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Utility meters – general requirements

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Amendments

No.	Date	Page/s	Location	Details of change
1	MM 2023	-	Various	Separation of test procedures for different kinds of utility meter – gas meter, electricity meter and water meter.
2	MM 2023	-	Various	Clarification of sampling plans and selection.
3	MM 2023	2	Clause 2.2.4	Clarification of acceptance of ISO/IEC 17020.
4	MM 2023	-	-	Removal of references to in-service inspection and re-verification.
5	MM 2023	-	Various	Clarification of requirements for marking of verification marks and issuing of batch verification certificates.
6	MM 2023	5	2.2.4.3	Acceptance level for batch verification reduced from 1% to 0.1%.

Preface

NITP 14.0 contains the general requirements for the verification of utility meters.

This document must be used in conjunction with the following documents as applicable:

- NITP 14.1 – Utility meters – gas meters
- NITP 14.2 – Utility meters – electricity meters
- NITP 14.3 – Utility meters – water meters

The Chief Metrologist has determined that NITP 14.0 together with the specific NITP (14.1, 14.2 or 14.3) are the national instrument test procedures for utility meters.

This document specifies:

- the general requirements for the verification of utility meters including batch/lot sampling regimes for utility meters imported into Australia from other jurisdictions, as well as the production and issue of batch verification certificates as a means of identifying verified imported utility meters in lieu of a verification mark, and
- the related requirements for utility meter verifiers.

This document does not mandate the pattern approval or verification of utility meters that are of a type and class exempt from the operation of the National Measurement Act 1960 (Cth) (the Act) under regulation 5.6 of the *National Trade Measurement Regulations 2009* (Cth) (the Regulations).

Contents

Explanation of terms

Terms used in this document are defined in the legislation detailed in clause 1 (Scope), *OIML V 1 International Vocabulary of Terms in Legal Metrology* ,*OIML V 2-200 International Vocabulary of Metrology – Basic and General Concepts and Associated Terms,* and *General Information for Test Procedures*. In addition, the following definitions apply:

Batch

definite quantity of utility meters manufactured under uniform processes and conditions (also known as a *lot*)

Batch verification certificate

certificate issued by a utility meter verifier as evidence that an imported batch of utility meters has been tested as required for batch verification and is verified in accordance with the Act

Country of manufacture

jurisdiction in which the final assembly and sealing of a utility meter took place

Verification

Refer to the *National Measurement Act 1960* for the definition.

Note: Initial verification and subsequent verification are both verification, undertaken at different times during the operational life of a utility meter. As such, the requirements of the Act, as it pertains to verification, apply in both cases.

Initial verification

verification of a utility meter that has never been verified, undertaken prior to the use of the utility meter

Subsequent verification

verification performed on a utility meter following repair, maintenance or adjustment affecting the metrological performance and/or sealing of a utility meter

Manufacture

process involving the final assembly and sealing of a utility meter

Sample

definite quantity of utility meters selected at random from a batch of utility meters

Sampling plan

specified procedure in which a sample of utility meters is selected and drawn from a predefined batch, tested in accordance with NMI requirements and decisions regarding the batch are made based upon the results of the sample under test

Serial number

unique alphanumeric identifier marked on a utility meter

Abbreviations

Gas meters

Q_{min}	minimum flowrate
Q_t	transitional flowrate
Q_{max}	maximum flowrate
Q_N	flowrate equal to Qmin for gas meters with a flowrate range exceeding a specified number of test points
Q_i	flowrate corresponding to a test point derived from relevant formula or criteria

Electricity meters

I_b	basic current, expressed in amperes
I_{max}	maximum current, expressed in amperes
I_{min}	minimum current, expressed in amperes
I_n	rated current, expressed in amperes
I_{st}	starting current
I_{tr}	transitional current
k	number of pulses emitted by the output device of the meter per kilowatt hour (imp/kWh)
m	number of measuring elements
U_{nom}	reference voltage, expressed in volts

Water meters

Q	flowrate
Q_1	minimum flowrate
Q_2	transition flowrate
Q_3	maximum continuous flowrate
Q_4	overload flowrate

1. Scope

National Instrument Test Procedures (NITP) 14.0 describes the general requirements for verification of utility meters. Together with the applicable specific NITP (14.1, 14.2 or 14.3) these are the National Instrument Test Procedures to assess whether utility meters operate within the maximum permissible errors (MPEs) and are of an approved pattern.

Note: MPEs are specified in the *National Measurement Regulations 1999* (Cth). Alternative MPEs may be stated in certificates of approval issued on or after 1 July 2007.

All utility meters must also comply with the *National Measurement Act 1960* (Cth), the *National Measurement Regulations 1999* (Cth) and the *National Trade Measurement Regulations 2009* (Cth).

2. General requirements for verification

2.1 Equipment

The following equipment is required for the verification of utility meters:

1. Certificate of approval
2. Appropriate reference standard(s) of measurement and/or certified measuring instrument(s) with:
   a) a current Regulation 13 certificate or Regulation 21 written notice for each reference standard of measurement.
   b) a current Regulation 37 or Regulation 40 written notice for each certified measuring instrument.
3. Control instrument (if applicable).

   A control instrument must comply with the following conditions:

   a) The control instrument is calibrated at least every 12 months using appropriate reference standards of measurement and/or certified measuring instruments.
   b) The control instrument is kept and used in a controlled laboratory environment.
   c) The control instrument is periodically checked/tested internally by the laboratory.
   d) All calibration and testing records are kept for the control instrument.
   e) The uncertainty budget of the laboratory includes components to account for calibration uncertainty and drift in the control instrument.

   Note: A control instrument may be a non-automatic weighing instrument calibrated using reference standards of measurement (weights) and used for determining the mass of water that can be converted to a volume. It is expected that the control instrument, its operation and maintenance are incorporated into the third-party accreditation of the laboratory's quality management system.

The expanded uncertainty in the determination of the reference quantity must not exceed one-third of the applicable MPE.

The expanded uncertainty must be determined in accordance with the *Joint Committee on Guides to Metrology (JCGM) 100:2008 Evaluation of measurement data — Guide to the Expression of Uncertainty in Measurement* with a coverage factor, k = 2.

2.2 Verification methodologies

2.2.1 Gas meters

All gas meters must be verified individually in accordance with NITP 14.1 (noting provisions for batch testing to allow for a reduction of meters tested at Q_{min}).

2.2.2 Electricity meters

Electricity meters manufactured in Australia must be verified individually in accordance with NITP 14.2 (noting provisions for batch testing to allow for a reduction of test points required).

Electricity meters imported into Australia must be verified either:

1. individually in accordance with NITP 14.2 (noting provisions for batch testing to allow for a reduction of test points required), or
2. in batches in accordance with clause 2.2.4.

The provisions for batch testing specified in NITP 14.2 allowing for a reduction of test points also apply to meters sampled for batch verification.

2.2.3 Water meters

Water meters manufactured in Australia must be verified individually in accordance with NITP 14.3 (noting provisions for batch testing to allow for a reduction of test points required).

Water meters imported into Australia must be verified either:

1. individually in accordance with NITP 14.3 (noting provisions for batch testing to allow for a reduction of test points required), or
2. in batches in accordance with clause 2.2.4.

The provisions for batch testing specified in NITP 14.3 allowing for a reduction of test points also apply to meters sampled for batch verification.

2.2.4 Batch verification of imported utility meters (electricity meters and water meters)

In accordance with sub-paragraph 18GG(1)(a)(ii) of the Act, a utility meter verifier has the authority to verify a batch of utility meters provided that the utility meter verifier is satisfied that the utility meters that constitute that batch comply with the requirements of verification as specified in section 18GK of the Act.

Decisions regarding the verification of a batch of utility meters must be based upon the results of testing performed on a sample of utility meters drawn from that batch and the defined acceptance level.

A batch of utility meters is not considered to be verified until all testing has been completed, all acceptance criteria have been met and a batch verification certificate has been issued.

All utility meters that constitute a batch must be tested in the country of manufacture and meet the requirements of the relevant test procedure specified in NITP 14.2 or NITP 14.3 (as applicable).

Testing in the country of manufacture must be performed in a facility (e.g. a laboratory attached to a production facility) with appropriate third-party accreditation to international standards concerning testing and calibration laboratory competency. Such accreditation must be to ISO/IEC 17025, or alternatively, facilities must be certified by inspection or assessment organisations accredited to ISO/IEC 17020.

Facilities must also have accreditation or certification to a relevant technical standard (for the type of utility meter under test) or field of testing.

Facilities must maintain reference standards that are traceable to the national primary standards of that country.

Third-party accreditation must be performed by an organisation that is a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA) or the International Accreditation Forum (IAF) Multilateral Recognition Agreement (MLA).

A batch verification certificate must identify all utility meters in the batch.

2.2.4.1 Requirements for determining a batch

A batch must only comprise utility meters that are:

1. of the same pattern
2. of the same accuracy class
3. manufactured in the same location
4. manufactured within the same 12-month period
5. manufactured in the same location
6. initially verified in the country of manufacture within the same 12-month period
7. determined in a manner consistent with the continuous and uniform nature of the manufacturing process, and
8. compliant with any additional criteria for a batch that is specified in the certificate of approval.

Furthermore, based upon the type of utility meter in question, the following details must also be the same for all meters in a batch:

1. Electricity meters:
    a) reference voltage (U_{nom})
    b) current parameters (as expressed in the certificate of approval):
        i) maximum current (I_{max})
        ii) basic current (I_b) for direct-connected meters
        iii) rated current (I_n) for transformer-operated meters, and
        iv) transitional current (I_{tr})
    c) number of phases.
2. Water meters:
    a) maximum continuous flow rate (Q_3)
    b) ratio of the maximum continuous flow rate to the minimum flow rate (Q_3/Q_1), and
    c) nominal diameter.

2.2.4.2 Batch details

Upon or prior to importation into Australia, the details of each batch of utility meter must be supplied to a utility meter verifier. These details must include:

1. the exact batch size (i.e. number of meters in the batch)
2. serial numbers of the utility meters that constitute the batch
3. certificate of approval number and any applicable variants
4. manufacturer
5. type or model of the meter
6. date of manufacture
7. location of manufacture
8. date of testing in the country of manufacture
9. the accreditation or certification details of the laboratory that performed initial testing in the country of manufacture

10. the results of initial testing performed in the country of manufacture in accordance with the relevant verification test procedure specified in NITP 14.2 or NITP 14.3 (as applicable), and
11. any other relevant details pertaining to the specifications, manufacture or testing of the utility meters that constitute the batch.

The utility meter verifier is responsible for ensuring that the batch complies with the above requirements and for recording all details of the batch.

2.2.4.3 Sampling plans

The utility meter verifier must draw a sample of utility meters at random from the batch in accordance with Table 1.

All utility meters that form part of a sample must be tested by the utility meter verifier.

Table 1 determines sample sizes and acceptance/rejection criteria for the purposes of verifying batches of utility meters. The following requirements apply:

1. The inspection level determines the sample size that must be tested and is dependent upon the size of the batch.
2. The acceptance level specifies the maximum number of meter failures that any sample may have. Based upon the number of meter failures and the acceptance levels used, the batch must be either accepted or rejected as specified in Table 1.
3. A meter failure is defined as a utility meter that, when tested in accordance with the relevant verification test procedure, does not meet the associated acceptance criteria.
4. Where the number of meter failures within the sample tested is:
    a) equal to **or less than** the acceptance number of the relevant acceptance level, the batch must be accepted, or
    b) equal to **or higher than** the rejection number, the batch must be rejected.

The sampling plans specified in Table 1 are based upon single sampling plans from *AS 1199.1-2003 Sampling procedures for inspection by attributes*. Use of switching rules or skip-lot sampling (as described in AS 1199.1-2003) is not permitted; each batch must be considered in isolation without reference to the performance of previously tested batches. Furthermore, the sample size must be determined and implemented consistently, without adjustment, in accordance with Table 1.

Utility meter verifiers may develop and implement alternative sampling plans, such as those described in *AS 2490-1997 Sampling procedures and charts for inspection by variable for percent nonconfoming*. All sampling plans must be of reasonable and appropriate design, providing confidence equal to or better than the sampling plans provided in this document and therefore a sound statistical basis for decision making concerning the verification of a batch of utility meters. Use of switching rules or skip-lot sampling is not permitted. Each batch must be considered in isolation without reference to the performance of previously tested batches.

Table 1. Sampling plans − sample sizes and acceptance levels (inspection level II)

Size of batch	Sample size	Acceptance level	
		0.1%	
		Accept	Reject
2 to 8	2	0	1
9 to 15	3	0	1
16 to 25	5	0	1
26 to 50	8	0	1
51 to 90	13	0	1
91 to 150	20	0	1
151 to 280	32	0	1
281 to 500	50	0	1
501 to 1200	80	0	1
1201 to 3200	125	0	1
3201 to 10 000	200	0	1
10 001 to 35 000	315	1	2
35 001 to 150 000	500	1	2
150 001 to 500 000	800	2	3
500 001 and over	1250	3	4

2.2.5 Repaired utility meters

A repaired utility meter cannot be considered part of a batch as it no longer satisfies the definition of a 'batch' (because it is not considered to be part of a continuous manufacturing process).

Only utility meters that are verified individually may be repaired and re-tested. Any repairs must not alter the meter from the pattern specified in the certificate of approval.

Any utility meter that fails testing when tested as part of a batch for batch verification must not be verified. Such a meter may be repaired, re-tested and verified individually.

2.3 Visual inspection

Visually inspect the utility meter(s) under test to confirm compliance with the following characteristics:

1. The utility meter(s) must comply with the relevant certificate of approval in all respects (including sealing).
2. All indications must be clearly visible.

2.4 Test procedures for gas meters

The specific test procedures for the verification of gas meters are detailed in NITP 14.1 – Utility meters − gas meters.

2.5 Test procedures for electricity meters

The specific test procedures for the verification of electricity meters are detailed in NITP 14.2 – Utility meters − electricity meters.

2.6 Test procedures for water meters

The specific test procedures for the verification of water meters are detailed in NITP 14.3 – Utility meters − water meters.

2.7 Documentation and records

2.7.1 Batch verification certificate

Where a utility meter verifier is satisfied that an imported batch of utility meters complies with the requirements for batch verification (clause 2.2.4) and decides to verify the utility meters, the utility meter verifier must issue a batch verification certificate.

The form of the certificate must include at least the following:

1. name and contact details of the utility meter verifier
2. NATA accreditation number of the facility
3. make, model, certificate of approval number and any applicable variants
4. name and contact details of the facility that performed the testing in the country of manufacture
5. date(s) that testing was performed
6. date that the batch of utility meters was verified
7. list of serial numbers of the utility meters that constitute the batch, and
8. statement indicating that all utility meters that constitute the batch are verified.

Where the serial numbers of a batch are sequential and uninterrupted, the first and last numbers must be provided on the batch verification certificate (with a statement confirming that the serial numbers are sequential and uninterrupted). Otherwise, the complete list must be included as an appendix to the certificate.

Imported utility meters identified on a batch verification certificate via the serial number and pattern approval number are taken to be marked with a verification mark in accordance with Regulation 2.36B of the *National Trade Measurement Regulations 2009*.

The test results for both the testing performed in the country of manufacture and the sample testing performed by the utility meter verifier must be included as appendices to the batch verification certificate.

Note: If it is impractical to provide the test results as an appendix, alternative methods may be used (e.g. include a reference or link to a full set of test results, which is available upon request by either the meter purchaser or NMI).

A model format of a batch verification certificate can be found in Appendix A.

2.7.2 Verification marks

Utility meters individually tested (including meters tested in accordance with provisions for batch testing to allow for a reduction of test points as per NITP 14.1, 14.2 and 14.3) and verified must be physically marked with a verification mark. Test results for both the testing performed in the country of manufacture (if applicable) and the sample testing performed by the utility meter verifier must be documented.

2.7.3 Access and availability of relevant records

Utility meter verifiers must document and record the verification of utility meters in an appropriate manner for the purposes of record-keeping and external reporting.

Records of all verified utility meters, including verification test results, the details of imported batches of utility meters and all certificates issued by a utility meter verifier must be retained by the utility meter verifier for a period of no less than fifteen years from the date of verification.

A copy of the batch verification certificate must be provided to the importer of the utility meter.

It is strongly recommended that the batch verification certificate (and any associated test reports) be provided to any person or organisation upon purchase or acquisition of any utility meter that is identified on the certificate.

A copy of any batch verification certificate and any associated test reports or appendices as detailed in this document must be provided to NMI upon request.

Appendix A. Model batch verification certificate

Batch Verification Certificate
in accordance with regulation 2.36B of the *National Trade Measurement Regulations 1999* (Cth)
in accordance with section 18GG(4)(c) of the *National Measurement Act 1960* (Cth)

Utility Meter Verifier[1]

Name .....

Address .....

Telephone ..... Website .....

Email .....

Utility Meter Pattern[2]

Certificate of approval number ..... Variant number .....

Supplier[3] .....

Manufacturer .....

Model/type .....

Facility that Tested the Batch of Meters upon Assembly in the Country of Manufacture

Name .....

Address .....

Telephone ..... Website .....

Email .....

Accreditation details[4] .....

Batch Details

Date of importation .....

Verification Methodology and Test Procedure

Verification test procedure(s) as specified in NITP 14.0 and:

☐ NITP 14.1 ☐ NITP 14.2 ☐ NITP 14.3 ☐ Other (please specify).....

Sampling plan as specified in:

☐ NITP 14.0 ☐ Other (please specify) .....

Identification of Verified Meters

Identifying serial numbers for the batch[5] .....

Verification

Date of verification[6] .....

Date(s) of sample testing .....

Batch size ..... Sample size .....

Being a person, or a person representing a body, appointed as a utility meter verifier under section 18RA of the *National Measurement Act 1960* (Cth), I hereby certify that the batch of utility meters identified above are verified in accordance with section 18GG of the *National Measurement Act 1960* (Cth).

NATA accreditation number .....

Signature ..... Date .....

Name of signatory..... Position held .....

Note 1: If the certificate is prepared on stationery which contains this information, do not repeat it in the body of the certificate.

Note 2: As stated in the certificate of approval.

Note 3: The individual or company applying for the certificate; the supplier may be the manufacturer.

Note 4: Accreditation number, or similar identifier is required as well as the responsible accreditation body/authority. Accreditation is required to ISO 17025 by an ILAC MRA Signatory or alternatively to ISO/IEC 17020.

Note 5: If serial numbers are sequential and uninterrupted, the first and last serial numbers must be given with a statement confirming that the serial numbers are sequential and uninterrupted. Otherwise, the complete list must be included as an appendix to this certificate.

Note 6: Date on which the certificate is issued – all required testing must be completed prior to or upon this date.