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Part 1: Metrological and Technical Requirements

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Amendments

No.	Date	Page	Location	Details of change
1	27/07/2020	iii	Preface	Updated to identify key changes in this edition
2	27/07/2020	1	1	Expanded to 1.1 Scope and 1.2.
3	27/07/2020	1	1.1	Removed explicit listing of accuracy classes from scope
4	27/07/2020	1	1.2	Added to provide for the use of Australian Standards as an alternative pathway for pattern approval. It also now provides for NMI to vary or interpret requirements to support new or different technologies and applications.
5	27/07/2020	11	5.2, Table 5	Reduced upper temperature for class 1 and 1.5 to 55 °C.
6	27/07/2020	11	5.4	Corrected “Annex 0” reference to Annex A.2.4
7	27/07/2020	13	7.1	Corrected “Annex 0” reference to Annex A.2.8
8	27/07/2020	13	8.1, item g)	Temperature marking requirements updated with change in upper temperature to 55 °C.
9	27/07/2020	15	10.1.3	Updated to recognise the different pathways.
10	27/07/2020	16	A.1.2	Corrected “Annex 0” reference to Annex A.2.8
11	27/07/2020	29	A.2.19	Added the OIML R 46 impulse voltage test as an alternative test procedure.
12	27/07/2020	-	-	Removed Annex B which listed differences from other standards because they have now been superseded.
13	27/07/2020	31	Annex B	Renumbered Annexes. Mandatory Test Points is now Annex B and labelled as mandatory.
14	27/07/2020	32	Annex C	Added Annex C Accuracy classes and Error Limits for the Australian Standards Pathway as an informative Annex.
15	27/07/2020	33	Annex D	Added Annex D Implementation of the Australian Standards pathway as an informative annex.
16	27/07/2020	33	Bibliography	Added [27], [28], [29] and [30]
17	27/07/2020	-	-	Reformatting and other minor editorial changes.

Contents

Preface

It is Australian Government policy to harmonise Australian standards with international metrological requirements to the greatest possible extent. This document now recognises a suite of standards published by Standards Australia which are modified adoptions of International Electrotechnical Commission (IEC) standards. Specifically, in clause 1.2, this edition introduces an alternative pathway for approval based on these Australian Standards.

The National Measurement Institute (NMI) also works closely with the International Organisation of Legal Metrology (OIML) and intends to adopt a third pathway for approval based on OIML R 46. The timeframe for the adoption of OIML R 46 will correspond with the transition of OIML R 46 into scheme A of the OIML Certificate System (OIML-CS).

Another change in this document is in recognition of the constantly evolving technology and applications for electricity metering. As stated in clause 1.2, NMI reserves the right to vary or interpret requirements if it is deemed appropriate to support new or different technologies or applications.

The full list of changes between the second and third editions of this document are given above in the Amendments table.

1 Scope and Application

1.1 Scope

This document contains requirements for the metrological control of active-energy electricity meters (meter) intended for use for trade, including the metrological and technical requirements for pattern approval and verification. The requirements apply to all watt hour meters used for single-rate or multi-rate operation, in single or polyphase installations, having a nominal operating frequency of 50 Hz and a connection voltage not exceeding 600 V.

In-field performance requirements are not addressed in this document.

1.2 Application

This document describes two pathways for approval. Each pathway is described below.

The National Measurement Institute reserves the right to vary or interpret requirements, under either pathway, if it is deemed appropriate to support new or different technologies or applications.

1.2.1 Pathway 1 via this document

The first pathway is presented in the requirements of this document, specifically:

- Clause 2, Terminology
- Clauses 3 to 9 inclusive
- Clause 10, General: Pattern Approval and Verification
- Annex A, Performance Tests
- Annex B, Mandatory Test Points

1.2.2 Pathway 2 via Australian Standards

A suite of standards published by Standards Australia [27], [28] and [29] provides a second pathway for the pattern approval of electricity meters. Under this pathway, the requirements specified in the relevant Australian standards apply, along with some mandatory clauses of this document. The mandatory clauses of this document are listed below.

- Clause 2, Terminology, where applicable to the other clauses below.
- Clause 3, Units of measurement
- Clause 4.3, Calculated Quantities
- Clause 4.4, Rules for determination of Errors
- Clause 8.1, Markings[1]
- Clause 9.1, Verification Mark[2]
- Clause 9.2, Sealing
- Clause 10, General: Pattern approval and Verification

Note 1: Temperature limit markings are not required if the temperature range is -10 °C to 55 °C or wider.

Note 2: Refer to clause 10.2 and NITP 14 for information on how a certificate of verification may be issued instead of a physical mark on the meter.

The Australian Standards cover 4 accuracy classes: class 0.2 S, 0.5 S, 1 and 2. The four accuracy classes and associated error limits are summarised in Annex C.

The Australian Standards also refer to the safety standard [30]. Full compliance with this safety standard may be required under jurisdictional or contractual requirements. For the purposes of pattern approval, only some parts of the safety standard are required. For further information see Annex D, Implementation of the Australian Standards Pathway.

2 Terminology

The following definitions have been based for the most part on those in references [1] to [5].

2.1 Accuracy Class

The class of measuring instruments or measuring systems that meet stated metrological requirements that are intended to keep measurement errors or instrumental uncertainties within specified limits under specified operating conditions.

2.2 Auxiliary Circuit

The elements (lamps, contacts, etc.) and connections of an auxiliary device within the meter case intended to be connected to an external device, e.g. clock, relay, impulse counter.

2.3 Auxiliary Device/Accessory

A device or function within the meter that is not part of the basic metrology function. The main auxiliary devices are:

- communication for transmitting measurement data;
- tariff changing controls;
- load control devices; and
- disconnect/reconnect contactors.

Note: For the purposes of the operation of accessories test in Table 4 an auxiliary device is an accessory.

2.4 Basic Current (I_b)

The value of the current in accordance with which the relevant performance of a direct-connected meter is fixed.

Note: The term ‘current’ indicates root mean square (rms) values unless otherwise specified.

2.5 Basic Insulation

Insulation applied to live parts to provide basic protection against electric shock.

Note: Basic insulation does not necessarily include insulation used exclusively for functional purposes.

2.6 Checking Facility

A facility which is incorporated in the meter and which enables faults that would otherwise be significant faults to be detected and acted upon in such a way that incorrect registration is prohibited or recorded separately.

Note: The action should be either to stop measuring and record the time and duration of the stop, or record the time and duration of the significant fault and the amount of energy measured during the significant fault.

2.7 Current Circuit

The internal connections of the meter and part of the measuring element through which flows the current of the circuit to which the meter is connected.

2.8 Direct-connected Meter

A meter intended for use without an external measurement transformer, i.e. for direct connection to the circuit being metered.

2.9 Distortion Factor

The ratio of the rms value of the harmonic content (obtained by subtracting from a non-sinusoidal alternating quantity its fundamental term) to the rms value of the non-sinusoidal quantity. The distortion factor is usually expressed as a percentage.

2.10 Disturbance

An influence quantity having a value within the limits specified in this document, but outside the specified rated operating conditions of the meter.

Note: An influence quantity is a disturbance, if for that influence quantity the rated operating conditions are not specified.

2.11 Double Insulation

Insulation comprising both basic insulation and supplementary insulation.

2.12 Error

The indication of a meter minus the true value of the corresponding input quantity.

2.13 Fault

The difference between the error and the intrinsic error of a meter.

Note 1: Principally a fault is the result of an undesired change of data contained in, or flowing through, a meter.

Note 2: From the definition it follows that in this Document, a ‘fault’ is a numerical value which is expressed either in a unit of measurement or as a relative value, for instance as a percentage.

2.14 Indicator or Display

The part of the meter that displays the measurement results either continuously or on demand.

Note: An indicating device may also be used to display other relevant information.

2.15 Induction or Electromechanical Watt Hour Meter

A watt hour meter in which currents in fixed coils react with currents induced in the conducting moving element, generally a disc or discs, which causes their movement proportional to the energy to be measured.

2.16 Influence Factor

An influence quantity having a value within the rated operating conditions of the meter specified in this document.

2.17 Influence Quantity

A quantity that is not the quantity to be measured but that affects the result of the measurement.

2.18 Insulating Encased Meter of Protective Class 2

Meter with a case of insulating material in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions (such as double insulation or reinforced insulation) are provided, there being no provision for protective earthing or reliance upon installation conditions. Insulating encased meters of protective class 1 are excluded from this document as they are not used in Australia.

2.19 Initial Intrinsic Error

The intrinsic error of a meter as determined prior to performance tests and durability evaluations.

2.20 Intrinsic Error

The error of indication of a meter determined under reference conditions.

2.21 Limit Range of Operation

The extreme conditions which an operating meter can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its rated operating conditions.

2.22 Maximum Current (I_{max})

The highest value of current at which the meter purports to meet the accuracy requirements of this document.

2.23 Maximum Permissible Error

The extreme value of the error, with respect to a known reference quantity value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system.

2.24 Mean Temperature Coefficient

The ratio of the variation of the percentage error to the change of temperature which produces this variation.

2.25 Measuring Element

The part of the meter which produces an output proportional to the energy measured.

2.26 Meter Base

The back of the meter by which it is generally fixed and to which are attached the measuring element, the terminals or the terminal block, and the cover. For a flush-mounted meter, the meter base may include the sides of the meter case.

2.27 Meter Case

This comprises the meter base and the meter cover(s).

2.28 Meter Constant

The value expressing the relation between the energy registered by the meter and the corresponding value of the test output (for solid state meters) or the number of revolutions of the rotor (for electromechanical meters). For solid state meters, the constant should be in either pulses per kilowatt hour (imp/kWh) or watt hours per pulse (Wh/imp); for electromechanical meters, this value should be in either revolutions per kilowatt hour (rev/kWh) or as watt hours per revolution (Wh/rev).

2.29 Meter Cover

The enclosure on the front of the meter, made either wholly of transparent material or of opaque material provided with window(s) through which the operation indicator (if fitted) and the display can be read.

2.30 Meter Socket

A base with jaws to accommodate terminals of a detachable meter and which has terminals for connection to the supply line. It may be a single-position socket for one meter or a multiple-position socket for two or more meters.

2.31 Percentage Error

Percentage error is given by the following formula:

$$\text{percentage error} = (\text{energy registered by the meter} - \text{true energy}) \times 100 / \text{true energy}$$

Note: Since the true value cannot be determined, it is approximated by a value with a stated uncertainty that can be traced to national standards.

2.32 Performance

The ability of the meter to accomplish its intended functions.

2.33 Performance Test

A test or test program intended to verify whether the equipment under test (EUT) is able to accomplish its intended functions.

2.34 Plug-in Meter

A meter having a base fitted with contact blades and intended for insertion in a meter socket.

2.35 Rated Current (I_n)

The value of the current in accordance with which the relevant performance of a transformer-operated meter is fixed.

2.36 Rated Operating Conditions

An operating condition that must be fulfilled during measurement in order that a measuring instrument or measuring system performs as designed.

2.37 Reference Conditions

An operating condition prescribed for evaluating the performance of a measuring instrument or measuring system or for comparison of measurement results.

2.38 Reference Frequency (f_{nom})

The value of the frequency in accordance with which the relevant performance of the meter is fixed.

2.39 Reference Temperature

The ambient temperature specified for reference conditions.

2.40 Reference Voltage (U_{nom})

The value of the voltage in accordance with which the relevant performance of the meter is fixed.

2.41 Register of a Meter

That part of the meter which enables the measured value to be determined.

2.42 Reinforced Insulation

Single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation.

Note: The term 'insulation system' does not imply that the insulation should be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

2.43 Significant Fault

A fault greater than the permissible limits of variation specified in this document.

The following faults are not considered significant even when they exceed the specified permissible limits of variation:

- faults arising from simultaneous and mutually independent causes originating in the meter itself or in its checking facilities;
- faults implying the impossibility of performing any measurement;
- transitory faults being momentary variations in the indication, which cannot be interpreted, memorised or transmitted as a measurement result;
- faults that are detected and acted upon by means of the checking facility of the meter.

Note: Faults in the non-metrological components of the meter, such as display and communications, are included in the above definition if they result in inaccurate metrological information, e.g. through causing that metrological information to become inaccessible.

2.44 Specified Operating Range

The range of values of a single influence quantity which forms a part of the rated operating conditions.

2.45 Static or Solid State or Electronic Watt Hour Meter

A watt hour meter in which current and voltage act on solid state (electronic) elements to produce an output proportional to the energy to be measured.

2.46 Storage and Transport Conditions

The extreme conditions which a non-operating meter can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its rated operating conditions.

2.47 Supplementary Insulation

Independent insulation applied in addition to basic insulation, in order to provide protection against electric shock in the event of a failure of the basic insulation.

2.48 Terminal Block

A support made of insulating material on which all or some of the terminals of the meter are grouped together.

2.49 Terminal Cover

A cover that covers the meter terminals and, generally, the ends of the external wires or cables connected to the terminals.

2.50 Transformer-operated Meter

A meter intended for use with one or more external measurement transformers.

2.51 Voltage Circuit

The internal connections of the meter, part of the measuring element and, in the case of static meters, part of the power supply, supplied with the voltage of the circuit to which the meter is connected.

2.52 Watt Hour Meter (Active-Energy Meter)

An instrument intended to measure active energy by integrating active power with respect to time.

3 Units of Measurement

The following units of measurement and their symbols shall be used.

Active energy	
Unit	Symbol
watt hour	Wh
kilowatt hour	kWh
megawatt hour	MWh
gigawatt hour	GWh

4 Maximum Permissible Errors, Classification and Minimum Measured Quantities

4.1 Minimum Measured Quantity

The minimum measured quantity of a meter is the smallest quantity of energy for which the meter measurement complies with the performance requirements of this document.

The minimum measured quantity of a meter shall have the form 1×10^{n} authorised units of energy, where n is an integer.

The smallest interval marked on the indicator shall not be less than the minimum measured quantity.

The minimum measured quantity shall satisfy the conditions of use of the meter. It is recommended that the minimum measured quantity of a meter shall be one order of magnitude less than the smallest energy trading quantity required for its application.

4.2 Maximum Permissible Variation between Indicators

Where a meter has more than one indicator there shall be no indicated difference between the indications of the same quantity on different indicators.

4.3 Calculated Quantities

For all calculated quantities included in the transaction, the indicated quantity shall equal the quantity obtained by using the indicated values included in the calculation together with any rounding applied. If the indicated calculated quantity is rounded, it shall be rounded to ±0.5 of the minimum measured quantity.

Calculated quantities include energy values stored in meter registers such as time of use, import and export and phase registers.

4.4 Rules for the Determination of Errors

The rules for the determination of errors are as follows:

a) the value of reference quantities or measurement standards used for the determination of maximum permissible errors shall have an expanded uncertainty (coverage factor two) no greater than one-third of the maximum permissible error specified for the meter under test (see ISO Guide to the Expression of Uncertainty in Measurement [6]);
b) the maximum permissible errors apply to all meters irrespective of their principles of operation;
c) the maximum permissible error specifications are applicable to all indications included in the transaction as appropriate.

4.5 Reference Conditions for Determination of Errors

The reference conditions which should be used when determining all errors, including the initial intrinsic error, are summarised in Table A.1.

4.6 Meter Constant

There shall be no error in the relationship between the test output and the indication on the display when the meter constant marked on the nameplate is applied.

4.7 Class Indices

A meter shall be classified as one of 0.2, 0.5, 1 or 1.5, depending on its design and required limits of maximum permissible error, in accordance with Table 1 and Table 2.

Table 1. Percentage error limits for single phase and polyphase direct-connected meters with balanced loads

Range for test current	Power factor	Percentage error limits for meters of class[1]	
		1	1.5
$0.05\ I_b \leq I < 0.1\ I_b$	1	± 1.5	± 1.5
$0.1\ I_b \leq I \leq I_{max}$	1	± 1.0	± 1.5
$0.1\ I_b \leq I < 0.2\ I_b$	0.5 inductive	± 1.5	± 1.5
	0.8 capacitive	± 1.5	—
$0.2\ I_b \leq I \leq I_{max}$	0.5 inductive	± 1.0	± 1.5
	0.8 capacitive	± 1.0	—

Note 1: Requirements based on AS 1284.1 [5] and AS 62053.21 [7].

Table 2. Percentage error limits for single phase and polyphase transformer-operated meters with balanced loads

Range for test current	Power factor	Percentage error limits for meters of class[1]		
		0.2	0.5	1
$0.01\ I_n \leq I < 0.05\ I_n$	1	± 0.4	± 1.0	—
$0.02\ I_n \leq I < 0.05\ I_n$	1	—	—	± 1.5
$0.05\ I_n \leq I \leq I_{max}$	1	± 0.2	± 0.5	± 1.0
$0.02\ I_n \leq I < 0.1\ I_n$	0.5 inductive	± 0.5	± 1.0	—
	0.8 capacitive	± 0.5	± 1.0	—
$0.05\ I_n \leq I < 0.1\ I_n$	0.5 inductive	—	—	± 1.5
	0.8 capacitive	—	—	± 1.5
$0.1\ I_n \leq I \leq I_{max}$	0.5 inductive	± 0.3	± 0.6	± 1.0
	0.8 capacitive	± 0.3	± 0.6	± 1.0

Note 1: Requirements based on AS 62053.21 [7] and AS 62053.22 [8].

Table 3. Percentage error limits for polyphase meters carrying a single-phase load, but with balanced polyphase voltages applied to voltage circuits

Meter type	Range for test current	Power factor	Percentage error limits for meters of class1			
			0.2	0.5	1	1.5
Direct-connected	$0.1\ I_b \leq I \leq I_{max}$	1	—	—	± 2.0	± 2.5
	$0.2\ I_b \leq I \leq I_{max}$	0.5 inductive	—	—	± 2.0	± 2.5
Transformer-operated	$0.05\ I_n \leq I \leq I_{max}$	1	± 0.3	± 0.6	± 2.0	—
	$0.1\ I_n \leq I \leq I_{max}$	0.5 inductive	± 0.4	± 1.0	± 2.0	—

Note 1: Requirements based on AS 1284.1 [5], AS 62053.21 [7] and AS 62053.22 [8]

Table 4. Influence factors (I) and disturbances (D)

Influence factors and disturbances	Test clause or reference	I/D	Range for test current (balanced load)	Power factor	Limits of variation in percentage error for meters of class			
					0.2	0.5	1	1.5
Voltage variation[1]	A.2.12	I [1]	$0.05\ I_b \le I \le I_{max}$	1	—	—	0.7	1.0
			$0.1\ I_b \le I \le I_{max}$	0.5 ind.	—	—	1.0	1.0
			$0.02\ I_n \le I \le I_{max}$	1	—	—	0.7	—
			$0.05\ I_n \le I \le I_{max}$	0.5 ind.	—	—	1.0	—
			$0.05\ I_n \le I \le I_{max}$	1	0.1	0.2	—	—
			$0.1\ I_n \le I \le I_{max}$	0.5 ind.	0.2	0.4	—	—
Frequency variation	A.2.13	I	$0.05\ I_b \le I \le I_{max}$	1	—	—	0.5	1.0
			$0.1\ I_b \le I \le I_{max}$	0.5 ind.	—	—	0.7	1.0
			$0.02\ I_n \le I \le I_{max}$	1	—	—	0.5	—
			$0.05\ I_n \le I \le I_{max}$	0.5 ind.	—	—	0.7	—
			$0.05\ I_n \le I \le I_{max}$	1	0.1	0.2	—	—
			$0.1\ I_n \le I \le I_{max}$	0.5 ind.	0.1	0.2	—	—
Harmonic components in the current and voltage circuits	A.2.21	I	$0.5\ I_{max}$	1	0.4	0.5	0.8	1.0
Reversed phase sequence	—	D	$0.1\ I_b$ or $0.1\ I_n$	1	0.05	0.1	1.5	1.5
Voltage unbalance[2]	[2]	I	I_b or I_n	1	0.5	1.0	2.0	—
Auxiliary voltage ±15%[3]	AS 62053.22	D	$0.01\ I_n$	1	0.05	0.1	—	—
DC component in the AC circuit[4]	AS 62053.21, Annex A[5]	D	$I_{max}/\sqrt{2}$	1	—	—	3.0	6.0
Continuous magnetic induction of external origin	AS 62053.21, clause 8.2.4 AS 62053.22, clause 8.2.3	D	I_b or I_n	1	2.0	2.0	2.0	3.0
Magnetic induction of external origin 0.5 mT[6]	[6]	D	I_b or I_n	1	0.5	1.0	2.0	—
			I_b or $0.5\ I_n$	1	—	—	—	2.0
Electromagnetic RF fields[7]	A.2.9	D	I_b or I_n	1	1.0	2.0	2.0	3.0
Conducted RF fields[7]	A.2.10	D	I_b or I_n	1	1.0	2.0	2.0	3.0
Fast transient bursts[7]	A.2.15	D	I_b or I_n	1	1.0	2.0	4.0	6.0
Variations due to short-time overcurrent's	A.2.16	D	I_b	1	—	—	1.5	1.5
			I_n	1	0.05	0.05	0.5	—
Operation of accessories[8]	AS 62053.21	D	$0.05\ I_b$ or $0.05\ I_n$	1	—	—	0.5	—
	AS 62053.22	D	$0.01\ I_n$	1	0.05	0.1	—	—
Sub-harmonics in the AC circuit	A.2.17[5]	D	$0.5\ I_b$ or $0.5\ I_n$	1	0.5	0.75	1.5	3.0
Odd harmonics in the AC circuit	A.2.18[5]	D	$0.5\ I_b$ or $0.5\ I_n$	1	0.4	0.5	0.8	1.0
Tilt at 3° in any direction from the vertical[9]	AS 1284.1	I	$0.1\ I_b$	1	—	—	—	0.8
Current coil self-heating[9]	AS 1284.1[10]	D	I_{max}	1	—	—	—	1.0
			I_{max}	0.5 ind.	—	—	—	1.0
Alternative usage and phase reversal (balanced two-element driven)[9]	AS 1284.1	D	$0.05\ I_b$	1	—	—	—	1.0
			I_b	1	—	—	—	0.5
Alternative usage and phase reversal (single-element driven)[9]	AS 1284.1	D	$0.1\ I_b$	1	—	—	—	1.0
			$2\ I_b$	1	—	—	—	0.5
Register friction[9]	AS 1284.1	D	$0.05\ I_b$	1	—	—	—	0.5
Register changeover[9]	AS 1284.1	D	$0.05\ I_b$	1	—	—	—	0.4
Shock[9]	AS 1284.1	D	$0.05\ I_b$	1	—	—	—	0.5
			I_b	1	—	—	—	0.3
			I_b	0.5 ind.	—	—	—	0.3

Note 1: Voltage variations outside of ±10% are classified as disturbances. For the voltage ranges from –20% to –10% and +10% to +15% the limits of variation in percentage errors are three times the values given in Table 4. Below $0.8U_n$ the error of the meter may vary between +10% and –100%.

Note 2: Polyphase (three-phase four wire) meters shall measure and register within the limits of variation in percentage error given in Table 4 if any one or two phases of the three phase network are interrupted.

Note 3: Applicable only if the auxiliary supply is not internally connected to the voltage measuring circuit.

Note 4: This test does not apply to transformer-operated meters.

Note 5: The distortion factor of the voltage shall be less than 1%.

Note 6: A magnetic induction of external origin of 0.5 mT produced by a current of the same frequency as that of the voltage applied to the meter and under the most unfavourable conditions of phase and direction shall not cause a variation in the percentage error of the meter exceeding the values shown in Table 4. The magnetic induction shall be obtained by placing the meter in the centre of a circular coil, 1 m in mean diameter, of square section and of small radial thickness relative to the diameter, and having 400 At.

Note 7: Meters constructed with passive elements only, including electromechanical meters, are exempt from this test.

Note 8: All applicable accessories (auxiliary devices) shall be tested. The meter shall be operated at reference conditions and its error continuously monitored while accessories are operated. It is preferable that the connection to the auxiliary device(s) is marked to indicate the correct method of connection. If these connections are made by means of plugs and sockets, they should be irreversible. However, in the absence of those markings or irreversible connections, the variations of errors shall not exceed those indicated in this table if the meter is tested with the connections giving the most unfavourable condition.

Note 9: This test is only required for induction meters and any other meters which may be influenced by their working position.

Note 10: The meter should be preconditioned for 1 hour with the voltage circuit at reference voltage and the current circuit at zero current. The percentage error should then be determined while the current coil is still in an unheated condition.

4.8 Value of Maximum Permissible Error

The maximum permissible error of a meter shall not exceed the values specified in Table 1, Table 2 and Table 3 for the class of meter concerned. The mandatory test points are specified in Annex C.

If the manufacturer specifies that the meter is capable of measuring active energy flow in both positive and negative directions (export and import), then the accuracy of the meter shall be tested with energy flowing in each direction and comply with the maximum permissible errors specified in Table 1, Table 2 and Table 3 in each direction.

5 Influence Factors and Disturbances

5.1 Limits of Variation for Influence Factors and Disturbances

Meters shall not exceed the specified maximum permissible errors when tested over the ranges of influence factors and disturbances listed in Table 4.

5.2 Temperature Range

The minimum acceptable temperature ranges of the meter shall be as shown in Table 5. It should be noted that some of the temperatures specified are different to those given in AS 62052.11 [4] as well as those in IEC 62052-11 [9].

Table 5. Minimum acceptable temperature ranges

Meters of class	0.2 or 0.5	1 or 1.5
Specified operating range	−10 °C to +45 °C	−10 °C to +55[1] °C
Limit range of operation	−20 °C to +55 °C	−20 °C to +70 °C
Storage and transportation	−25 °C to +70 °C	−25 °C to +70 °C

Note 1: This value of 55 °C aligns with upper temperatures in other international standards.

5.3 Limits of Error Due to Ambient Temperature Variation

The mean temperature coefficient, as determined by the procedure in Annex A.2.3, should not exceed the limits specified in Table 6.

Table 6. Temperature coefficient requirements (I_n specifications apply to transformer-operated meters; I_b specifications apply to direct-connected meters)

Meter type	Range for test current	Power factor	Mean temperature coefficient[1], in %/K, for meters of class			
			0.2	0.5	1	1.5
Direct-connected	$0.1\ I_b \le I \le I_{max}$	1	—	—	0.05	0.05
	$0.2\ I_b \le I \le I_{max}$	0.5 inductive	—	—	0.07	0.07
Transformer-operated	$0.05\ I_n \le I \le I_{max}$	1	0.01	0.03	0.05	0.05
	$0.1\ I_n \le I \le I_{max}$	0.5 inductive	0.02	0.05	0.07	0.07

Note 1: The mean temperature coefficient shall be determined over the whole operating range, using temperature intervals as described in Annex A.2.3. The temperature shall not fall outside the specified operating temperature range at any time during the test.

5.4 Humidity

All meters shall be subjected to the damp heat cyclic test described in Annex A.2.4. At the conclusion of this test, the meter shall show no damage and shall operate correctly. Any information displayed by the meter shall remain unchanged.

5.5 Solar Radiation

All meters, unless intended for, and clearly marked as, ‘for indoor use only’, shall be subjected to the solar radiation test described in Annex A.2.5. At the conclusion of the test, no change in the appearance of the meter shall be evident and the meter function shall not be impaired.

5.6 Dust

All meters shall be subjected to the dust test (without suction in the meter) described in Annex A.2.6. At the conclusion of the test, there shall be no evidence of dust accumulation in a manner which could affect meter operation or safety, nor shall there be evidence of dust deposition in a way which could lead to tracking along the creepage distances. The function of the meter shall not be impaired.

5.7 Starting and No-Load Condition

5.7.1 General

For these tests, the conditions and the values of the influence quantities shall be as specified in Annex A.1.1 except for any changes specified below.

5.7.2 Initial Start Up of the Meter

The meter shall be functional within 5 s after the rated voltage is applied to the meter terminals.

5.7.3 Running with No Load

When the voltage is applied with no current flowing in the current circuit, the test output of a meter shall not produce more than one pulse. For this test, the current circuit shall be open-circuit and a voltage of 115% of the reference voltage shall be applied to the voltage circuits.

The minimum test period shall be:

- $\frac{900\times10^6}{kmU_{\text{nom}}I_{\text{max}}}$ min for meters of class 0.2;
- $\frac{600\times10^6}{kmU_{\text{nom}}I_{\text{max}}}$ min for meters of class 0.5 and 1;
- $\frac{480\times10^6}{kmU_{\text{nom}}I_{\text{max}}}$ min for class 1.5 meters.

Where:

k is the number of pulses emitted by the output device of the meter per kilowatt hour (imp/kWh);

m is the number of measuring elements;

U_{nom} is the reference voltage in volts; and

I_{max} is the maximum current in amperes.

In the case of an induction meter, a current of 0.001 I_{b} with power factor of 1 shall be in each current circuit, and connected in turn for forward and reverse rotation. The reference voltage shall be applied to each voltage circuit. Under these conditions, the rotor may start but shall not complete a revolution.

It is acceptable to use an appropriate meter register instead of the test output to assess this requirement by appropriately substituting the resolution for the meter constant to determine the minimum test period.

5.7.4 Starting

Static meters shall start and continue to register at the current (and, in the case of polyphase meters, with balanced load) specified in Table 7. Class 1.5 induction meters shall start and complete at least one revolution at the current specified, with each voltage circuit being at reference voltage.

Table 7. Starting current for meters

	Power factor	Class of meter			
		0.2	0.5	1	1.5
Direct-connected meter	1	—	—	0.004 I_{b}	0.005 I_{b}
Transformer-operated meter	1	0.001 I_{n}	0.001 I_{n}	0.002 I_{n}	0.0025 I_{n}

6 Internal Clocks

Any solid state internal clock used for electricity meters and load control devices shall meet the timing requirements specified in AS 62054.21 [10].

Meters must demonstrate a convenient methodology of clock synchronisation via the local optical or serial port.

For meters recording load profile for tariff calculation, the clock synchronisation must not permit clock adjustment that crosses an interval boundary.

7 Operational Requirements

7.1 Suitability of Construction

Meters shall withstand the amount of vibration and shock that may be encountered under conditions of normal use, and as given by the tests outlined in Annexes A.2.7 and A.2.8.

Dust shall not impair the performance of the meter, as demonstrated by the test outlined in Annex A.2.6.

7.2 Acting upon Significant Faults

Meters shall be designed and manufactured such that when they are exposed to disturbances, significant faults do not occur, or if they do they are detected, logged and acted upon by communicating this information to the responsible parties until the situation has been rectified, for example through the use of meter alerts. The log shall be in the form of a permanent record with an associated date and time for each event.

7.3 Display

A meter shall have a display which is legible whilst operating, and visible to the consumer when installed in the normal installation position as specified by the manufacturer. The display may be physically separate from the meter.

There shall be a procedure that shows all relevant elements of the indicator display, regardless of whether or not current is flowing through the meter, with sufficient time to allow the operator to check them.

A meter shall be able to display the quantity of electrical energy corresponding to the maximum current (I_{max}) for at least 4 000 h, without returning to the same index.

7.4 Auxiliary Devices Interface

If instructions or data, which alter the parameters that determine the measurement result, can be introduced through the interface into the meter, the interface shall be sealed as described in clause 9.2.

7.5 Optical Port

Any optical port shall be capable of reliable operation in the range of lighting conditions specified by the manufacturer. The performance of the optical port shall comply with the requirements of Annex A.1.3.

8 Markings

8.1 Information to be Displayed on Meter Exterior

Meters shall be clearly and permanently marked in the vicinity of the indicating device with the following information:

a) manufacturer's name or mark;
b) model designation;
c) serial or identification number;
d) pattern approval number;
e) number of phases and the number of wires for which the meter is suitable (for example single-phase two wire, three-phase three wire, three-phase four wire); these markings may be replaced by the graphic symbols used in IEC 62053-52 [11];
f) reference frequency;
g) temperature limits (if more restrictive than –10 °C to +55 °C);
h) meter constant (in units as specified in clause 2.28), which may be marked on the meter using a sticker which must be permanent and indelible;
i) rated voltage;
j) rated currents;

k) class of meter; and
l) ‘for indoor use only’ if the meter is intended for indoor use only.

Space for a verification mark shall be provided as described in clause 9.1.

8.2 Notices

Any special notice or limitation of use relating to the meter shall be either clearly marked on a notice visible to the operator or provided in an operators’ manual.

9 Verification Mark and Sealing

9.1 Verification Mark

Provision shall be made for the application of a verification mark either on a stamping plug or an adhesive label. The following requirements apply:

- the mark shall be easily affixed without affecting the metrological properties of the meter;
- the mark shall be visible without moving or dismantling the meter when in use;
- the part on which the mark is located shall not be removable from the meter without damaging the mark; and
- the size of the space shall be sufficient to contain the marks applied by the verifying authority and to ensure that those marks shall be legible. A minimum size of 200 mm^2 is recommended.

9.2 Sealing

Provision shall be made for sealing those devices and parameters that have a metrologically significant effect and that determine the measurement result. This may include devices and parameters that affect the configuration of the meter as well as those which affect the calibration. If instructions or data, which alter the parameters that determine the measurement result, can be introduced through an auxiliary device interface into the meter, the interface shall also be sealed (see clause 7.4).

Sealing may be by mechanical or solid state means. Mechanical means include those where access to a solid state means of changing the parameters (for example via a keyboard) is prohibited by a mechanical seal.

The requirements for solid state seals are:

- Access by authorised persons to protected parameters shall be protected by some form of physical key or a password or access code (for example a four-digit code).
- Any access to alter protected parameters shall be automatically recorded (for example by means of a counter which automatically increments when access is initiated).
- The record shall be readily accessible by a simple action (for example by display of the counter when a button identified as being for this purpose is pressed, or during the indication check).
- The record shall be readily identifiable as such and shall not be easily confused with other indications of the meter.
- A reference record in the same form as the incremental record shall be permanently marked on the meter to indicate that the parameters have been accessed since the last verification (for example the reference record could be associated with the verification mark).
- The record shall not repeat in a sequence of less than 99 alterations. It shall also persist reliably for a period of at least two years (unless it is overwritten by a further alteration). The record shall persist through tests for influence factors and disturbances specified in the document.

10 General

10.1 Pattern Approval

10.1.1 Documentation

Submission of a meter for pattern approval shall be in accordance with the latest version of *NMI P 106 Approval and Certification Procedures for Measuring Instruments Suitable for Use for Trade and any Other Legal Purpose* [12]. A submission shall be accompanied by sufficient technical information including drawings, specifications, photographs and descriptions to ensure complete understanding of the construction and method of operation of the meter.

Details of the measurement data contained in the memory and calculation methods shall also be provided.

For meters with solid state components the documentation shall include a list of solid state sub-assemblies with their essential characteristics, and a description of the solid state devices with drawings, diagrams and general software information explaining their construction and operation. Evidence of traceability for internal clocks may be required (see clause 6).

The software and/or firmware versions for which pattern approval is being sought shall be specified. The applicant shall advise NMI of future modifications to software and/or firmware with the potential to affect the metrology of the meter.

The applicant shall keep a record of any changes to the meter design (including software and firmware) with the potential to affect the metrology of the meter. The record shall contain sufficient information to show which serial numbers have been affected by these changes.

10.1.2 Meters Submitted for Testing

Examination shall be carried out on one or more sample meters submitted for laboratory tests.

10.1.3 Laboratory Examination

The meter shall be examined in conjunction with the submitted documentation to ensure that it complies with the applicable specifications. The applicable clauses for each pathway are provided in clause 1.2.

10.1.4 Laboratory Tests

10.1.4.1 General

Laboratory tests shall be performed in accordance with any limitations of use marked on the meter or included in any documentation accompanying the meter.

10.1.4.2 Acceptable Indications

For compliance with the maximum permissible errors, indications of $(N \pm 1)d$ are acceptable whereas indications of $(N \pm 2)d$ are not acceptable, where d is the scale interval and N is an integer.

10.1.4.3 Tests for Interface

If the meter is provided with an interface through which auxiliary devices or other meters can be connected, the tests shall be carried out with a sample device connected and tests applicable to the interface applied (see clause 7.4). The electromagnetic susceptibility test (see Annex A.2.9) may be carried out on a meter with a meandering cable, 3 m long, connected to the interface.

10.2 Verification

Verification shall be performed in accordance with *NITP 14 National Instrument Test Procedures for Utility Meters*. Meters shall comply with any requirements listed in the certificate of approval.

Annex A. Performance Tests (Mandatory)

A.1 Conditions for Tests

A.1.1 Reference Conditions

The reference conditions which should be used when determining accuracy are summarised in Table A.1.

The following test conditions shall be maintained:

- the meter shall be tested in its case with the cover in position; all parts intended to be earthed shall be earthed; and
- before any test is made, the circuits shall have been energised for a time sufficient to reach thermal stability.

In addition, for polyphase meters:

- the phase sequence shall be as marked on the diagram of connections;
- the voltages and currents shall be substantially balanced:
- each of the voltages between phase and neutral and between any two phases shall not differ from the corresponding voltage by more than ±1%;
- each of the currents in the conduits shall not differ from the average current by more than ±2%; and
- the phase displacements of each of these currents from the corresponding phase-to-neutral voltage, irrespective of the phase angle, shall not differ from each other by more than 2°.

A.1.2 Tests for Influence Factors and Disturbances

Before tests are conducted the meter shall be in zero or ready condition. The tests shall first be carried out under reference conditions and then as specified in Table 4 and Annex A.2. Static meters shall undergo all the tests listed in Annex A.2. Induction meters may be exempt from tests listed in Annexes A.2.7, A.2.8, A.2.9, A.2.10, A.2.11, A.2.14 and A.2.15 but shall undergo the additional tests indicated in Table 4. The procedures for these additional tests are specified in AS 1284.1 [5].

Only one influence factor or disturbance shall be evaluated at a time. All indicators shall be checked. Any calculated quantities shall be checked for correct multiplication and rounding (see clause 4.3).

The effect of influence factors and disturbances on any interfaces (see clause 7.4) or solid state sealing provisions (see clause 9.2) shall also be checked.

A.1.3 Requirements for Optical Ports

Optical ports shall comply with the requirements of clauses 4.3.5.4 and 5.2 of AS 62056.21 [13].

Table A.1. Reference conditions and their permissible tolerances

Influence quantity	Reference value	Permissible tolerances for meters of class			
		0.2	0.5	1	1.5
Ambient temperature[1]	Reference temperature of 23 °C	±2 °C	±2 °C	±2 °C	±2 °C
Voltage	For direct-connected and current-transformer operated meters: 230/400 V For voltage-transformer operated meters: 63.5/110 V	±1.0%	±1.0%	±1.0%	±1.0%
Frequency	50 Hz	±0.3%	±0.3%	±0.3%	±0.3%
Phase sequence	L1-L2-L3	—	—	—	—
Voltage unbalance	All phases connected	—	—	—	—
Waveform	Sinusoidal voltages and currents	Distortion factor less than			
		2%	2%	2%	3%
Continuous magnetic induction of external origin	Equal to zero	—	—	—	—
Magnetic induction of external origin at the reference frequency [2]	Magnetic induction equal to zero	Induction value which causes a variation of error not greater than			
		±0.1%	±0.1%	±0.2%	±0.2%
		But shall in any case be smaller than 0.05 mT			
Electromagnetic RF fields, 30 kHz to 2.4 GHz	Equal to zero	< 1 V/m	< 1 V/m	< 1 V/m	< 1 V/m
Operation of accessories	None	—	—	—	—
Conducted disturbances, induced by RF fields, 150 kHz to 80 MHz	Equal to zero	< 1 V	< 1 V	< 1 V	< 1 V
Mounting position[3]	Vertical[3]	—	—	—	0.5° in any direction
Phase angle between each current and corresponding line-to-neutral voltage	Angle equivalent to specified power factor	2°	2°	2°	2°
Current unbalance where balanced currents required	Specified value with all phases equal	±1%	±1%	±2%	±2%
Voltage unbalance (l-l or l-n as appropriate)	All phases connected. All phases equal	±1%	±1%	±1%	±2%

Note 1: If the tests are made at a temperature other than the reference temperature, including permissible tolerances, the results shall be corrected by applying the appropriate temperature coefficient of the meter.

Note 2: The test consists of:

a) For a single-phase meter, determining the errors first with the meter normally connected to the mains and then after inverting the connections to the current circuits as well as to the voltage circuits. Half of the difference between the two errors is the value of the variation of error. Because of the unknown phase of the external field, the test should be made at 0.1 I_b or 0.05 I_n at unity power factor and 0.2 I_b or 0.1 I_n at 0.5 power factor.

b) For a three-phase meter, making three measurements at 0.1 I_b or 0.05 I_n at unity power factor, after each of which the connection to the current circuits and to the voltage circuits are changed over 120° while the phase sequence is not altered. The greatest difference between each of the errors so determined and their average value is the value of the variation of error.

Note 3: Applicable to induction meters only.

A.2 Test Procedures for Influence Factors and Disturbances

Please note that this section is only intended to provide summaries of the various test procedures; the format and some of the wording is based on *OIML D 11* [1]. Detailed information can be found in the references cited in each table.

A.2.1 Dry Heat

Applicable standards	AS 60068.2.2 [14]
Object of test	To verify compliance with the provisions of clause 4.8 under conditions of high temperature, taking into account the appropriate temperature coefficient specified in clause 5.3. In addition, at the end of the test, the EUT shall show no damage or change of information and shall operate correctly.
Test procedure in brief	The test consists of exposure to the specified high temperature under 'free air' conditions for the time specified (the time specified is the time after the EUT has reached temperature stability). The change of temperature shall not exceed 1 °C/min during heating up and cooling down. The absolute humidity of the test atmosphere shall not exceed 20 g/m^3. When testing is performed at temperatures lower than 35 °C, the relative humidity shall not exceed 50%. The EUT shall remain in operating condition for the duration of its exposure to high temperature conditions. Power to the EUT shall then be switched off before the temperature is lowered. The EUT may be switched on again once sufficient time has elapsed during the recovery period for its temperature to stabilise. The EUT shall be tested as specified in Annex A.1: a) at the reference temperature following conditioning; b) at the maximum operating temperature, 72 h after temperature stabilisation; and c) after recovery of the EUT at the reference temperature.
High temperature	The maximum temperature specified by the manufacturer for the specified operating range, ±2 °C.
Duration	72 h

A.2.2 Cold

Applicable standards	AS 60068.2.1[15]
Object of test	To verify compliance with the provisions of clause 4.8 under conditions of low temperature, taking into account the appropriate temperature coefficient specified in clause 5.3. In addition, at the end of the test, the EUT shall show no damage or change of information and shall operate correctly.
Test procedure in brief	The test consists of exposure to the specified low temperature under 'free air' conditions for the time specified (the time specified is the time after the EUT has reached temperature stability). The change of temperature shall not exceed 1°C/min during cooling down and heating up. The EUT shall remain in operating condition for the duration of its exposure to low temperature conditions. Power to the EUT shall then be switched off before the temperature is raised. The EUT may be switched on again once sufficient time has elapsed during the recovery period for its temperature to stabilise. The EUT shall be tested under conditions specified in Annex A.1: a) at the reference temperature following conditioning; b) at the minimum operating temperature, 72 h after temperature stabilisation; and c) after recovery of the EUT at the reference temperature.
Lower temperature	The minimum temperature specified by the manufacturer for the specified operating range, ±3 °C.
Duration	72 h

A.2.3 Mean Temperature Coefficient

Object of test	To verify compliance with the provisions of clause 5.3 and Table 6.
Test procedure in brief	The meter error shall be determined at a minimum of four temperature values across the whole operating range. These temperatures should be selected so as to meet the following criteria: • the minimum and maximum temperatures of the specified operating range must be included; • where the specified operating range is –10 °C to 60 °C, the temperatures selected should include 15 °C and 35 °C; • where the specified operating range is –10 °C to 45 °C, the temperatures selected should include 25 °C; and • for other specified operating ranges, temperature values selected should preferably be 20 K but absolutely no more than 25 K away from the next nearest temperature value. The mean temperature coefficient shall then be determined for each of the temperature intervals between successive temperature values. All values of the mean temperature coefficient shall comply with the values in Table 6. The temperature shall not fall outside the specified operating temperature range at any time during the test.

A.2.4 Damp Heat Cyclic Test

Applicable standards	AS 60068.2.30 [16]
Object of test	To verify compliance with the provisions of clause 4.8 under conditions of high humidity when combined with cyclic temperature changes, taking into account the appropriate temperature coefficient specified in clause 5.3. In addition, 24 h after the end of this test, the EUT shall be submitted to an insulation test according to A.2.19 and A.2.20, except that the impulse voltage shall be multiplied by a factor of 0.8, and a functional test, during which the EUT shall show no damage or change of information and shall function correctly. No trace of corrosion likely to affect the functional properties of the EUT shall be apparent.
Test procedure in brief	The test consists of exposure to cyclic temperature variation between 25 °C and the appropriate upper temperature, maintaining the relative humidity above 95% during the temperature change and low temperature phases, and at 93% at the upper temperature phases. Condensation should occur on the EUT during the temperature rise. At the commencement of the test, the EUT shall be in an unpacked, switched-off and ready-to-use condition. It shall be mounted so that for all practical purposes it is thermally isolated. The 24 h cycle consists of: 1. Temperature rise during 3 h. 2. Temperature maintained at upper value until 12 h from the start of the cycle. 3. Temperature lowered to lower value within 3 h to 6 h, the rate of fall during the first hour and a half being such that the lower value would be reached in 3 h. The humidity shall be not less than 95%, except for the first 15 min when it shall be not less than 90%. 4. Temperature maintained at lower value until the 24 h cycle is completed. The stabilising period before and recovery after the cyclic exposure shall be such that all parts of the EUT are within 3 °C of their final temperature. Voltage and auxiliary circuits shall be energised with the reference voltage, without any current in the current circuits. No special precautions are to be taken regarding the removal of surface moisture.
Upper temperature	The maximum temperature specified by the manufacturer for the specified operating range, ±2 °C.
Duration	6 cycles

A.2.5 Solar Radiation Test

Applicable standards	Appendix D, AS 1284.1 [5]
Object of test	To verify compliance with the provisions of clause 5.5 by checking for visual changes in appearance after exposure to ultraviolet light. At the conclusion of the test, the function of the meter shall not be impaired and no changes in the meter appearance shall be apparent.
Test procedure in brief	The test consists of exposure to an ultraviolet lamp with light output between 21 750 lm and 27 000 lm for a period of 48 h at a distance of 250 mm. At the commencement of the test, part of the EUT shall be covered to prevent irradiation. The test surfaces of the EUT shall face the lamp. After 48 h of irradiation, the exposed and covered parts of the EUT shall be compared.

A.2.6 Dust Test

Applicable standards	AS 60529 [17]
Object of test	To verify compliance with the provisions of clause 5.6 under exposure to dust. At the conclusion of the test, there shall be no evidence of dust accumulation in a manner which could affect meter operation or safety, nor shall there be evidence of dust deposition in a way which could lead to tracking along the creepage distances. The function of the meter shall not be impaired.
Test procedure in brief	The EUT shall be supported in its normal operating position inside a closed test chamber which contains a suspension of talcum powder. The amount of talcum powder shall be 2 kg per cubic metre of test chamber volume. The particle size of the talcum powder shall be such that the powder shall be able to pass through a square-meshed sieve with nominal wire diameter of 50 µm and nominal inter-wire gap width of 75 µm. The EUT shall be in non-operating condition. The same atmospheric pressure shall be maintained inside the meter as outside. At the conclusion of the test, a visual inspection of the meter interior shall be carried out, and the meter function tested.
Enclosure category	2
Duration	8 h

A.2.7 Vibration (Sinusoidal) Test

Applicable standards	AS 60068.2.6 [18]
Object of test	To verify performance of the EUT under conditions of sinusoidal vibration. After the test, the EUT shall show no damage or change of information and shall operate correctly.
Test procedure in brief	The EUT shall be tested by sweeping the frequency in the specified frequency range, at 1 octave/min, at the specified acceleration level with a specified number of sweep cycles per axis. The EUT shall be tested in three, mutually perpendicular main axes mounted on a rigid fixture by its normal mounting means. It shall normally be mounted so that the gravitational force acts in the same direction as it would in normal use. Where the effect of gravitational force is not important, the EUT may be mounted in any position. The test shall be carried out with the EUT in non-operating condition and without packing materials.
Severity level	2
Frequency range	10–150 Hz
Max acceleration level	10 m/s^2
Number of sweep cycles per axis	10
Additional information	Single point control should be used. For frequency < 60 Hz, constant amplitude of movement 0.075 mm. For frequency > 60 Hz, constant acceleration of 9.8 m/s^2.

A.2.8 Mechanical Shock Test

Applicable standards	AS 60068.2.27 [19]
Object of test	To verify performance of the EUT under conditions of non-repetitive mechanical shocks likely to be encountered during transportation or operation. After the test, the meter shall show no damage or change of information and shall operate correctly.
Test procedure in brief	The EUT is fastened by its normal mounting means to a fixture or to the table of the shock-testing machine and a series of pulses are applied to the fixing point closest to the centre of the table surface of the shock-testing machine. Three successive shocks are applied in each direction of three mutually perpendicular axes of the specimen (total of 18 shocks). The EUT is to be in non-operating condition and without packing during the test.
Severity level	1
Pulse shape	Half-sine
Peak acceleration	300 m/s^2
Pulse duration	18 ms

A.2.9 Radiated Electromagnetic (EM) Radiofrequency (RF) Fields

Applicable standards	AS/NZS 61000.4.3 [20]
Object of test	To verify compliance with the limits of variation in error specified in Table 4 under conditions of radiated EM fields. In addition, during the test, the behaviour of the equipment shall not be perturbed.
Test procedure in brief	The EUT shall be exposed to EM field strength as specified by the severity level and a field uniformity as defined by the referenced standard. The frequency range to be considered is swept with the modulated signal, pausing to adjust the RF signal level or to switch oscillators and antennae as necessary. Where the frequency range is swept incrementally, the step size shall not exceed 1% of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s. The sensitive frequencies (e.g. clock frequencies, frequencies emitted by the EUT) shall be analysed separately. The test shall normally be performed with the generating antenna facing each side of the EUT. When equipment can be used in different orientations, all sides shall be exposed to the field during the test. The polarisation of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally. For the test the EUT should be placed on a non-conductive table 0.8 m high and connected to power and signal wires according to relevant installation instructions. The test shall be carried out in a shielded enclosure to comply with international laws prohibiting interference to radio communications, and the shielded enclosure should also be used as a 'barrier' between the EUT and the required test instrumentation. 1. Test with current: (a) Meter in operating condition, voltage and auxiliary circuits energised with reference voltage, basic current I_b (or rated current I_n as appropriate) and $\cos \varphi$ (or $\sin \varphi$ as appropriate) according to the values given in Table 4. (b) Unmodulated test field strength 10 V/m. 2. Test without any current: (a) Meter in operating condition, voltage and auxiliary circuits energised with reference voltage, without any current in the current circuits and the current terminals shall be open circuit. (b) Unmodulated test field strength 30 V/m.
Frequency range	80–2400 MHz (continuous)
Modulation	Carrier modulated with 80% AM at 1 kHz sine wave
Additional information	The EUT shall be tested within its intended operating and climatic conditions. Cable length exposed to the field: 1 m.

A.2.10 Conducted Radiofrequency (RF) Fields

Applicable standards	AS/NZS 61000.4.6 [21]
Object of test	To verify compliance with the limits of variation in error specified in Table 4 under conditions of conducted RF fields. In addition, during the test, the behaviour of the EUT shall not be perturbed.
Test procedure in brief	Radiofrequency EM current, simulating the influence of EM fields, shall be coupled or injected into the power ports and I/O ports of the EUT using coupling/decoupling devices as defined in the referenced standard. The performance of the test equipment consisting of an RF generator, (de-)coupling devices, attenuators, etc., shall be verified. The EUT shall be placed on an insulating support 0.1 m above the ground reference plane, which may be on a table. Cable length between the EUT and auxiliary equipment shall not exceed the maximum length specified by the manufacturer of the EUT. If the EUT has multiple identical ports (same input or output electronic circuits, loads, connected equipment, etc.), at least one of these ports shall be selected for testing to ensure that all different types of ports are covered. The EUT shall be tested within its intended operating and climatic conditions. The frequency range to be considered is swept with the modulated signal, pausing to adjust the RF signal level or to change coupling devices as necessary. Where the frequency range is swept incrementally, the step size shall not exceed 1% of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s. The sensitive frequencies (e.g. clock frequencies) shall be analysed separately. The tests shall be carried out under the following conditions: • the voltage and auxiliary circuits energised with reference voltage; • basic current I_b (or rated current I_n) and $\cos \varphi$ (or $\sin \varphi$) according to the values given in Table 4.
RF amplitude (50 Ω)	10 V (emf)
Frequency range	0.15–80 MHz
Modulation	80% AM at 1 kHz sine wave
Additional information	Since the EUT may be disturbed by transients occurring during frequency stepping, provisions should be made to avoid such disturbance. For example, before the frequency change, the strength of the signal can be decreased a few dB below the test level.

A.2.11 Electrostatic Discharge Test

Applicable standards	AS/NZS 61000.4.2 [22]	
Object of test	To verify performance of the EUT under conditions of direct and indirect electrostatic discharges. The application of the electrostatic discharge shall not produce a change in the register by more than x kW h and the test output shall not produce a signal equivalent to more than x kW h; The value of x is derived from the following formula: $x = 10^{-6} \cdot m \cdot U_{nom} \cdot I_{max}$ where: m is the number of measuring elements; U_{nom} is the reference voltage in volts; and I_{max} is the maximum current in amperes. During the test, a temporary degradation or loss of function or performance is acceptable; however the meter shall operate correctly following the test.	
Test procedure in brief	An ESD generator shall be used with a performance as defined in the referenced standard. Before stating the tests, the performance of the generator shall be verified. The EUT shall be mounted as table-top equipment and tested within its intended climatic conditions. During the test, the meter shall be in operating condition with voltage and auxiliary circuits energised with reference voltage and without any current in the current circuits (open circuit). At least 10 discharges shall be applied. The time interval between successive discharges shall be at least 10 s. For EUT not equipped with a ground terminal, the EUT shall be fully discharged between discharges. Contact discharge should be used unless there are no metallic outer surfaces. Direct application: • In the contact discharge mode to be carried out on conductive surfaces, the electrode shall be in contact with EUT. • In the air discharge mode on insulated surfaces, the electrode is approached to the EUT and the discharge occurs by spark. Indirect application: • The discharges are applied in the contact mode to coupling planes mounted in the vicinity of the EUT.	
Severity level	4	
No of discharges	10 (in the most sensitive polarity)	
Test voltage	Contact discharge	8 kV
	Air discharge	15 kV

A.2.12 AC Mains Voltage Variation

Object of test	To verify compliance with the limits in variation of error specified in Table 4 under conditions of varying AC mains power voltage.	
Test procedure in brief	The test consists of exposure to the specified power condition for a period sufficient for achieving temperature stability and for performing the required measurements.	
Mains voltage[1, 2]	Upper limit	$U_{\text{nom}} + 10\%$
	Lower limit	$U_{\text{nom}} - 10\%$
Mains voltage, extended[1,2]	$+10\%\ U_{\text{nom}} < U \leq +15\%\ U_{\text{nom}}$ $-20\%\ U_{\text{nom}} \leq U < -10\%\ U_{\text{nom}}$ $-100\%\ U_{\text{nom}} \leq U < -20\%\ U_{\text{nom}}$	
Additional information	Note 1: In the case of three phase mains power, the voltage variation shall apply for each phase successively. Note 2: The values of U_{nom} are those marked on the measuring instrument. In case a range is specified, the '–' relates to the lowest value and the '+' to the highest value of the range.	

A.2.13 Frequency Variation

Object of test	To verify compliance with the limits in variation of error specified in Table 4 under conditions of varying AC mains power frequency.	
Test procedure in brief	The test consists of exposure to the specified power condition for a period sufficient for achieving temperature stability and for performing the required measurements.	
Mains frequency[1]	Upper limit	$f_{\text{nom}} + 2\%$
	Lower limit	$f_{\text{nom}} - 2\%$
Additional information	Note 1: The values of f_{nom} are those marked on the measuring instrument. In case a range is specified, the '–' relates to the lowest value and the '+' to the highest value of the range.	

A.2.14 Voltage Dips and Short-term Interruptions

Applicable standards	None.			
Object of test	To verify performance of the EUT under conditions of short-time mains voltage reductions. The voltage dips and interruptions shall not produce a change in the register of more than x kWh and the test output shall not produce a signal equivalent to more than x kWh; the value of x is given in Annex A.2.11.			
Test procedure in brief	A test generator suitable to reduce for a defined period of time the amplitude of the AC mains voltage is used. The performance of the test generator shall be verified before connecting the EUT. The EUT shall be tested with voltage and auxiliary circuits energised with the reference voltage and without any current in the current circuits.			
	ΔU	Duration	Number of dips or interruptions	Time between dips or interruptions
Voltage dip	50%	1 min	1	—
Voltage interruption	100%	1 s	3	50 ms
	100%	20 ms	1	—

A.2.15 Electrical Fast Transient Bursts

Applicable standards	AS/NZS 61000.4.4 [23]	
Object of test	To verify compliance with the limits in variation of error specified in Table 4 under conditions where electrical bursts are superimposed on the mains voltage. During the test, a temporary degradation or loss of function or performance is acceptable.	
Test procedure in brief	A burst generator shall be used with the performance characteristics as specified in the referenced standard. The characteristics of the generator shall be verified before connecting the EUT. The test consists of exposure to bursts of voltage spikes for which the output voltage on 50 Ω and 1000 Ω load are defined in the referenced standard. Both positive and negative polarity of the bursts shall be applied. The duration of the test shall not be less than 1 min for each amplitude and polarity. The injection network on the mains shall contain blocking filters to prevent the burst energy being dissipated in the mains. The test pulses shall be continuously applied during the measuring time. The test shall be carried out under the following conditions: • the EUT mounted as table-top equipment; • climatic conditions within the limits specified for the operation of the EUT and test equipment by their respective manufacturers; • the voltage and auxiliary circuits energised with reference voltage; • basic current I_b (or rated current I_n as appropriate) and $\cos \varphi$ (or $\sin \varphi$) according to the values given in Table 4; and • test voltage applied in common mode (line to earth) to the voltage circuits, the current circuits (if separated from the voltage circuits in normal operation), and the auxiliary circuits (if separated from the voltage circuits in normal operation).	
Tests:	On auxiliary circuits with a reference voltage over 40 V	On current and voltage circuits (including an auxiliary supply to the meter where relevant)
Test severity level	3	4
Amplitude	2 kV	4 kV
Repetition rate	5 kHz	5 kHz
Duration of test	60 s at each polarity	
Additional information	Cable length between EUT and coupling device: 1 m	

A.2.16 Short-time Overcurrents

Applicable standards	AS 62053.21 [7], AS 62053.22 [8], AS 1284.1 [5]				
Object of test	To verify compliance with the limits of variation in error specified in Table 4 under conditions of short-time overcurrents. The EUT shall perform correctly when back to its initial working conditions after tests A and B, and shall not cause damage to surrounding equipment when subjected to the conditions of Tests C, D and E.				
Test procedure in brief	The test consists of the application of short-time overcurrents to the EUT with the voltage maintained at the terminals, followed by a recovery period of about 1 h during which the EUT is allowed to return to its initial temperature with the voltage circuits energised. The test circuit shall be practically non-inductive and the test shall be performed for polyphase meters phase-by-phase.				
Tests:	Test A[1]	Test B[2]	Test C[1]	Test D[3,5]	Test E[4,5]
Overcurrent value	30 I_{max}	20 I_{max}	7 000 A	250 A	50 A
Duration	10 ms	0.5 s	60 ms	60 ms	60 ms
Additional information	Relative tolerance for overcurrent value: +0% to –10%. Note 1: For direct-connected static meters. Note 2: For current transformer-operated meters and all static meters of class 0.2 or 0.5. Note 3: For 5 A current transformer-operated meters. Note 4: For 1 A current transformer-operated meters. Note 5: Where 20 I_{max} is greater than 250 A (for 5 A current transformer-operated meters) or 50 A (for 1 A current transformer-operated meters), tests D and E may be omitted. Tests C, D and E are not found in the AS/IEC standards referenced. Test C has been included because in some states/territories a multiple tenanted building may be supplied by a 500 kVA transformer feeding several whole current meters. These meters are not individually fused. If there is a short at the load side of the meter then it is possible that 7 000 A could flow through the meter for about 60 ms.				

A.2.17 Sub-harmonics in the AC Circuit

Applicable standards	AS 62053.21 [7]
Object of test	To verify compliance with the limits of variation in error specified in Table 4 when exposed to sub-harmonics in the AC circuit.
Test procedure in brief	The meter shall be subjected to a test sinusoidal waveform with amplitude twice that of the reference sinusoidal signal and which is switched off after every second period for the next two periods. Care should be taken to ensure that no DC current is introduced. The test shall be performed with basic current 0.5 I_b (or rated current 0.5 I_n as appropriate) and power factor 1.

A.2.18 Odd Harmonics in the AC Circuit

Applicable standards	AS 62053.21 [7]
Object of test	To verify compliance with the limits of variation in error specified in Table 4 when exposed to odd harmonics in the AC circuit.
Test procedure in brief	The meter shall be subjected to a test sinusoidal waveform with amplitude twice that of the reference sinusoidal signal and which is set to zero for the first and third quarters of each period. The test shall be performed with basic current 0.5 I_b (or rated current 0.5 I_n as appropriate) and power factor 1.

A.2.19 Impulse Voltage Test

Applicable standards	AS 62052.11 [4], SP-Method 1618 [24] Or OIML R 46 [26] if using the alternative test procedure	
Object of test	To verify retention of adequate dielectric qualities under the application of an impulse voltage consistent with normal conditions of use. After this test, there shall be no change at reference conditions in the percentage error greater than the uncertainty of the measurement and no mechanical damage to the EUT. During the test relative to earth, no flashover, disruptive discharge or puncture shall occur.	
Test procedure in brief	The test procedure shall be performed as described in AS 62052.11 (clause 7.3.2) except for the test for circuits and between circuits (clause 7.3.2.1 of AS 62052.11) where the impulse voltage, source impedance, source capacitance and stored energy values shown below (from SP-Method 1618).	
Alternative test procedure	An acceptable alternative to the test procedure above and the test conditions below is the impulse voltage test specified in OIML R 46 [26].	
Test conditions	For circuits and between circuits	For electric circuits relative to earth
Impulse voltage	12 kV +0%, –15%	10 kV +0%, –10%
Source capacitance	0.125 µF	—
Source impedance	40 Ω ± 5 Ω	500 Ω ± 50 Ω
Stored energy	9.0 J ± 1.0 J	0.5 J ± 0.05 J
Impulse waveform at no load	1.2/50 impulse specified in IEC 60060-1 [24]	
Time between impulses	Minimum 3 s	
Front time T_1 (voltage rise time)	1.2 ± 30% (with no load)	
Time to half-value T_2 (voltage fall time)	50 ± 20% (with no load)	
Additional information	The specified values for impulse voltage and stored energy for the test for circuits and between circuits come from SP-Method 1618 and are higher than the values listed in Table 3b of AS 62052.11 [4] and the corresponding table of IEC 62052-11 [9]. The values of source capacitance and source impedance have been chosen to align with those cited in SP-Method 1618 and thus also with the new impulse voltage and stored energy values. The impulse voltage test should be carried out before the AC voltage test (Annex A.2.20).	

A.2.20 AC Voltage Test

Applicable standards	AS 62053.21 [7], AS 62053.22 [8], AS 1284.1 [5]
Object of test	To verify retention of adequate dielectric qualities under the application of a test voltage consistent with normal conditions of use. After this test, there shall be no change at reference conditions in the percentage error greater than the uncertainty of the measurement and no mechanical damage to the EUT. During this test no flashover, disruptive discharge or puncture shall occur.
Test procedure in brief	The AC voltage test shall be carried out in accordance with the details shown below. The test voltage shall be substantially sinusoidal, having a frequency between 45 and 65 Hz, and applied for 1 min. The power source shall be capable of supplying at least 500 VA. During the tests relative to earth, the auxiliary circuits with reference voltage equal to or below 40 V shall be connected to earth. All these tests shall be carried out with the meter case closed, and the meter cover and terminal cover in place.
Test voltage (rms)	Points of application of test voltage:
2 kV	(a) Between circuits not intended to be connected together in service.
4 kV	(b) Between, on the one hand, all the current and voltage circuits as well as the auxiliary circuits whose reference voltage is over 40 V, connected together, and, on the other hand, earth.
40 V	If a visual inspection does not conclusively demonstrate compliance with protective class 2 requirements as specified in clause 5.7 of AS 62052.11 [4]: (c) Between, on the one hand, all conductive parts inside the meter connected together and, on the other hand, all conductive parts outside the meter that are accessible with a test finger, connected together.
Additional information	The AC voltage test should be performed after the impulse voltage test (Annex A.2.19).

A.2.21 Harmonic Components in the Current and Voltage Circuits

Applicable standards	AS 62053.21 [7], AS 62053.22 [8]
Object of test	To verify compliance with the limits of variation in error specified in Table 4 when exposed to harmonic components in the current and voltage circuits.
Test conditions	Fundamental frequency current: $I_1 = 0.5\ I_{max}$ Fundamental frequency voltage: $U_1 = U_{nom}$ Fundamental frequency power factor: 1 Content of fifth harmonic voltage: $U_5 = 10\%$ of U_{nom} Content of fifth harmonic current: $I_5 = 40\%$ of fundamental current
Test procedure in brief	The variation in percentage error shall be measured under the most unfavourable phase displacement of the fifth harmonic in the current compared with the fundamental error.

Annex B. Mandatory Test Points (Mandatory)

B.1 Mandatory Test Points for Pattern Approval

The mandatory test points for pattern approval are specified in Tables B.1 to B.4.

Table B.1. Mandatory test points for Table 1

Current (A)	Power factor		
	1	0.5 inductive	0.8 capacitive
0.05 I_b	Yes	No	No
0.1 I_b	Yes	Yes	Yes
0.2 I_b	Yes	Yes	Yes
I_b	Yes	Yes	Yes
I_{max}	Yes	Yes	Yes

Table B.2. Mandatory test points for Table 2

Current (A)	Power factor		
	1	0.5 inductive	0.8 capacitive
0.01 I_n	Yes	No	No
0.02 I_n	Yes	Yes	Yes
0.05 I_n	Yes	Yes	Yes
0.1 I_n	Yes	Yes	Yes
I_n	Yes	Yes	Yes
I_{max}	Yes	Yes	Yes

Table B.3. Mandatory test points for Table 3 for direct-connected meters

Current (A)	Power factor	
	1	0.5 inductive
0.1 I_b	Yes	No
0.2 I_b	Yes	Yes
I_b	Yes	Yes
I_{max}	Yes	Yes

Note: The test points apply to each phase.

Table B.4. Mandatory test points for Table 3 for transformer-operated meters

Current (A)	Power factor	
	1	0.5 inductive
0.05 I_n	Yes	No
0.1 I_n	Yes	Yes
I_n	Yes	Yes
I_{max}	Yes	Yes

Note: The test points apply to each phase.

B.2 Mandatory Test Points for Verification

The mandatory test points for verification are specified in *NITP 14 National Instrument Test Procedures for Utility Meters*.

Annex C. Accuracy classes and Error Limits for the Australian Standards Pathway (Informative)

The Australian Standards cover 4 accuracy classes: class 0.2 S, 0.5 S, 1 and 2. The four accuracy classes and associated error limits (maximum permissible errors) are summarised in Tables C.1 and C.2 below.

Table C.1. Percentage error limits for single phase and polyphase direct-connected meters with balanced loads

Value of current		Power factor	Percentage error limits for meters of class			
For direct connected meters	For transformer operated meters		0.2 S	0.5 S	1	2
—	$0.01\ I_n \le I < 0.05\ I_n$	1	±0.4	±1.0	—	—
$0.05\ I_b \le I < 0.1\ I_b$	$0.02\ I_n \le I < 0.05\ I_n$	1	—	—	±1.5	±2.5
$0.1\ I_b \le I \le I_{max}$	$0.05\ I_n \le I \le I_{max}$	1	±0.2	±0.5	±1.0	±2.0
$0.1\ I_b \le I < 0.2\ I_b$	$0.02\ I_n \le I < 0.1\ I_n$	0.5 inductive	±0.5	±1.0	—	—
		0.8 capacitive	±0.5	±1.0	—	—
$0.1\ I_b \le I < 0.2\ I_b$	$0.05\ I_n \le I < 0.1\ I_n$	0.5 inductive	—	—	±1.5	±2.5
		0.8 capacitive	—	—	±1.5	—
$0.2\ I_b \le I \le I_{max}$	$0.1\ I_n \le I \le I_{max}$	0.5 inductive	±0.3	±0.6	±1.0	±2.0
		0.8 capacitive	±0.3	±0.6	±1.0	—

Table C.2. Percentage error limits for polyphase meters carrying a single-phase load, but with balanced polyphase voltages applied to voltage circuits

Value of current		Power factor	Percentage error limits for meters of class			
For direct connected meters	For transformer operated meters		0.2 S	0.5 S	1	2
$0.1\ I_b \le I \le I_{max}$	$0.05\ I_n \le I \le I_{max}$	1	±0.3	±0.6	±2.0	±3.0
$0.2\ I_b \le I \le I_{max}$	$0.1\ I_n \le I \le I_{max}$	0.5 inductive	±0.4	±1.0	±2.0	±3.0

Annex D. Implementation of the Australian Standards Pathway (Informative)

As specified in 10.1.1.1, one pathway for pattern approval is based on a suite of Australian Standards [27], [28] and [29]. This Annex provides further information on the implementation of this pathway.

The suite of standards [27], [28] and [29] make reference to other standards including the Australian Standard [30] for safety requirements. However, the objective of pattern approval is to assess metrological performance.

For this reason, NMI does not require full compliance with the Australian Standards. In particular, safety requirements that are not also related to metrology will not be required or assessed for pattern approval.

Tables D.1 to D.8 provide a listing clauses and whether they will be assessed for pattern approval.

Table D.1 NMI M 6-1 Mandatory Clauses

NMI M 6-1 Clauses	Description	Assessed?
3	Units of Measurement	Yes
4.3	Calculated Quantities	Yes
4.4	Rules for Determination of Errors	Yes
8.1	Markings	Yes
9.1	Verification Mark	Yes
9.2	Sealing	Yes

Table D.2 Terms and definitions, and, Standard electrical values

Clauses of [27]	Description	Assessed?
3	Terms and definitions	Yes
4	Standard electrical values	Yes

Table D.3 Mechanical requirements and Tests

Clauses of [27]	Description	Assessed?
5.1	General Mechanical Requirements	Not Assessed
5.2.1	Sealing[1]	Not Assessed
5.2.2.1	Spring Hammer Test	Not Assessed
5.2.2.2	Shock Test	Yes
5.2.2.3	Vibration Test	Yes
5.3	Window	Yes
5.4	Terminals - Terminal block(s) - Protective earth terminal	Not Assessed
5.5	Terminal cover(s)	Not Assessed
5.6	Clearance and creepage distances	Not Assessed
5.7	Insulating encased meter of protective class II	Not Assessed
5.8	Resistance to heat and fire	Not Assessed
5.9	Protection against penetration of dust and water	Not Assessed
5.10	Display of measured values	Yes
5.11	Output device	Yes
5.12	Marking of meter[2]	Yes

Note 1: Refer to sealing requirements of NMI M 6-1, Clause 9.2

Note 2: Also see marking requirements of NMI M 6-1, Clause 8.1. Safety related markings are not assessed.

Table D.4 Climatic Conditions

Clauses of [27]	Description	Assessed?
6.1	Temperature range	Yes
6.2	Relative Humidity	Not Assessed
6.3.1	Dry Heat Test	Yes
6.3.2	Cold test	Yes
6.3.3	Damp Heat Cyclic	Yes
6.3.4 / Appendix ZA	Protection Against Solar Radiation	Yes

Table D.5 Electrical Requirements

Clauses of [27]	Description	Assessed?
7.1.2	Voltage dips and short interrupts	Yes
7.2	Heating	Not Assessed
7.3	Insulation. Reference to [30] clauses 6.7, 6.8 and 6.10	Not Assessed
7.3 / Appendix ZZ	Impulse test for robustness, [30] Appendix ZZ	Yes
7.4	Immunity to earth fault	Yes
7.4	Reference to [30] Clause 6.10.3.2	Not Assessed
Clauses of [28], [29]	Description	Assessed?
7.1	Power consumption	Yes
7.2	Influence of short-time overcurrents	Yes
7.2	Reference to [30] clauses 6.9.8, 6.10.5 and 6.10.6.	Not Assessed
7.3	Influence of self-heating	Yes
7.4	AC Voltage test	Not Assessed

Table D.6 Electrical Requirements – Electromagnetic compatibility (EMC)

Clauses of [27]	Description	Assessed?
7.5.1	General	Yes
7.5.2	Test of immunity to electrostatic discharges (ESD)	Yes
7.5.3	Test of immunity to electromagnetic RF fields	Yes
7.5.4	Fast transient burst test	Yes
7.5.5	Test of immunity to conducted disturbances, induced by RF fields	Yes
7.5.6	Surge immunity test	Yes
7.5.7	Damped oscillatory waves immunity test	Yes
7.5.8	Radio interference suppression	Not Assessed

Table D.7 Accuracy Requirements

Clauses of [28], [29]	Description	Assessed?
8.1	Limits of error due to variation of the current	Yes
8.2	Limits of error due to influence quantities	Yes
8.3	Test of starting and no-load condition	Yes
8.4	Meter constant	Yes

Table D.8 Appendices

Clauses of [27]	Description	Assessed?
Appendix ZA	Method for the Determination of the Resistance of Certain Components to Ultraviolet Light[1]	Yes
Appendix ZB	Disconnect After Reconnect Capability	Not assessed
Appendix ZC	Time Keeping Performance	Yes

Note 1: This test is also referenced in clause 6.3.4 Protection Against Solar Radiation.

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[5] AS 1284.1 (2004) Electricity Metering – Part 1: General Purpose Induction Watt Hour Meters

[6] ISO/IEC Guide 98-3:2008: Guide to the Expression of Uncertainty in Measurement (GUM). ISO, Geneva, 2008

[7] AS 62053.21 (2005) Electricity Metering Equipment (AC) – Particular Requirements – Static Meters for Active Energy (Classes 1 and 2) (modified from IEC 62053-21 (2003))

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[9] IEC 62052-11 (2003) Electricity Metering Equipment (AC) – General Requirements, Tests and Test Conditions – Metering Equipment

[10] AS 62054.21 (2006) Electricity Metering (AC) – Tariff and Load Control – Particular Requirements for Time Switches (identical with IEC 62054.21 (2004))

[11] IEC 62053-52 (2005) Electricity Metering Equipment (AC) – Particular Requirements – Part 52: Symbols

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[15] AS 60068.2.1 (2003) Environmental Testing Part 2.1: Tests – Test A: Cold (identical with IEC 60068-2-1 (1990) incorporating Amendment 1:1993 and Amendment 2:1994)

[16] AS 60068.2.30 (2003) Environmental Testing Part 2.30: Tests – Test Db and Guidance: Damp Heat, Cyclic (12 + 12-hour Cycle) (identical with IEC 60068-2-30 (1980) incorporating amendment 1:1985)

[17] AS 60529 (2004) Degrees of Protection Provided by Enclosures (IP Code) (modified from IEC 60529 (2001))

[18] AS 60068.2.6 (2003) Environmental Testing – Tests - Test Fc: Vibration (Sinusoidal) (identical with IEC 60068-2-6 (1995) including Corrigendum 1:1995)

[19] AS 60068.2.27 (2003) Environmental Testing – Tests – Test Ea and Guidance: Shock (identical with IEC 60068-2-27 (1987))

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