 and lists equivalent existing Australian Standard (AS) and International Organization for Standardisation (ISO) methodologies suitable for measurement of flows in open channel and partially filled pipes. Water meters which meet equivalent AS and ISO standards and are fitted and commissioned in accordance with the manufacturer requirements are approved for use by the department.

No.	Methodology Description	Equivalent International Standard	Australian Standard
1	Ultrasonic	ISO 6416	AS 3778.3.7
2	Electromagnetic	ISO 9213	AS 3778.3.8
3	Thin-plate weirs, sharp crest, V-notch	ISO 1438	AS 3778.43.1
4	Thin-plate weirs, sharp crest, rectangular, suppressed	ISO 1438	AS 3778.4.1
5	Thin-plate weirs, sharp crest, rectangular	ISO 1438	AS 3778.4.1
6	Weirs, broad-crested with sharp upstream edge	ISO 3486	AS 3778.4.2
7	Weirs, broad-crested with sharp rounded upstream edge	ISO 4374	AS 3778.4.3
8	Weirs, triangular profile	ISO 4360	AS 3778.4.5
9	Weirs, streamlined triangular profile	ISO 9827	
10	Weirs, triangular profile, flat-V	ISO 4377	AS 3778.4.6
11	Weirs, V-shaped, broad crested	ISO 8333	AS 3778.4.4
12	Weirs, trapezoidal profile	ISO 4362	
13	Flumes, rectangular	ISO 4359	AS 3778.4.7

14	Flumes, trapezoidal	ISO 4359	AS 3778.4.7
15	Flumes, U-shaped	ISO 4359	AS 3778.4.7
16	Flumes, Parshall and SANIIRI	ISO 9826	

3.1 Dethridge wheels

Dethridge wheels are used for measurement of flows in open channel and partially filled pipe systems by many water users and water providers throughout WA. However, while the dethridge wheel has been nationally recognised as the primary metering device for open channels since the early 1900's, it is highly unlikely that the device will meet the new metering provisions of ATS 4747.

The principal issue with dethridge wheels are their questionable ability to accurately measure flows when *in-situ* and within permissible limits as required by ATS 4747. Factors that can impact on the wheels accuracy levels include, but are not limited to the following:

- Difficulty in maintaining the wheel in correct water level conditions
- variations to dethridge outlet settings compared to required design standards
- clearances between emplacement and the fins
- bearing wear over time
- damage to the drum, or fins
- obstructions of the wheel caused by debris, or other matter.

Furthermore, there are also important occupational, health and safety considerations for water users associated with operating dethridge wheels.

Accordingly, the department does not recommend the use of dethridge wheels for new, or existing open channel and partially-full pipe systems.

Water users that have existing dethridge wheels will need to consider formulating a replacement plan for phasing out the device and replacing it with a suitable approved meter that will meet the specification in accordance with *RIWI (Approved Meters) Order 2009*.

4 Water meter accuracy limits and testing/certification

The department requires that water meters when tested in laboratory conditions must be within 2.5% accuracy across the full flow rate range. While the maximum permissible limit of error allowable for in situ test conditions is within +/-5%.

A water meter may be tested and certified in-situ provided it is performed by accredited water professional and the master meter (or reference flow meter) is NATA accredited. The meter test report is to state the date of the test, serial number, size, make of the meter and the error of measurement in percentage. Testing methodology is to be in accordance with ATS 4747 and the water meter test report is to be provided to the department is requested.

5 Recording and reporting water meter information

On the installation of a water meter there is a requirement for the licensee to submit to the relevant Department of Water, Regional office the following information:

- The exact location of the meter/s (using Global Positioning System coordinates, if available).
- The date the meter/s were installed and the make, size, type and serial number of each meter.
- Photograph, and/or a diagram of meter fitted on pipe-work, include dimensions showing lengths of clear pipe before and after the water meter up to the first off-take.
- The meter reading at the time of installation.

Licensees with metering requirements on their water licences will usually be required to read the meters regularly and submit the information to the department.

The department may also undertake periodic inspections of meter installations for compliance and enforcement purposes.

6 Tamper proof security seals

Manufacturers of water meters attach seals to the meter dial on all meters to prevent tampering of the register. The department also fits additional tamper proof security seals onto government owned meters to prevent meter removal and interference with the internal mechanism.

In some areas, or situations the department may affix or require to be fixed, tamper proof security seals onto privately owned water meters for compliance and enforcement purposes.

Approval is required from the department prior to removal of any security seal.

7 Additional considerations

Due to the large range of water meter manufacturers, it is recommended that water users consult a water professional prior to purchase to ensure that the water meter conforms to all of the department's requirements. Additional matters for consideration are as follows:

- **Water Source:** if the source is from a river, watercourse or groundwater system there may be water quality and debris issues which may impact on meter accuracy, flow pressure issues, reliability and longevity of a meter.
- **Installation:** it is recommended that the water meter supplier provide an installation guide specifying installation requirements to achieve the manufacturer stated accuracy standards.
- **Flow Range:** the water meter manufacturer, or supplier should indicate the required operating flow rates and conditions for the meter. This is essential in identifying any pressure losses after the water meter is installed and for accuracy to ensure that it reads in minimum to maximum flow ranges.
- **Cost for meter servicing, parts and calibration:** this is especially important for remote areas of the State where maintenance or servicing of the water meter may be difficult.

8 Water meter types

Water meters can either be driven mechanically or non-mechanically with each having specific attributes to suit various operating conditions. A brief overview is provided below:

- **Mechanical meters:** operate by a propeller, turbine or paddle wheel coupled to a measurement dial, or electronic display. These meters are suited to clear water with no debris and generally less expensive than non-mechanical types. However, they have a higher maintenance requirement.
- **Electromagnetic meter:** (also known as magflow meter) is a non-mechanical meter mainly used in urban, wastewater and industrial systems. Magflow meters consist of a section of pipe with a magnetic field projected across it and electrodes to detect electrical voltage changes. They are useful where debris, and poor water quality is an issue.
- **Ultrasonic water meter:** (also known as Doppler flow meter) is a non-mechanical meter suited to the same purposes as the magflow meter. The ultrasonic meter has a sensor that can be either inserted inside, or attached outside of the pipe. The sensor measures the water velocity in the pipe, and then converts this to flow rate.
- **Angle meter:** a mechanical meter designed with the inlet and outlet ports at 90 degrees to each other. They can often be installed in place of a bend in the pipe system and useful in areas where there are space limitations. Providing this type of meter has NATA accreditation and/or meets the requirements of AS 4747 they are acceptable for use (Refer to Appendix B).

9 Damage and interference with a water meter

Under the *Rights in Water and Irrigation Regulations 2000* there are provisions relating to the damage and interference of water meters. Should a department owned and installed water meter be damaged, then the licensee may be liable for the costs of those repairs. Furthermore, it is an offence for a person to damage a water meter, or install or alter a meter or any associated fittings so that it does not accurately measure the quantity of water being taken. A penalty of \$2,000 is applicable.

There are also provisions under the *RIWI Act 1914*, which allow the department to cause a test of a meter if there are concerns relating to its accuracy.

Periodic inspections of water meters are undertaken to ensure compliance with legislation.

Appendices

Appendix A – *Rights in Water and Irrigation (Approved Meters) Order 2009*

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No. 77. 05-May-2009

WA301

Rights in Water and Irrigation Act 1914

Rights in Water and Irrigation (Approved Meters) Order 2009

Made by the Minister under Schedule 1 clause 46 of the Act.

9.1.1.1.1 1. Citation

This order is the *Rights in Water and Irrigation (Approved Meters) Order 2009*.

9.1.1.1.2 2. Commencement

This order comes into operation as follows —

- (a) clauses 1 and 2 — on the day on which this order is published in the *Gazette*;
- (b) the rest of the order — on the day after that day.

9.1.1.1.3 3. Approved meters

A meter is approved for the purposes of Schedule 1 clause 46 of the Act if the meter —

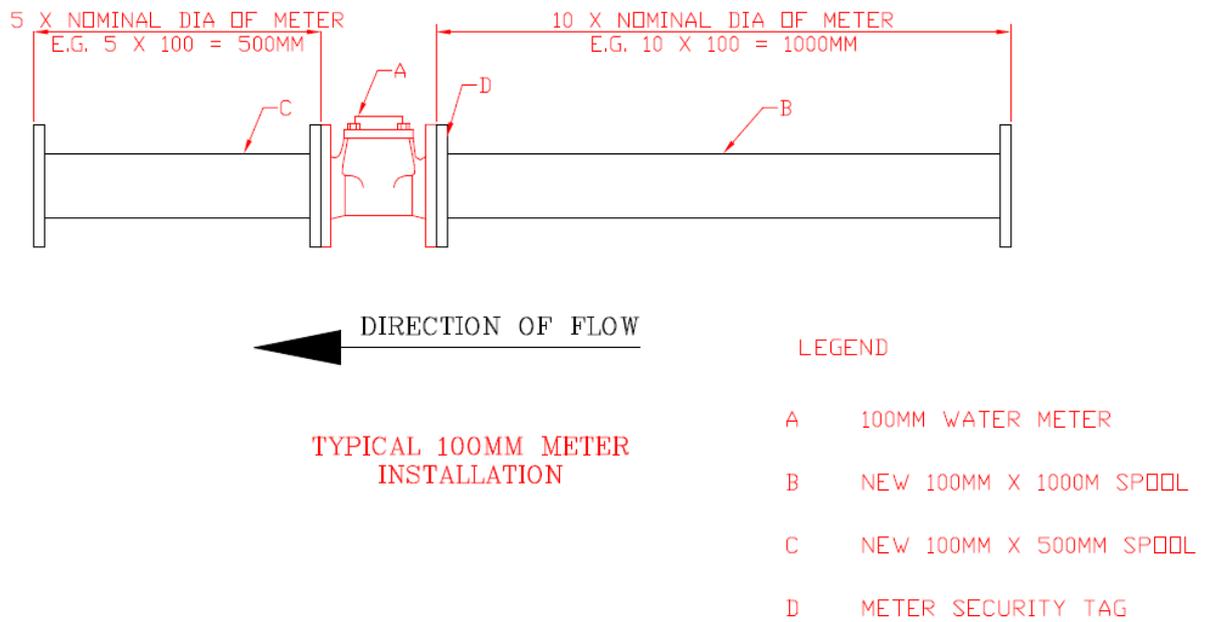
- (a) complies with the suite of specifications in Australian Technical Specification 4747 — 2008, *Meters for non-urban water supply*, published by Standards Australia; or
- (b) has been —
 - (i) tested at a National Association of Testing Authorities accredited laboratory and verified on a National Association of Testing Authorities report or certificate to be within 2.5% accuracy; and
 - (ii) installed in accordance with the manufacturer's specifications.

9.1.1.1.4 4. Rights in Water and Irrigation (Approved Meters) Order 2003 revoked

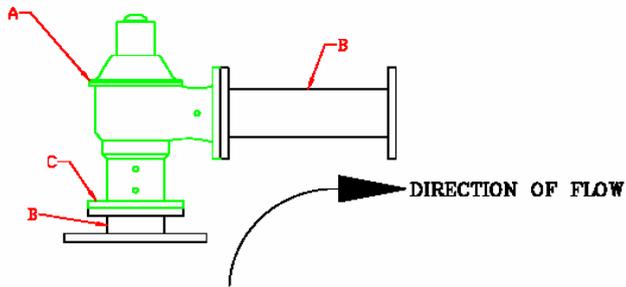
The *Rights in Water and Irrigation (Approved Meters) Order 2003* is revoked.

Dr GRAHAM JACOBS MLA, Minister for Water;
Mental Health.

Appendix B - Diagram of water meter installation showing pipework measurements



Appendix C - Diagram of angle water meter installation



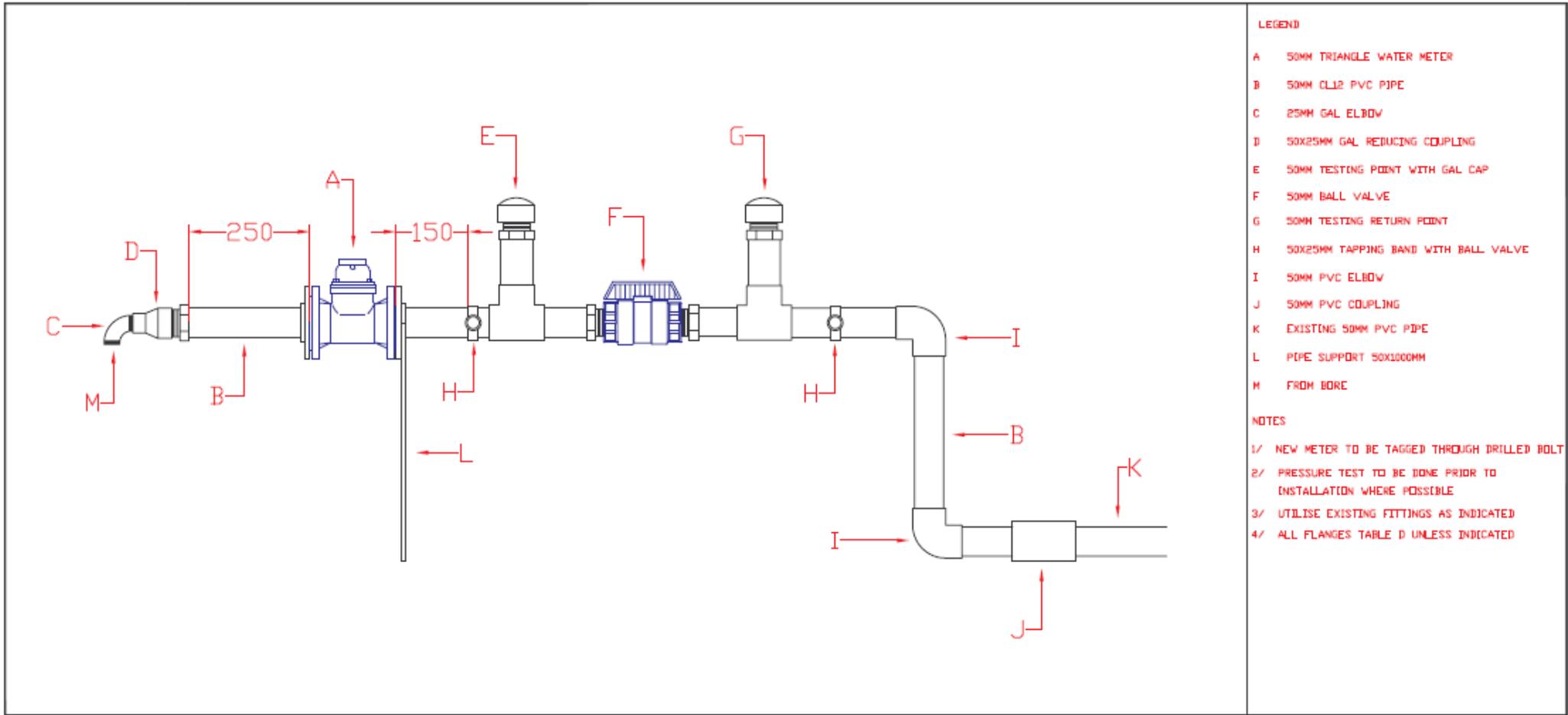
**TYPICAL 100MM HYDROMETER
INSTALLATION**

LEGEND

- A 100MM HYDROMETER
- B SPOOL
- C METER SECURITY TAG

ANGLE OR STRAIGHT METERS DO NOT
STRAIGHT SPOOLS BEFORE AND AFTER

Appendix D - Diagram of a testing tee design





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168 St Georges Terrace, Perth, Western Australia
PO Box K822 Perth Western Australia 6842
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Fax: (08) 6364 7601
www.water.wa.gov.au