

Schedule

Issue date: 25 March 2025
Valid Until: -



NO: SAMM 157

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of SAMM 157 dated 25 March 2025)

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LABORATORY LOCATION/ CENTRAL OFFICE:	Makmal Perkhidmatan Perjangkaan Tenaga Nasional Berhad Bangunan Annex, No.3, Jalan 51A/223 Peti Surat 682 46770 Petaling Jaya, Selangor , 44670, SELANGOR MALAYSIA
	
ACCREDITED SINCE :	25 MARCH 2025
FIELD(S) OF CALIBRATION:	ELECTRICAL

This laboratory has demonstrated its technical competence to operate in accordance with MS ISO/IEC 17025:2017 (ISO/IEC 17025:2017).

This laboratory's fulfillment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001 (see Joint ISO-ILAC-IAF Communiqué dated April 2017).

*** The uncertainty covered by the CMC is expressed as the expanded uncertainty corresponding to a coverage probability of approximately 95 % and have a coverage factor of k=2 unless stated otherwise.**

CENTRAL LOCATION	Makmal Perkhidmatan Perjangkaan Tenaga Nasional Berhad Bangunan Annex, No.3, Jalan 51A/223 Peti Surat 682 46770 Petaling Jaya, Selangor , 44670, Selangor
FIELD(S) OF CALIBRATION :	ELECTRICAL,

SCOPE OF CALIBRATION : ELECTRICAL

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
Ac Current (including	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
Ac Voltage	60.33 V to 63.5 V	0.068 V	
	None	(2400 0.19 V)	
	60.33 V to 63.5 V	0.068 V	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	60.33 V to 63.5 V	0.068 V	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	60.33 V to 63.5 V	0.068 V	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	60.33 V to 63.5 V	0.068 V	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	10 Hz to 1 MHz	0.01 mV	calibrator model
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	2.2 mV to 220 V (See Matrix A)	(See Matrix A)	Fluke 5730A
	1100 V Range (110 V to 1100 V) 15 Hz to 50 Hz 50 Hz to 1 kHz	360 + 20 mV 85 +4 mV	Fluke 5730A
	800 V to 1050 V 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz	0.8 mV/V + 0.13 V 0.8 mV/V + 0.21 V 1.2 mV/V + 0.32 V	Wavetek 9100
	2.2 mV to 1000V (See Matrix D)	(See Matrix D)	Fluke 5790A
	10 mV to 700V (See Matrix E)	(See Matrix E)	HP 3458A Opt. 002
	(0 kV to 9.99 kV) @ 50/60 Hz (10 kV to	1.2mVNV +0.1V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)
	2.2 mV to 220 V (See Matrix A) 1100 V Range (110 V to 1100 V) 50 Hz to 1 kHz	(See Matrix A) 90 +4 mV	Fluke 5700A

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	800 V to 1050 V 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz	0.8 mV/V V 0.8 mV/V + 0.21 V V	Wavetek 9100
	10 mV to 700V (See Matrix D)	(See Matrix D)	HP 3458A
	0 to 1000 V	(See Matrix K)	Measurement using Multimeter model Wavetek
	0 to 33 mV 10 Hz to 45 Hz	0.03 mV	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	60.33 V to 63.5 V	0.068 V	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	60.33 V to 63.5 V	0.068 V	
	0 to 33 mV	None	
	100 mV	None	
	45 Hz to 10 kHz 10 kHz to 20 kHz	8	
	to 1050 V	See Matrix A	Generation using Calibrator Model Wavetek 9100 Compare with Keysight 3458A
	0 to 1000 V	See Matrix C	Measurement Keysight 3458A Digital Multimeter
	0 V to 1050 V	See Matrix A	Generation using calibrator model Wavetek 9100 Compare with Keysight 3458A
	0 V to 1000 V	See Matrix C	Measurement using Keysight 3458A Digital Multimeter
	3Vto6V	None	Generation using
	None	None	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	7.5 V to 14.999 V	0.21 mV/V - 0.20 mV	
	0 to 1020 V	See Matrix A	Fluke 5522A
	0 to 1020 V	See Matrix A	Fluke 5522A
	1 mV to 1000 V	See Matrix A	HP 3458A
	None		
	0 mV to 10 V (Refer The Matrix A)	(Refer The Matrix A)	
	10 V to 750 V	None	
	(Refer The Matrix B)	(Refer The Matrix B)	
	At 50 Hz 1 kV to 10 kV	13 mV/V	
	At 50 Hz 1 kV to 10 kV	16 mV/V	
	2.2 mV to 220 V	See Matrix E	Measurement
	330V to 1020V	None	using Fluke
	45Hz to 1kHz	0.24mV/V + 11mV	5522A
	1kHz to 5kHz	0.21mV/V + 8.6mV	
	5kHz to 10kHz	0.24mV/V +	
	0 mV to 750 V	Refer Matrix A	measurement with 6 % digit multimeter
	2.2 mV to 220 V (See Matrix A)	(See Matrix A)	
	220 V to 1100 V	None	
	15 Hz to 50 Hz	0.30 mV/V + 16 mV	
	220 V to 1100 V	None	
	50 Hz to 1 kHz	77 + 3.2 mV	
	See Matrix E	None	
	0.5 kV to 10 kV	12 mV/V + 13 mV	
	1.0 to 33 mV	None	
	10 Hz to 45 Hz	3.6	
	45 Hz to 10 kHz	43	
	10 kHz to 20	3.6 UV	
	20 kHz to 50 kHz	5.7	
	50 kHz to 100 kHz	11	
	100 kHz to 500 kHz	26	
	33 to 330 mV	None	
	10 Hz to 45 Hz	13	
	45 Hz to 10 kHz	77 uv	
	10 kHz to 20	13	
	20 kHz to 50 kHz	18	
	50 kHz to 100 kHz	45 110	
	100 kHz to 500 kHz		
	0.33 to 3.3 V	None	
	10 Hz to 45 Hz	0.1 mV	
	45 Hz to 10 kHz	0.1 mV	Generation using
	10 kHz to 20 kHz	0.1 mV	calibrator model

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	20 kHz to 50 kHz	0.2 mV	Fluke 5500A
	50 kHz to 100 kHz	0.2 mV	
	100 kHz to 500 kHz	1.1 mV	
	3.3 to 33. V	None	
	10 Hz to 45 Hz	1.2mV	
	45 Hz to 10 kHz	None	
	10 kHz to 20 kHz	1.2mV	
	20 kHz to 50 kHz	2.1mV	
	50 kHz to 100 kHz	2.8 mV	
	33 to 330 V	None	
	10 Hz to 45 Hz	None	
	45 Hz to 10 kHz	14 mV	
	10 kHz to 20 kHz	14 mV	
	330 to 1020 V	None	
	45 Hz to 1 kHz	39 mV	
	1 kHz to 5 kHz	52 mV	
	-1 Ato -100 mA	None	HP 3458A
	10 mV rang	None	
	0 mV to 10 mV	None	
	100 mV rang	None	
	10 mV to 100 mV	None	
	1V rang	None	
	100 mV to 1 V	None	
	10 V range	(See Matrix A)	
	1Vto10V	None	
	100 V rang	None	
	10 V to 100 V	None	
	1000 V rang	None	
	100 V to 700 V	None	
	(See Matrix A)	None	
	10 Hz to 45 Hz	0.14 mV	
	45 Hz to 10 kHz	85	
	10 kHz to 20 kHz 20 kHz to 50 kHz	91 0.11 mV	
	50 kHz to 100 kHz	0.16 mV	
	100 kHz to 500 kHz	0.41 mV	
	33 to 330 mV	None	
	10 Hz to 45 Hz	0.9 mV	
	45 Hz to 10 kHz	0.2 mV	
	10 kHz to 20 kHz	None	
	20 kHz to 50 kHz	0.6 mV	
	50 kHz to 100 kHz	1.0 mV	
	100 kHz to 500 kHz	2.8 mV	
	0.33 to 3.3 V	None	
	10 Hz to 45 Hz	5.9 mV	Generation
	45 Hz to 10 kHz	1.2mV	using

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	10 kHz to 20 kHz	3.1 mV	calibrator
	20 kHz to 50 kHz	5.6 mV	model
	50 kHz to 100 kHz	11 mV	Fluke 5500A
	100 kHz to 500 kHz	22 mV	
	3.3 to 33 V	None	
	10 Hz to 45 Hz	59 mV	
	45 Hz to 10 kHz	16 mV	
	10 kHz to 20 kHz	33 mV	
	20 kHz to 50 kHz	76 mV	
	50 kHz to 100 kHz	110 mV	
	33 to 330 V	None	
	10 Hz to 45 Hz	0.2	
	45 Hz to 10 kHz	0.3	
	10 kHz to 20 kHz	0.3	
	330 to 1020 V	None	
	45 Hz to 1 kHz	0.7	
	1 kHz to 5 kHz	2.3	
	- 1000 V to -100 V	None	HP 3458A
	10 mV rang	None	
	0 mV to 10 mV	None	
	100 mV range	None	
	10 mV to 100 mV	None	
	1V rang	None	
	100 mV to 1V	None	
	10 V rang	(See Matrix B)	
	1V to 10V	None	
	100 V rang	None	
	10 V to 100 V	None	
	1000 V rang	None	
	100 V to 700 V	None	
	(See Matrix B)	None	
	33 mV to 750 V	See Matrix A	reference to EURAMET cg-15,
	33 mV to 750 V	None	Version 3 (02/2015)
	33 mV to 1020 V See Matrix A	See Matrix A	Calibrator Fluke 5520A
	100 to 1050 V See Matrix C	See Matrix C	Multimeter Fluke 8508A
	33 mV to 1020 V See Matrix E	See Matrix E	Calibrator Fluke 5520A
	100 to 1050 V See Matrix G	See Matrix G	Multimeter Fluke 8508A
	See Matrix A	See Matrix A	Direct measurement using
	See Matrix C	See Matrix C	Direct Measurement using Fluke

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	10 kHz to 20 kHz	1.0mV/V	Method
	330 V to 1020 V	None	
	45 Hz to 1 kHz	0.67	
	1 kHz to 5 kHz	2.3mV/V	
	5 kHz to 10 kHz	2.3mV/V	
	1 mV to 750 V	See Matrix C	Calibrated according to procedure LCP01703, Rev 01 using Direct Method
	750 V to 1000 V 45 Hz to 1 kHz 1 kHz to 10 kHz	9.2mV/V 9.2mV/V	Calibrated according to procedure LCP01703, Rev 01 using Direct Method
	45 Hz to 65 Hz	35	procedure LCP01707, Rev 01 using Direct
	45 Hz to 65 Hz	None	Method
	45 Hz to 65 Hz	None	
	1 mA to 10 mA	0.90 mA/A	Calibrated according to
	10 mA to 100 mA	0.77	procedure LCP01703 &
	0.045 kHz to 1 kHz	9.2mV/V	using Direct Method
	1 kHz to 10 kHz	9.2mV/V	
	to 40 kV 45 Hz to 65 Hz	62 mV/V	Calibrated according to procedure LCP01707, Rev 01
	to 40 kV 45 Hz to 65 Hz	None	using Direct Method
Electromechanical	None	None	
	Error at input levels	None	
	None	None	
	Error at input levels	None	
	None	None	
	Error at input levels	None	
	None	None	
	Error at input levels	None	
	None	None	
	Error at input levels	None	
	None	None	
	Error at input levels	None	
	Up to 120 bar	None	Comparison using
	Up to 20 bar	None	
Energy Meter	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	

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	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	
	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	
	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	
	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	
	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	
	Energy Measurement	None	In-house calibration
	None	None	
	below:	None	
	Error at input levels:	None	procedure with
	0, 0.50 (Lag and Lead),	None	
	of current	None	
	of current	MS/IEC 62053-22:2009 clause 8.1	
	of current	MS 2689:2028	
Instrument	None	None	
	None	None	5522A
	1Vto10V	(42 mV)	
	10 Hz to 60 Hz	None	
	5Ato15A	(0.75 mA/A +0.051 A)	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	None	None	
	None	None	
	None	None	
	None	None	
	Up to 6.1g	0.032 mg	with standard
	None	None	
	None	None	
	None	None	
	100 kHz to 26.5 GHz	None	
	None	None	
	None	None	
	None	None	
	0.03 to 0.33 mA	None	
	1.0 to 33 mV	None	
	None	None	
	100 yA	None	HP 3458A
	None	None	
	None	None	
	None	None	Measuring
Measurement	Frequency at 50 Hz	None	
	Range	Capability	Remarks
	Frequency at 50 Hz	None	
	Range	Capability	Remarks
	Frequency at 50 Hz	None	
	Range	Capability	Remarks
	Frequency at 50 Hz	None	
	Range	Capability	Remarks
	Frequency at 50 Hz	None	
	None	None	
	Range	Capability	Remarks
	Frequency at 50 Hz	None	
	Range	Capability	Remarks
	Frequency at 50 Hz	None	
	measurement	measurement	measurement
	600 mm to 1000 mm	None	with references
	600 mm to 1000 mm	None	2016 Vernier,
	600 mm to 1000 mm	None	
	600 mm to 1000 mm	None	
	220 mV to 2.2 V	5 + 0.7 uv	using Fluke
	2.2Vto11V	3.5 + 2.5	5720A
	11 V to 22V	3.5 +4	
	22 V to 220 V	5 + 40 pV	
	220 V to 1100 V	6.5 + 0.4 mV	
	220 to 2.2 mA	35 + 7 nA	using Fluke
	2.2 mA to 22 mA	35 + 40 nA	5720A
	22 mA to 100 mA	45 + 0.7	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
	100 mA to 220 mA	(45 + 0.2 +	
	100 mA to 220 mA	0.7 pA	
	220 mA to 1A	80 + 12	
	1A to 2.2A	(80 + 10 +	
	1A to 2.2A	12 yA	
	2.2A to 11A	0.36 + 0.48 mA	Measurement
	2.2A to 11A	None	using Fluke
	2.2A to 11A	None	5725A
	1.90	95	using Fluke
	(See Matrix E)	None	using Fluke
	(See Matrix E)	None	5720A
	220 V to 1100 V	See Matrix E	Measurement
	(See Matrix E)	None	using Fluke
	(See Matrix E)	None	5725A
	(see Matrix F)	None	using Fluke
	(see Matrix F)	None	5720A
	2.2A to 11A	see Matrix F	Measurement
	(see Matrix F)	None	using Fluke
	(see Matrix F)	None	5725A
	Range	Expressed as	Remarks
	service inspection	None	
Measurement Instrument	Frequency at 50 Hz	None	
	Frequency at 50 Hz	None	
	Frequency at 50 Hz	None	
	Frequency at 50 Hz	None	
	Frequency at 50 Hz	None	
	Frequency at 50 Hz	None	
	Frequency at 50 Hz	None	
Resistive Shunt And	0.01 A to 0.1A	0.034 A	
	0.01 A to 0.1A	0.034 A	
	0.01 A to 0.1A	0.034 A	
	0.01 A to 0.1A	0.034 A	
	0.01 A to 0.1A	0.034 A	
	0.01 A to 0.1A	0.034 A	
	0.01 A to 0.1A	0.034 A	
Single Phase	None	None	
	Measurement at input levels	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	1) Limit of Error due to variation of current	Clause 8.1	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty ($\pm$)*	Remarks
Single Phase Static Energy Meter	2) Test of Starting and No Load Condition	Procedure No. with reference to IEC 62053-21:2003-01 Clause 8.3	
	2) Test of Starting and No Load Condition	Procedure No. MIM- CL-S09 with	
	3) Meter Constant	reference to IEC 62053-21:2003-01	
	3) Meter Constant	Clause 8.4	
	Power Factor: 0, 0.5, 0.866 and 1.0 Frequency at 50 Hz	0.024 % of reading (Three Phase)	IEC 62053-21:2003 IEC 62053-22:2003 IEC 62053-23:2003
	Power Factor: 0, 0.5, 0.866 and 1.0 Frequency at 50 Hz	0.024 % of reading (Three Phase)	IEC 62053-21:2003 IEC 62053-22:2003 IEC 62053-23:2003
	Power Factor: 0, 0.5, 0.866 and 1.0 Frequency at 50 Hz	0.024 % of reading (Three Phase)	IEC 62053-21:2003 IEC 62053-22:2003 IEC 62053-23:2003
	Power Factor: 0, 0.5, 0.866 and 1.0 Frequency at 50 Hz	0.024 % of reading (Three Phase)	IEC 62053-21:2003 IEC 62053-22:2003 IEC 62053-23:2003
	Power Factor: 0, 0.5, 0.866 and 1.0 Frequency at 50 Hz	0.024 % of reading (Three Phase)	IEC 62053-21:2003 IEC 62053-22:2003 IEC 62053-23:2003
	Power Factor: 0, 0.5, 0.866 and 1.0 Frequency at 50 Hz	0.024 % of reading (Three Phase)	IEC 62053-21:2003 IEC 62053-22:2003 IEC 62053-23:2003
Three Phase	Energy Measurement	None	
	1.0	None	
	1) Limit of error due to variation	IEC 62053-11:2003-Cl ause: 8.1	
	Energy Measurement	None	
	Energy Measurement	None	
	Energy Measurement	None	
	Energy Measurement	None	
	Energy Measurement	None	
Three Phase Electromechanical Energy Meter	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003

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	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003
	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003
	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003
	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003
	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003
	Error at input levels: Voltage: 60 V to 264 V Current: 0.001 A to 100A	0.017 % of reading (Single Phase)	procedure with reference to standards IEC 62053-11:2003
Three Phase Static	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
	None	None	
Three Phase Static Energy Meter	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load
	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load
	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load
	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load
	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load

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	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load
	Voltage: 60 V to 276 V (Vpn Current: 0.001A to 100A)	Energy Measurement Error at 0.037 % of reading	Direct comparison with reference energy at prevailing load
Transformer Type)	None	0.059 A	
	None	0.059 A	
	None	0.059 A	
	None	0.059 A	
	None	0.059 A	
	None	0.059 A	
	None	0.059 A	

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