Australian Government

National Measurement Institute

NMI M 6-2
Electricity Meters

Part 2: Test Report Format

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CONTENTS

PREFACE

This document provides a test report format for the pattern approval and verification of active-energy static electricity meters of classes 0.2, 0.5, 1 and 1.5 covered by *NMI M 6-1 Electricity Meters. Part 1: Metrological and Technical Requirements*. It may clarify NMI M 6-1, but it does not add to or alter any requirements.

The test reports should make testing more efficient and consistent, and if testing has been conducted against other standards, the test reports may be used as a checklist to determine what further testing and information is required.

Please note that not all tests apply to all meter.

1. TEST INFORMATION

Test Report	
Report reference number	
Date of issue	
Date of testing	
Laboratory details	
Name	
Address	
Contact details	
Test specification	
Standard	NMI M 6-1
Client details	
Applicant	
Address	

2. METER INFORMATION AND SPECIFICATIONS

Manufacturer	
Model	
Accuracy class	
Temperature ranges	
Specified operating range	
Limit range of operation	
Storage and transportation	
Number of phases	
Number of elements	
Number of wires	
Connection type	
Design type (e.g. solid state, induction)	
Reference frequency	
Reference voltage	
Basic current (direct-connected)	
Rated current (transformer-operated)	
Rated maximum current	
Clock type	
Enclosure type	
Protective class	
Software/firmware version	

3. REQUIREMENTS

Clause number and requirement (from NMI M 6-1)		Value / Remark	Result
3	**Units of measurement**		
	Valid units of measurement used		
4.1	**Minimum measured quantity**		
	Has the form 1×10^n authorised units of energy, where n is an integer		
4.2	**Maximum permissible variation between indicators**		
	No indicated difference between indications of same quantity on different indicators		
4.3	**Calculated quantities**		
	Indicated quantity equals value obtained using indicated values with applicable rounding		
	If rounding applied it is ±0.5 minimum measured quantity		
4.6	**Meter constant**		
	No error in relationship between test output and indication on display		
4.7	**Class indices (accuracy class)**		
	Meter classified as one of 0.2, 0.5, 1 or 1.5		
4.8	**Maximum permissible error**		
	Percentage errors do not exceed the relevant values specified in tables 1, 2 and 3 due to variations in current	(see results below)	
5.2	**Temperature range** (ranges shall comply with the minimum acceptable ranges in Table 5)		
	Specified operating range		
	Limit range of operation		
	Storage and transportation		
5.7.2	**Initial start up of the meter**		
	Time to start – shall be functional within 5 s		
5.7.3	**Running with no load**		
	Test voltage		
	Test current		
	Test period		
	Test output pulses – shall be no more than one		
	Rotor revolutions – may start but shall not complete a revolution		
5.7.4	**Starting**		
	Test current		
	Meter starts and continues to register		
	Rotor revolutions – shall start and complete at least one revolution		
7.2	**Acting upon significant faults** (static meters only)		
	Has capability to detect, log and communicate significant faults		
	Logged data kept in permanent record with date and time stamp		

Clause number and requirement (from NMI M 6-1)		Value / Remark	Result
7.3	**Display**		
	Meter has a display which is legible whilst operating		
	Visible to consumer in normal installation position		
	There is a procedure to show all relevant elements of indicator display, with sufficient time to check them		
	Able to display quantity of energy corresponding to I_{max} for at least 4 000 h without returning to same index		
	Calculated value (energy at I_{max} for 4 000 h)		
	Number of display digits		
7.4	**Auxiliary devices interface**		
	Interface shall be sealed if parameters can be altered by instructions or data introduced through interface		
8.1	**Information to be displayed on meter exterior**		
	Manufacturer's name or mark		
	Model designation		
	Serial number		
	NMI certificate of approval number (space for)		
	Number of phases, number of wires		
	Reference frequency		
	Specified operating temperature limits (if more restrictive than –10°C to +60°C)		
	Meter constant		
	Rated voltage		
	Rated currents		
	Class index		
8.2	**Notices**		
	Any special notices or limitations of use shall be clearly marked or provided in manual		
9.1	**Verification mark**		
	Easily affixed without affecting metrological properties of the meter		
	Visible without moving or dismantling the meter when in use		
	Part where mark is located shall not be removable with damage to mark		
	Sufficient space (≥ 200 mm^2)		
9.2	**Sealing**		
	Access to protected parameters protected		
	Access to protected parameters recorded		
	Records readily accessible		
	Record easily identifiable (not confused)		
	Reference record marked on meter		
	Record shall not repeat in a sequence of less than 99 alterations; record shall persist reliably for at least 2 years and persist through influence and disturbance tests		

4. MAXIMUM PERMISSIBLE ERRORS

Refer to NMI M 6-1, clause 4.8 (Tables 1 to 3).
Mandatory test currents are shown. Extra test points should be included where appropriate for the particular meter.

4.1 Direct-connected Meters with Balanced Loads

Current (A)	Power factor	Percentage error	Limit (±%) for class	
			1	1.5
0.05 I_b	1		1.5	1.5
0.1 I_b			1.0	1.5
0.2 I_b				
I_b				
I_{max}				
0.1 I_b	0.5 inductive		1.5	1.5
0.2 I_b			1.0	1.5
I_b				
I_{max}				
0.1 I_b	0.8 capacitive		1.5	
0.2 I_b			1.0	
I_b				
I_{max}				

4.2 Transformer-operated Meters with Balanced Loads

Current (A)	Power factor	Percentage error	Limit (±%) for class		
			0.2	0.5	1
0.01 I_n	1		0.4	1.0	
0.02 I_n					1.5
0.05 I_n			0.2	0.5	1.0
0.1 I_n					
I_n					
I_{max}					
0.02 I_n	0.5 inductive		0.5	1.0	
0.05 I_n					1.5
0.1 I_n			0.3	0.6	1.0
I_n					
I_{max}					
0.02 I_n	0.8 capacitive		0.5	1.0	
0.05 I_n					1.5
0.1 I_n			0.3	0.6	1.0
I_n					
I_{max}					

4.3 Polyphase Direct-connected Meters

Phase	Current (A)	Power factor	Percentage error	Limit (±%) for class	
				1	1.5
Phase 1	0.1 I_b	1		2.0	2.5
	0.2 I_b				
	I_b				
	I_{max}				
	0.2 I_b	0.5 inductive		2.0	2.5
	I_b				
	I_{max}				
Phase 2	0.1 I_b	1		2.0	2.5
	0.2 I_b				
	I_b				
	I_{max}				
	0.2 I_b	0.5 inductive		2.0	2.5
	I_b				
	I_{max}				
Phase 3	0.1 I_b	1		2.0	2.5
	0.2 I_b				
	I_b				
	I_{max}				
	0.2 I_b	0.5 inductive		2.0	2.5
	I_b				
	I_{max}				

4.4 Polyphase Transformer-operated Meters

Phase	Current (A)	Power factor	Percentage error	Limit (±%) for class		
				0.2	0.5	1
Phase 1	0.05 I_n	1		0.3	0.6	2.0
	0.1 I_n					
	I_n					
	I_{max}					
	0.1 I_n	0.5 inductive		0.4	1.0	2.0
	I_n					
	I_{max}					
Phase 2	0.05 I_n	1		0.3	0.6	2.0
	0.1 I_n					
	I_n					
	I_{max}					
	0.1 I_n	0.5 inductive		0.4	1.0	2.0
	I_n					
	I_{max}					
Phase 3	0.05 I_n	1		0.3	0.6	2.0
	0.1 I_n					
	I_n					
	I_{max}					
	0.1 I_n	0.5 inductive		0.4	1.0	2.0
	I_n					
	I_{max}					

5. INFLUENCE FACTORS AND DISTURBANCES

5.1 Voltage Variation

Refer to NMI M 6-1, Table 4 and A.2.12.
For three phase mains power, voltage variations shall apply for each phase successively.

5.1.1 Direct-connected Meters, Classes 1 and 1.5

Voltage variation (% from U_{nom})	Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class	
				1	1.5
+10	0.05 I_b	1		0.7	1.0
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive		1.0	1.0
	I_b				
	I_{max}				
–10	0.05 I_b	1		0.7	1.0
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive		1.0	1.0
	I_b				
	I_{max}				
+15	0.05 I_b	1		2.1	3.0
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive		3.0	3.0
	I_b				
	I_{max}				
–20	0.05 I_b	1		2.1	3.0
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive		3.0	3.0
	I_b				
	I_{max}				
–50	0.05 I_b	1		–100 to +10	
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive			
	I_b				
	I_{max}				

5.1.2 Transformer-operated Meters, Class 1

Voltage variation (% from U_{nom})	Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class
				1
+10	0.02 I_n	1		0.7
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		1.0
	I_n			
	I_{max}			
–10	0.02 I_n	1		0.7
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		1.0
	I_n			
	I_{max}			
+15	0.02 I_n	1		2.1
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		3.0
	I_n			
	I_{max}			
–20	0.02 I_n	1		2.1
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		3.0
	I_n			
	I_{max}			
–50	0.02 I_n	1		–100 to +10
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		
	I_n			
	I_{max}			

5.1.3 Transformer-operated Meters, Classes 0.2 and 0.5

Voltage variation (% from U_{nom})	Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class	
				0.2	0.5
+10	0.05 I_n	1		0.1	0.2
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive		0.2	0.4
	I_n				
	I_{max}				
–10	0.05 I_n	1		0.1	0.2
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive		0.2	0.4
	I_n				
	I_{max}				
+15	0.05 I_n	1		0.3	0.6
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive		0.6	1.2
	I_n				
	I_{max}				
–20	0.05 I_n	1		0.3	0.6
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive		0.6	1.2
	I_n				
	I_{max}				
–50	0.05 I_n	1		–100 to +10	
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive			
	I_n				
	I_{max}				

5.2 Frequency Variation

Refer to NMI M 6-1, Table 4 and A.2.13.

5.2.1 Direct-connected meters, Classes 1 and 1.5

Frequency variation (% from f_{nom})	Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class	
				1	1.5
+2	0.05 I_b	1		0.5	1.0
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive		0.7	1.0
	I_b				
	I_{max}				
–2	0.05 I_b	1		0.5	1.0
	I_b				
	I_{max}				
	0.1 I_b	0.5 inductive		0.7	1.0
	I_b				
	I_{max}				

5.2.2 Transformer-operated Meters, Class 1

Frequency variation (% from f_{nom})	Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class
				1
+2	0.02 I_n	1		0.5
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		0.7
	I_n			
	I_{max}			
–2	0.02 I_n	1		0.5
	I_n			
	I_{max}			
	0.05 I_n	0.5 inductive		0.7
	I_n			
	I_{max}			

5.2.3 Transformer-operated Meters, Classes 0.2 and 0.5

Frequency variation (% from f_{nom})	Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class	
				0.2	0.5
+2	0.05 I_n	1		0.1	0.2
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive		0.1	0.2
	I_n				
	I_{max}				
–2	0.05 I_n	1		0.1	0.2
	I_n				
	I_{max}				
	0.1 I_n	0.5 inductive		0.1	0.2
	I_n				
	I_{max}				

5.3 Harmonic Components in the Current and Voltage Circuits

Refer to NMI M 6-1, Table 4.
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.

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class			
		f_{nom}	f_{nom} + harmonics		0.2	0.5	1	1.5
0.5 I_{max}	1				0.4	0.5	0.8	1.0

5.4 Reversed Phase Sequence

Refer to NMI M 6-1, Table 4.
Polyphase (three-phase four wire) meters shall measure and register within the limits of variation in percentage error if any one or two phases of the three phase network are interrupted.

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class			
		ABC	CBA		0.2	0.5	1	1.5
0.1 I_b (0.1 I_n)	1				0.05	0.1	1.5	1.5

5.5 Voltage Unbalance

Refer to NMI M 6-1, Table 4.
Polyphase (three-phase four wire) meters shall measure and register within the limits of variation in percentage error if any one or two phases of the three phase network are interrupted.

Current (A)	Power factor	Phases interrupted	Variation in error (%)	Limit of variation (%) by class		
				0.2	0.5	1
I_b (I_n)	1	1 phase – A		0.5	1.0	2.0
		1 phase – B				
		1 phase – C				
		2 phases – AB				
		2 phases – AC				
		2 phases – BC				

5.6 Auxiliary Voltage ±15%

Refer to NMI M 6-1, Table 4.
Applicable only if the auxiliary supply is not internally connected to the voltage measuring circuit.

Voltage (% from reference)	Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class	
			Reference	Measured		0.2	0.5
+15	0.01 I_n	1				0.05	0.1
–15							

5.7 DC Component in the AC Circuit

Refer to NMI M 6-1, Table 4.
This test does not apply to transformer-operated meters.

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class	
		f_{nom}	+ DC component		1	1.5
$I_{max}/\sqrt{2}$	1				3.0	6.0

5.8 Continuous Magnetic Induction of External Origin

Refer to NMI M 6-1, Table 4.

Current (A)	Power factor	Position of magnet	Variation in error (%)	Limit of variation (%) by class			
				0.2	0.5	1	1.5
I_b (I_n)	1	Front		2.0	2.0	2.0	3.0
		Left-hand side					
		Right-hand side					
		Top					
		Bottom					

5.9 Magnetic Induction of External Origin 0.5 mT

Refer to NMI M 6-1, Table 4.
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. 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.

Current (A)	Power factor	Variation in error (%)	Limit of variation (%) by class			
			0.2	0.5	1	1.5
I_b (I_n)	1		0.5	1.0	2.0	–
I_b (0.5 I_n)	1		–	–	–	2.0

5.10 Electromagnetic RF Fields

Refer to NMI M 6-1, Table 4 and A.2.9 (test with current test).
Meters constructed with passive elements only, including electromechanical meters, are exempt from this test.
Frequency range: 0 to 2 400 MHz
Modulation: 80% AM, 1kHz sine wave
Field strength: 10 V/m

Current (A)	Power factor	Polarisation	Facing meter	Variation in error (%)	Limit of variation (%) by class			
					0.2	0.5	1	1.5
I_b (I_n)	1	Vertical	Front		1.0	2.0	2.0	3.0
			Right					
			Left					
			Rear					
		Horizontal	Front					
			Right					
			Left					
			Rear					

Requirement	Remark	Result
During the test, the behaviour of the meter shall not be perturbed		

5.11 Conducted RF Fields

Refer to NMI M 6-1, Table 4 and A.2.10.
Meters constructed with passive elements only, including electromechanical meters, are exempt from this test.
RF amplitude (50 Ω): 10 V (e.m.f.)
Modulation: 80% AM, 1 kHz sine wave
Frequency range: 0.15 to 80 MHz

Current (A)	Power factor	Power port or I/O port	Variation in error (%)	Limit of variation (%) by class			
				0.2	0.5	1	1.5
I_b (I_n)	1			1.0	2.0	2.0	3.0

Requirement	Remark	Result
During the test, the behaviour of the meter shall not be perturbed		

5.12 Fast Transient Bursts

Refer to NMI M 6-1, Table 4 and A.2.15.
Meters constructed with passive elements only, including electromechanical meters, are exempt from this test. During the test, a temporary degradation or loss of function or performance is acceptable.

Current (A)	Power factor	Circuit	Voltage peak (kV)	Polarity (60 s at each)	Variation in error (%)	Limit of variation (%) by class			
						0.2	0.5	1	1.5
I_b (I_n)	1	Voltage	4	Positive		1.0	2.0	4.0	6.0
				Negative					
		Current		Positive					
				Negative					
		Auxiliary circuit	2	Positive					
				Negative					
		Auxiliary circuit		Positive					
				Negative					

5.13 Variations due to Short-time Overcurrents

Refer to NMI M 6-1, Table 4 and A.2.16.
The test shall be performed for polyphase meters phase-by-phase.

Current (A)	Power factor	Test	Over-current value (A)	Duration (ms)	Phase	Variation in error (%)	Limit of variation (%) by class			
							0.2	0.5	1	1.5
I_b	1	A	30 I_{max}	10	1		–	–	1.5	1.5
					2					
					3					
I_n	1	B	20 I_{max}	500	1		0.05	0.05	0.5	–
					2					
					3					
I_b	1	C	7000	60	1		Requirement Meter shall not cause damage to surrounding equipment			
					2					
					3					
I_n	1	D	250	60	1					
					2					
					3					
I_n	1	E	50	60	1					
					2					
					3					

Requirement	Remark	Result
For tests C, D and E the meter shall not cause damage to surrounding equipment		

5.14 Operation of Accessories

Refer to NMI M 6-1, Table 4.
Such an accessory, when enclosed in the meter case, is energised intermittently, for example the electromagnet of a multi-rate register. 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.

Current (A)	Power factor	Accessory	Connection	Variation in error (%)	Limit of variation (%) by class			
					0.2	0.5	1	1.5
0.05 I_b (0.05 I_n)	1				–	–	0.5	–
0.01 I_n	1				0.05	0.1	–	–

5.15 Sub-harmonics in the AC Circuit

Refer to NMI M 6-1, Table 4 and A.2.17.
Test waveform: sinusoid, 2 cycles on, 2 cycles off
Current amplitude: 2 × reference current

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class			
		f_{nom}	Test waveform		0.2	0.5	1	1.5
0.5 I_b (0.5 I_n)	1				0.5	0.75	1.5	3.0

5.16 Odd Harmonics in the AC Circuit

Refer to NMI M 6-1, Table 4 and A.2.18.
Test waveform: sinusoid, set to zero for first and third quarters of each period
Current amplitude: 2 × reference current

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class			
		f_{nom}	Test waveform		0.2	0.5	1	1.5
0.5 I_b (0.5 I_n)	1				0.4	0.5	0.8	1.0

5.17 Tilt at 3° in any Direction from the Vertical

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position.

Current (A)	Power factor	Direction of 3° tilt	Variation in error (%)	Limit of variation (%) by class			
				0.2	0.5	1	1.5
0.1 I_b	1	Forward		1.0	2.0	2.0	3.0
		Backward					
		Left					
		Right					

5.18 Current Coil Self-heating

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position.
Initial error: determine for each load while current coil is still unheated
Precondtioning: 1 h with voltage circuit at U_{nom}, current circuit with zero current
Test: continue until error becomes constant

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit of variation (%) by class
		Coil unheated (initial error)	Coil heated		1.5
I_{max}	1				1.0
I_{max}	0.5 inductive				1.0

5.19 Alternative Usage and Phase Reversal (Balanced Two-element Driven)

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position.

Current (A)	Power factor	Phase sequence	Percentage error	Variation in error (%)	Limit of variation (%) by class
					1.5
0.05 I_b	1	A1 leading A2 by 180°			
		A1 leading A2 by 120°			1.0
		A2 leading A1 by 120°			
I_b	1	A1 leading A2 by 180°			
		A1 leading A2 by 120°			0.5
		A2 leading A1 by 120°			

5.20 Alternative Usage and Phase Reversal (Single-element Driven)

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position.

Current (A)	Power factor	Phase sequence	Percentage error	Variation in error (%)	Limit of variation (%) by class
					1.5
0.1 I_b	1	A1 leading A2 by 180°			
		A1 leading A2 by 120°			1.0
		A2 leading A1 by 120°			
2 I_b	1	A1 leading A2 by 180°			
		A1 leading A2 by 120°			0.5
		A2 leading A1 by 120°			

5.21 Register Friction

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position. For a multi-rate meter, the changeover device shall be in each operating condition in turn.

Current (A)	Power factor	Changeover device operating condition	Rotor Speed		Variation in error (%)	Limit of variation (%) by class
			Heaviest load	Register disengaged		1.5
0.05 I_b	1					0.5

5.22 Register Changeover

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position.

Current (A)	Power factor	Changeover device operating condition	Rotor Speed	Variation in error (%)	Limit of variation (%) by class
					1.5
0.05 I_b	1				
					0.4*

* An additional variation of 0.5% may be permitted for certain multiple-element meters (refer to AS 1284.1, clause 4.3.15).

5.23 Shock

Refer to NMI M 6-1, Table 4.
This test is only required for induction meters and any other meters which may be influenced by their working position.
Initial error: determine for each load prior to subjecting to shock

Current (A)	Power factor	Initial error (before shock)	After shock test	Variation in error (%)	Limit of variation (%) by class
					1.5
0.05 I_b	1				0.5
I_b	1				0.3
I_b	0.5 inductive				0.3

6. AMBIENT TEMPERATURE VARIATION

Refer to NMI M 6-1, Table 6 and A.2.3.
The meter error shall be determined at a minimum of four temperature values across the whole operating range.

6.1 Direct-connected Meters

Current (A)	Power factor	Percentage error		Variation in error (%)	Mean temperature coefficient (%/K)		
		T_{Low}	T_{High}		Calculated	Limit by class	
						1	1.5
Temperature interval, T_{Low} to T_{High} (e.g. –10°C to 15°C)							
0.1 I_b	1					0.05	0.05
I_b							
I_{max}							
0.2 I_b	0.5 inductive					0.07	0.07
I_b							
I_{max}							
Temperature interval, T_{Low} to T_{High} (e.g. 5°C to 25°C)							
0.1 I_b	1					0.05	0.05
I_b							
I_{max}							
0.2 I_b	0.5 inductive					0.07	0.07
I_b							
I_{max}							
Temperature interval, T_{Low} to T_{High} (e.g. 25°C to 45°C)							
0.1 I_b	1					0.05	0.05
I_b							
I_{max}							
0.2 I_b	0.5 inductive					0.07	0.07
I_b							
I_{max}							

6.2 Transformer-operated Meters

Current (A)	Power factor	Percentage error		Variation in error (%)	Mean temperature coefficient (%/K)		
		T_{Low}	T_{High}		Calculated	Limit by class	
						1	1.5
Temperature interval, T_{Low} to T_{High} (e.g. –10°C to 15°C)							
0.1 I_b	1					0.05	0.05
I_b							
I_{max}							
0.2 I_b	0.5 inductive					0.07	0.07
I_b							
I_{max}							
Temperature interval, T_{Low} to T_{High} (e.g. 5°C to 25°C)							
0.1 I_b	1					0.05	0.05
I_b							
I_{max}							
0.2 I_b	0.5 inductive					0.07	0.07
I_b							
I_{max}							
Temperature interval, T_{Low} to T_{High} (e.g. 25°C to 45°C)							
0.1 I_b	1					0.05	0.05
I_b							
I_{max}							
0.2 I_b	0.5 inductive					0.07	0.07
I_b							
I_{max}							

7. INTERNAL CLOCKS

Refer to NMI M 6-1, clause 6.
This test applies to any solid state internal clock used for electricity meters and load control devices.

Internal clock type (synchronous or crystal-controlled) .....

Operational reserve (spring or battery/super-capacitor/primary cell) .....

7.1 Mains Supply

Testing period: 30 days
Test temperature: 23°C

	Date	Time		Difference (s)	Limit variation (s/day)		
		Ref	Test		Result	Synchronous	Crystal
Start						0.167	0.5
End							

7.2 Operational Reserve

Testing period: 36 h
Test temperature: 23°C

	Date	Time		Difference (s)	Limit variation (s/day)			
		Ref	Test		Result	Synchronous		Crystal
						Spring	Battery	
Start						120	1	1
End								

7.3 High Temperature

Testing period: 24 h
Test temperature: 45°C

	Date	Time		Difference (s)	Limit variation (s/day)	
		Ref	Test		Result	Crystal
Start						0.15
End						

7.4 Low Temperature

Testing period: 24 h
Test temperature: –10°C

	Date	Time		Difference (s)	Limit variation (s/day)	
		Ref	Test		Result	Crystal
Start						0.15
End						

8. PERFORMANCE TESTS

8.1 Optical Port Requirements

Refer to NMI M 6-1, A.1.3.

Requirement	Remark	Result
Environmental lighting condition		
Transmission speed		

8.2 Dry Heat Test

Refer to NMI M 6-1, A.2.1.
Duration: 72 h
Meter/EUT: In operating condition except whilst temperature is lowered or raised.
High temperature: ..... (maximum specified operating temperature)

Current (A)	Power factor	Percentage error			MPE by class			
		At reference before heat	At high temperature after 72 h	Reference after recovery	0.2	0.5	1	1.5
I_b (I_n)	1				0.2	0.5	1	1.5

Requirement	Remark	Result
No damage to meter		
No change of information		

8.3 Cold Test

Refer to NMI M 6-1, A.2.2.
Duration: 72 h
Meter/EUT: in operating condition except whilst temperature is lowered or raised.
Low temperature: ..... (minimum specified operating temperature)

Current (A)	Power factor	Percentage error			MPE by class			
		At reference before heat	At low temperature after 72 h	Reference after recovery	0.2	0.5	1	1.5
I_b (I_n)	1				0.2	0.5	1	1.5

Requirement	Remark	Result
No damage to meter		
No change of information		

8.4 Damp Heat Cyclic Test

Refer to NMI M 6-1, A.2.4.
Duration (cycles): 6 × 24 h cycles
Meter/EUT: non-operating condition
Low temperature: 25°C
High temperature: ..... (maximum specified operating temperature)

Requirement	Remark	Result
No trace of corrosion likely to affect the functional properties of the EUT shall be present		

24 h after the end of this test, submit the EUT to the following tests:

- AC voltage test (NMI M 6-1, A.2.20) — refer to clause 8.13.
- impulse voltage test (NMI M 6-1, A.2.19, except 0.8 of impulse voltage, i.e. 9.6 kV +0%, –15%)

Impulse voltage test					
Current (A)	Power factor	Percentage error		Variation in error (%)	Limit
		Before	After		
I_b (I_n)	1				(uncertainty of measurement)

Requirement	Remark	Result
During the test, no flashover, disruptive discharge or puncture shall occur		
After the test, no mechanical damage to the EUT		

8.5 Solar Radiation Test

Refer to NMI M 6-1, A.2.5.
UV lamp output: 21 750 lm to 27 000 lm
Duration: 48 h and distance of 250 mm
Meter/EUT: non-operating condition

Current (A)	Power factor	Percentage error	MPE by class			
			0.2	0.5	1	1.5
I_b (I_n)	1		0.2	0.5	1	1.5

Requirement	Remark	Result
For transparent parts – no noticeable deterioration or loss in transparency		
For non-transparent parts – no noticeable effect		
The function of the meter shall not be impaired (see error above)		

8.6 Dust Test

Refer to NMI M 6-1, A.2.6.
Enclosure category: 2
Duration: 8 h
Meter/EUT: non-operating condition

Current (A)	Power factor	Percentage error	MPE by class			
			0.2	0.5	1	1.5
I_b (I_n)	1		0.2	0.5	1	1.5

Requirement	Remark	Result
No dust accumulation which could affect meter operation or safety		
No dust deposition that could lead to tracking along creepage distances		
The function of the meter shall not be impaired (see error above)		

8.7 Vibration (Sinusoidal) Test

Refer to NMI M 6-1, A.2.7.
Severity level: 2
Frequency range: 10 to 150 Hz
Max acceleration level: 10 m/s^2
No sweep cycles per axis: 10
Meter/EUT: non-operating condition

Current (A)	Power factor	Percentage error	MPE by class			
			0.2	0.5	1	1.5
I_b (I_n)	1		0.2	0.5	1	1.5

Requirement	Remark	Result
No damage to meter		
No change of information		
Meter shall operate correctly (see error above)		

8.8 Mechanical Shock Test

Refer to NMI M 6-1, A.2.8.
Severity level: 1
Pulse shape: half-sine
Peak acceleration: 200 m/s^2
Pulse duration: 18 ms
Meter/EUT: non-operating condition, without packing

Current (A)	Power factor	Percentage error	MPE by class			
			0.2	0.5	1	1.5
I_b (I_n)	1		0.2	0.5	1	1.5

Requirement	Remark	Result
No damage to meter		
No change of information		
Meter shall operate correctly (see error above)		

8.9 Radiated Electromagnetic Radiofrequency Fields Test without Current

Refer to NMI M 6-1, A.2.9.
Frequency range: 80 to 2400 MHz (continuous)
Modulation: 80% AM, 1 kHz sine wave
Field strength: 30 V/m
Meter/EUT: in operating condition, reference voltage, current terminal open-circuit

Requirement	Remark	Result
The behaviour of the equipment shall not be perturbed		

8.10 Electrostatic Discharge Test

Refer to NMI M 6-1, A.2.11.
Number of discharges: at least 10
Polarity of discharges: the most sensitive polarity
Severity level: 4
Meter/EUT: in operating condition, reference voltage, current terminal open-circuit

Application (direct/indirect)	Coupling plane	Discharge mode (contact/air)	Test voltage (kV)	Change in		Limit, x (kW·h)
				Register	Test output	
Direct	–					
Indirect	Horizontal	Contact	15			
Indirect	Vertical	Contact	15			

Current (A)	Power factor	Percentage error	MPE by class			
			0.2	0.5	1	1.5
I_b (I_n)	1		0.2	0.5	1	1.5

Requirement	Remark	Result
Meter shall operate correctly (see error above)		

8.11 Voltage Dips and Short-term Interruptions Test

Refer to NMI M 6-1, A.2.14.
Meter/EUT: in operating condition, reference voltage, no current

Voltage dip or interruption	ΔU	Duration	Dips/interruptions		Change in		Limit, *x* (kW·h)
			Number	Time between	Register	Test output	
Dip	50%	1 min	1	–			
Interruption	100%	1 s	3	50 ms			
Interruption	100%	20 ms	1	–			

8.12 Impulse Voltage Test

Refer to NMI M 6-1, A.2.19.
Impulse voltage: 12 kV +0%, –15%
Source capacitance: 0.125 μF
Source impedance: 40 Ω ± 5 Ω
Stored energy: 9.0 J ± 1.0 J
Impulse waveform at no load: 1.2/50 impulse
Meter/EUT: non-operating condition

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit
		Before	After		
I_b (I_n)	1				(uncertainty of measurement)

Requirement	Remark	Result
During the test, no flashover, disruptive discharge or puncture shall occur		
After the test, no mechanical damage to the EUT		

8.13 AC Voltage Test

Refer to NMI M 6-1, A.2.20.
This test shall be performed as part of the damp heat cyclic test (refer to NMI M 6-1, A.2.4).

Current (A)	Power factor	Percentage error		Variation in error (%)	Limit
		Before	After		
I_b (I_n)	1				(uncertainty of measurement)

Requirement	Remark	Result
2 kV: during the test, no flashover, disruptive discharge or puncture shall occur		
4 kV: during the test, no flashover, disruptive discharge or puncture shall occur		
40 V: during the test, no flashover, disruptive discharge or puncture shall occur		
After the test, no mechanical damage to the EUT		