Schedule to

CERTIFICATE OF ACCREDITATION

TechRentals NZ **Client Number 1658**

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Authorised Representative
Mr Mauray Ganter
Laboratory Manager

Programme
Metrology & Calibration Laboratory

Accreditation Number 572 **Initial Accreditation Date** 21 July 1995

Conformance Standard
ISO/IEC 17025:2017
General requirements for the competence of testing and calibration laboratories

Laboratory Services Summary

5.28	Flow Measuring Devices
5.31	Volumetric Equipment
5.35	Hygrometry
5.42	Differential Pressure Measuring Devices (including Manometers)
5.55	Speed Measuring Devices
5.61	Temperature Measuring Equipment
5.88	Calibrators for Instrumentation
5.89	Indicating Instruments and Recording Instruments
5.91	Time and Frequency
5.93	Signal Sources

Key Technical Personnel

Mr Mauray Ganter	5.28, 5.31, 5.35, 5.42, 5.55, 5.61, 5.88, 5.89, 5.91, 5.93
Mr John He	5.28, 5.31, 5.35, 5.42, 5.55, 5.61, 5.88, 5.89, 5.91, 5.93
Mr Bernhard Kriel	5.28, 5.31, 5.35, 5.42, 5.55, 5.61, 5.88, 5.89, 5.91, 5.93
Mr Sankar Mohanakrishnan	5.28, 5.31, 5.35, 5.42, 5.55, 5.61, 5.88, 5.91

Calibration temperature 20 °C to 25 °C and relative humidity 40 % to 70 %.

Calibration and Measurement Capabilities (CMC) Uncertainties are expressed as an expanded uncertainty corresponding to a level of confidence of 95 % Note1.

Measurement results are traceable to the International System of Units (SI) via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

Calibrations are performed at the premises of the accredited laboratory.

Measurand/Range	Parameter	CMC Uncertainty

5.28 Flow Measuring Devices

By comparison with reference instrument to an in-house method based on manufacturer recommendations and/or customer requirements using a wind tunnel.

(a) Anemometers

Vane type

0.25 m/s to 0.5 m/s	0.031 m/s
0.5 m/s to 0.7 m/s	0.04 m/s
0.7 m/s to 4.5 m/s	0.06 m/s
4.5 m/s to 18.5 m/s	0.07 m/s to 0.19 m/s*

*increasing approximately linearly with increasing measurand

Hot wire type

0.2 m/s to 2 m/s	$-0.29\sqrt{x^3} + 0.70x - 0.46\sqrt{x} + 0.12$ m/s*
2 m/s to 17 m/s	0.0060x+0.018 m/s*

* Where x = measured air flow

(l) Other devices

Pitot tubes

Standard types (1.0 m/s to 17 m/s)	0.07 m/s or 1.6 % of reading whichever is greater
Type S (1.0 m/s to 17 m/s)	

5.31 Volumetric Equipment

By comparison with reference instrument to an in-house method based on manufacturer recommendations and/or customer requirements using a wind tunnel.

(b) Examination of other types of volumetric apparatus (including gas meters)

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Air samplers relating to (ISO/CD 14698-1)

Nominal 100 L/min	1.1 L

5.35 Hygrometry

By comparison with a reference hygrometer in a controlled climatic chamber to an in-house method based on manufacturer recommendations and/or customer requirements.

(a) Humidity measuring devices

Relative humidity, all CMC values in %rh

Relative Humidity	Temperature				
	10 °C	20 °C	25 °C	40 °C	47 °C
7 %rh	1.6	1.3	1.2	1.3	1.2
15 %rh	2.1	1.4	1.1	1.4	1.3
20 %rh	2.3	1.4	1.0	1.4	1.4
25 %rh	2.5	1.5	1.0	1.5	1.5
35 %rh	3.0	1.6	0.9	1.6	1.7
45 %rh	3.5	1.7	0.7	1.7	1.9
50 %rh	3.8	1.7	0.7	1.7	2.0
55 %rh	4.0	1.8	0.6	1.8	2.1
75 %rh	5.0	2.2	0.7	1.4	1.7
95 %rh	-	2.5	0.8	1.4	1.7

Air temperature, all CMC values in °C

Temperature	Relative Humidity				
	7 %rh	25 %rh	50 %rh	75 %rh	95 %rh
10 °C	0.27	0.28	0.30	0.29	-
14 °C	0.23	0.24	0.26	0.25	-
16 °C	0.21	0.22	0.24	0.23	-
20 °C	0.17	0.18	0.19	0.19	0.20
24 °C	0.13	0.14	0.15	0.15	0.16
25 °C	0.12	0.13	0.14	0.15	0.15
30 °C	0.13	0.14	0.14	0.15	0.15
36 °C	0.17	0.16	0.16	0.15	0.15
44 °C	0.21	0.20	0.17	0.16	0.15
47 °C	0.23	0.21	0.18	0.16	0.16

5.42 Differential Pressure Measuring Devices (including Manometers)

By comparison with reference calibrator to an in-house method based on manufacturer recommendations and/or customer requirements.

(a) Diaphragm types

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(b)	Liquid column types, inclined and vertical	
(c)	Transducers and transmitters	
(d)	Other types	
	0.05 Pa to 2000 Pa	0.014 % + 0.08 Pa
	2000 Pa to 2242 Pa	0.9 Pa

5.55 Speed Measuring Devices

(a) Tachometers

Optical tachometers in accordance with an in-house method based on manufacturer's recommendations and/or customer requirements

30 rpm to 8999 rpm	0.0003 % + 0.03 rpm
9000 rpm to 90000 rpm	0.0003 % + 0.60 rpm

5.61 Temperature Measuring Equipment

(a)	Rare metal thermocouples
(b)	Base metal thermocouples
(c)	Platinum (and other metallic) resistance thermometers
(e)	Thermistors and other semi-conductor thermometers
(k)	Vapour pressure thermometers
(l)	Filled metal systems
(m)	Bimetallic systems
(o)	Indicators, recorders and controllers
(p)	Other direct reading temperature measuring systems

By comparison with reference instruments in a temperature bath to an in-house method based on manufacturer recommendations and/or customer requirements.

-40 °C to 55 °C	73 x 10^{-6}T + 0.019 °C
55 °C to 125 °C	68 x 10^{-6}T + 0.019 °C where T = temperature

Indicators, recorders, and controllers by electrical simulation using a multifunction calibrator.

Rare metal thermocouples

Type B	600 °C to 800 °C	1.2 °C
	800 °C to 1000 °C	1.0 °C
	1000 °C to 1550 °C	0.81 °C
	1550 °C to 1820 °C	0.74 °C
Type R	0 °C to 250 °C	1.1 °C
	250 °C to 400 °C	0.87 °C
	400 °C to 1000 °C	0.77 °C

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	1000 °C to 1767 °C	0.67 °C
Type S	0 °C to 250 °C	1.2 °C
	250 °C to 1000 °C	0.87 °C
	1000 °C to 1400 °C	0.73 °C
	1400 °C to 1767 °C	0.63 °C
Base Metal Thermocouples		
Type C	0 °C to 150 °C	0.58 °C
	150 °C to 650 °C	0.46 °C
	650 °C to 1000 °C	0.45 °C
	1000 °C to 1800 °C	0.54 °C
	1800 °C to 2316 °C	0.74 °C
Type E	-250 °C to -100 °C	0.33 °C
	-100 °C to -25 °C	0.17 °C
	-25 °C to 350 °C	0.12 °C
	350 °C to 650 °C	0.11 °C
	650 °C to 1000 °C	0.12 °C
Type J	210 °C to -100 °C	0.22 °C
	-100 °C to -30 °C	0.19 °C
	-30 °C to 150 °C	0.11 °C
	150 °C to 760 °C	0.15 °C
	760 °C to 1200 °C	0.15 °C
Type K	-200 °C to -100 °C	0.37 °C
	-100 °C to -25 °C	0.25 °C
	-25 °C to 120 °C	0.32 °C
	120 °C to 1000 °C	0.21 °C
	1000 °C to 1372 °C	0.24 °C
Type L	-200 °C to -100 °C	0.16 °C
	-100 °C to 800 °C	0.17 °C
	800 °C to 900 °C	0.15 °C
Type N	200 °C to -100 °C	0.59 °C
	-100 °C to -25 °C	0.33 °C
	-25 °C to 120 °C	0.31 °C
	120 °C to 410 °C	0.25 °C
	410 °C to 1300 °C	0.23 °C
Type T	-250 °C to -150 °C	0.56 °C
	-150 °C to 0 °C	0.28 °C
	0 °C to 120 °C	0.20 °C
	120 °C to 400 °C	0.15 °C

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Type U	-200 °C to 0 °C	0.30 °C
	0 °C to 600 °C	0.15 °C
Platinum (and other metallic) resistance thermometers (Source 3W or 4W)		
Pt 385 100 Ω	-200 °C to -80 °C	0.007 °C to 0.015 °C
	-80 °C to 0 °C	0.015 °C to 0.02 °C
	0 °C to 100 °C	0.02 °C to 0.03 °C
	100 °C to 300 °C	0.03 °C to 0.05 °C
	300 °C to 400 °C	0.05 °C to 0.06 °C
	400 °C to 630 °C	0.06 °C to 0.08 °C
	630 °C to 800 °C	0.08 °C to 0.09 °C
Pt 385 1000 Ω	-200 °C to -80 °C	0.007 °C to 0.015 °C
	-80 °C to 0 °C	0.015 °C to 0.018 °C
	0 °C to 100 °C	0.018 °C to 0.03 °C
	100 °C to 260 °C	0.03 °C to 0.04 °C
	260 °C to 300 °C	0.04 °C to 0.05 °C
	300 °C to 400 °C	0.04 °C to 0.05 °C
	400 °C to 600 °C	0.05 °C to 0.07 °C
	600 °C to 630 °C	0.07 °C to 0.08 °C
Pt 3916 Ω	-200 °C to -190 °C	0.007 °C
	-190 °C to -80 °C	0.007 °C to 0.015 °C
	-80 °C to 0 °C	0.015 °C to 0.02 °C
	0 °C to 100 °C	0.02 °C to 0.03 °C
	100 °C to 260 °C	0.03 °C to 0.04 °C
	260 °C to 300 °C	0.04 °C to 0.05 °C
	300 °C to 400 °C	0.05 °C
	400 °C to 600 °C	0.05 °C to 0.07 °C
	600 °C to 630 °C	0.07 °C
Pt 3926 Ω	-200 °C to -80 °C	0.007 °C to 0.015 °C
	-80 °C to 0 °C	0.015 °C to 0.02 °C
	0 °C to 100 °C	0.02 °C to 0.03 °C
	100 °C to 300 °C	0.03 °C to 0.05 °C
	300 °C to 400 °C	0.05 °C
	400 °C to 630 °C	0.05 °C to 0.07 °C
PtNi 385 120 Ω (Ni120)	-80 °C to 0 °C	0.008 ºC to 0.012 °C
	0 °C to 100 °C	0.008 ºC to 0.017 °C
	100 °C to 260 °C	0.017 ºC to 0.012 °C

5.88 Calibrators for Instrumentation

By comparison with reference instrument to an in-house method based on manufacturer recommendations and/or customer requirements. Note that CMC Uncertainties only include reference device uncertainties and reported measurement uncertainty for a customer's calibrator is likely to be larger.

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(a)	DC voltage		
	± (0.010 to 200) mV		5 ppm + 2 ppm of range
	± (0.2 to 2) V		3.5 ppm + 0.5 ppm of range
	± (2 to 20) V		3.5 ppm + 2 ppm of range
	± (20 to 200) V		5.5 ppm + 0.2 ppm of range
	± (200 to 1050) V		5.5 ppm + 3 ppm of range
(b)	AC voltage		
	200 mV	20 Hz to 57 Hz	140 ppm + 70 ppm of range
		57 Hz to 1 kHz	115 ppm + 20 ppm of range
		1 kHz to 3 kHz	135 ppm + 20 ppm of range
		3 kHz to 10 kHz	135 ppm + 20 ppm of range
		10 kHz to 30 kHz	340 ppm + 20 ppm of range
		30 kHz to 60 kHz	340 ppm + 40 ppm of range
		60 kHz to 100 kHz	765 ppm + 100 ppm of range
	2 V	20 Hz to 57 Hz	115 ppm + 12 ppm of range
		57 Hz to 1 kHz	90 ppm + 12 ppm of range
		1 kHz to 3 kHz	100 ppm + 10 ppm of range
		3 kHz to 10 kHz	200 ppm + 15 ppm of range
		10 kHz to 30 kHz	220 ppm + 15 ppm of range
		30 kHz to 60 kHz	400 ppm + 70 ppm of range
		60 kHz to 100 kHz	900 ppm + 5500 ppm of range
		100 kHz to 500 kHz	1 % + 1 % of range
		500 kHz to 1 MHz	1 % + 1 % of range
	20 V	20 Hz to 57 Hz	90 ppm + 37 ppm of range
		57 Hz to 1 kHz	100 ppm + 10 ppm of range
		1 kHz to 3 kHz	90 ppm + 10 ppm of range
		3 kHz to 10 kHz	110 ppm + 10 ppm of range
		10 kHz to 30 kHz	150 ppm + 15 ppm of range
		30 kHz to 60 kHz	350 ppm + 75 ppm of range
		60 kHz to 100 kHz	900 ppm + 900 ppm of range
		100 kHz to 500 kHz	1 % + 1 % of range
		500 kHz to 1 MHz	1 % + 1 % of range
	200 V	20 Hz to 57 Hz	100 ppm + 350 ppm of range
		57 Hz to 1 kHz	90 ppm + 300 ppm of range
		1 kHz to 3 kHz	90 ppm + 12 ppm of range
		3 kHz to 10 kHz	110 ppm + 12 ppm of range
		10 kHz to 30 kHz	150 ppm + 15 ppm of range
		30 kHz to 60 kHz	350 ppm + 75 ppm of range
		60 kHz to 100 kHz	570 ppm + 100 ppm of range

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	1000 V	57 Hz to 1 kHz	115 ppm + 0.6 % of range
		1 kHz to 3 kHz	115 ppm + 75 ppm of range
		3 kHz to 10 kHz	115 ppm + 39 ppm of range
		10 kHz to 30 kHz	180 ppm + 2 % of range
(c)	DC current		
	± 200 µA		12 ppm + 4 ppm of range
	± 2 mA		12 ppm + 4 ppm of range
	± 20 mA		14 ppm + 65 ppm of range
	± 200 mA		48 ppm + 70 ppm of range
	± 2 A		185 ppm + 300 ppm of range
	± 20 A		400 ppm + 900 ppm of range
(d)	AC current		
	200 µA	10 Hz to 305 Hz	500 ppm + 100 ppm of range
		305 Hz to 1 kHz	500 ppm + 100 ppm of range
		1 kHz to 3 kHz	500 ppm + 100 ppm of range
		3 kHz to 5 kHz	500 ppm + 100 ppm of range
		5 kHz to 10 kHz	500 ppm + 100 ppm of range
	2 mA	10 Hz to 305 Hz	310 ppm + 100 ppm of range
		305 Hz to 1 kHz	300 ppm + 100 ppm of range
		1 kHz to 3 kHz	300 ppm + 100 ppm of range
		3 kHz to 5 kHz	300 ppm + 100 ppm of range
		5 kHz to 10 kHz	700 ppm + 200 ppm of range
	20 mA	10 Hz to 305 Hz	300 ppm + 100 ppm of range
		305 Hz to 1 kHz	300 ppm + 100 ppm of range
		1 kHz to 3 kHz	300 ppm + 100 ppm of range
		3 kHz to 5 kHz	300 ppm + 100 ppm of range
		5 kHz to 10 kHz	700 ppm + 200 ppm of range
	200 mA	10 Hz to 305 Hz	300 ppm + 100 ppm of range
		305 Hz to 1 kHz	290 ppm + 100 ppm of range
		1 kHz to 3 kHz	290 ppm + 100 ppm of range
		3 kHz to 5 kHz	290 ppm + 100 ppm of range
		5 kHz to 10 kHz	0.5 % + 200 ppm of range
	2 A	10 Hz to 305 Hz	620 ppm + 350 ppm of range
		305 Hz to 1 kHz	620 ppm + 100 ppm of range
		1 kHz to 3 kHz	700 ppm + 100 ppm of range
		3 kHz to 5 kHz	730 ppm + 100 ppm of range
		5 kHz to 10 kHz	0.2 % + 100 ppm of range

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	20 A	10 Hz to 305 Hz	820 ppm + 200 ppm of range
		305 Hz to 1 kHz	820 ppm + 200 ppm of range
		1 kHz to 3 kHz	1500 ppm + 200 ppm of range
		3 kHz to 5 kHz	0.25 % + 210 ppm of range
		5 kHz to 10 kHz	0.25 % + 500 ppm of range
(e)	Resistance		
Normal			
	2 Ω	4W	17 ppm + 4 pm of range
	20 Ω	4W	10 ppm + 1.5 pm of range
	200 Ω	4W	8 ppm + 17 pm of range
	2 kΩ	4W	8 ppm + 1 pm of range
	20 kΩ	4W	8 ppm + 1 pm of range
	200 kΩ	4W	8 ppm + 1 pm of range
	2 MΩ	4W	9 ppm + 14 pm of range
	20 MΩ	2W	20 ppm + 790 pm of range
	200 MΩ	2W	120 ppm + 0.4 % of range
	2 GΩ	2W	0.15 % + 3.7 % of range
Lo Current Mode			
	2 Ω	4W	17 ppm + 3 pm of range
	20 Ω	4W	10 ppm + 2 pm of range
	200 Ω	4W	8 ppm + 1 pm of range
	2 kΩ	4W	8 ppm + 1 pm of range
	20 kΩ	4W	8 ppm + 1 pm of range
	200 kΩ	4W	8 ppm + 2 pm of range
High Voltage Mode			
	20 MΩ	2W	17 ppm + 62 ppm of range
	200 MΩ	2W	65 ppm + 60 ppm of range
	2 GΩ	2W	180 ppm + 1 % of range
	20 GΩ	2W	1500 ppm + 1 % of range

5.89 Indicating Instruments and Recording Instruments

By comparison with reference calibrator to an in-house method based on manufacturer recommendations and/or customer requirements.

(a) DC voltmeters

0 mV to ± 329.9999 mV	0.005 % + 7 µV
0 V to ± 3.299999 V	0.004 % + 32 µV
0 V to ± 32.99999 V	0.004 % + 270 µV
± (30 to 329.9999) V	0.004 % + 3.8 mV
± (330 to 1020.000) V	0.004 % + 14 mV

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(b) AC voltmeters

1.0 mV to 32.999 mV	9.5 Hz to 10 Hz	0.12 % + 40 µV
	10 Hz to 57 Hz	0.09 % + 24 µV
	57 Hz to 1 kHz	0.08 % + 22 µV
	1 kHz to 10 kHz	0.11 % + 22 µV
	10 kHz to 20 kHz	0.13 % + 22 µV
	20 kHz to 50 kHz	0.16 % + 32 µV
	50 kHz to 100 kHz	0.22 % + 57 µV
	100 kHz to 450 kHz	0.53 % + 110 µV
33 mV to 329.999 mV	9.5 Hz to 10 Hz	0.04 % + 180 µV
	10 Hz to 57 Hz	0.04 % + 75 µV
	57 Hz to 1 kHz	0.03 % + 38 µV
	1 kHz to 10 kHz	0.02 % + 68 µV
	10 kHz to 20 kHz	0.03 % + 57 µV
	20 kHz to 50 kHz	0.06 % + 88 µV
	50 kHz to 100 kHz	0.13 % + 140 µV
	100 kHz to 500 kHz	0.28 % + 260 µV
0.33 V to 3.29999 V	9.5 Hz to 10 Hz	0.04 % + 2.2 mV
	10 Hz to 57 Hz	0.04 % + 600 µV
	57 Hz to 1 kHz	0.03 % + 230 µV
	1 kHz to 10 kHz	0.02 % + 250 µV
	10 kHz to 20 kHz	0.03 % + 250 µV
	20 kHz to 50 kHz	0.05 % + 250 µV
	50 kHz to 100 kHz	0.13 % + 830 µV
	100 kHz to 450 kHz	0.28 % + 1.1 mV
3.3 V to 32.9999 V	9.5 Hz to 10 Hz	0.04 % + 24 mV
	10 Hz to 57 Hz	0.04 % + 5.2 mV
	57 Hz to 1 kHz	0.03 % + 3.4 mV
	1 kHz to 10 kHz	0.02 % + 4.6 mV
	10 kHz to 20 kHz	0.04 % + 6.5 mV
	20 kHz to 50 kHz	0.07 % + 5.4 mV
	50 kHz to 90 kHz	0.13 % + 4.5 mV
33 V to 329.999 V	45 Hz to 1 kHz	0.04 % + 16 mV
	1 kHz to 10 kHz	0.05 % + 19 mV
	10 kHz to 18 kHz	0.06 % + 35 mV
	18 kHz to 50 kHz	0.08 % + 48 mV
	50 kHz to 100 kHz	0.14 % + 130 mV
330 V to 1020 V	45 Hz to 1 kHz	0.04 % + 34 mV
	1 kHz to 5 kHz	0.06 % + 31 mV
	5 kHz to 10 kHz	0.06 % + 760 mV

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(c)	DC ammeters		
	± (0 to 3.3) mA		0.01 % + 0.05 µA
	± (3.3 to 33) mA		0.01 % + 0.25 µA
	± (33 to 330) mA		0.01 % + 2.5 µA
	± (0.33 to 2.2) A		0.038 % + 44 µA
	± (2.2 to 11) A		0.06 % + 500 µA
	± (11 to 20) A		0.1 % + 750 µA
	DC Clamp meters using the Fluke 50:1 current coil		
	± (11 to 16.5) A		0.51 %
	± (16.5 to 110) A		0.51 %
	± (110 to 550) A		0.51 %
	± (550 to 1000) A		0.51 %
(d)	AC ammeters		
	29 µA to 329.99 µA	10 Hz to 57 Hz	0.13 % + 0.2 µA
		57 Hz to 1 kHz	0.10 % + 0.1 µA
		1 kHz to 5 kHz	0.13 % + 0.1 µA
		5 kHz to 10 kHz	0.52 % + 0.2 µA
	0.33 mA to 3.29999 mA	10 Hz to 57 Hz	0.13 % + 1.3 µA
		57 Hz to 1 kHz	0.08 % + 0.37 µA
		1 kHz to 5 kHz	0.04 % + 0.33 µA
		5 kHz to 10 kHz	0.27 % + 1.4 µA
	3.3 to 32.9999 mA	10 Hz to 57 Hz	0.11 % + 13 µA
		57 Hz to 1 kHz	0.04 % + 3 µA
		1 kHz to 5 kHz	0.04 % + 3 µA
		5 kHz to 10 kHz	0.11 % + 3 µA
	33 to 329.999 mA	10 Hz to 20 Hz	0.17 % + 2 µA
		20 Hz to 45 Hz	0.12 % + 2 µA
		45 Hz to 1 kHz	0.11 % + 2 µA
		1 kHz to 5 kHz	0.13 % + 2 µA
		5 kHz to 10 kHz	0.18 % + 2.3 µA
		10 kHz to 30 kHz	0.33 % + 3.1 µA
	0.33 A to 1.09999 A	10 Hz to 57 Hz	0.09 % + 380 µA
		57 Hz to 1 kHz	0.04 % + 140 µA
		1 kHz to 5 kHz	0.25 % + 490 µA
		5 kHz to 10 kHz	1.45 % + 3500 µA
	1.1 to 2.99999 A	10 Hz to 57 Hz	0.09 % + 810 µA
		57 Hz to 1 kHz	0.05 % + 350 µA
		1 kHz to 5 kHz	0.26 % + 560 µA

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	5 kHz to 10 kHz	1.20 % + 8200 µA
3 to 10.9999 A	500 Hz to 1 kHz	0.06 % + 2.2 mA
	1 kHz to 5 kHz	1.20 % + 14 mA
11 to 20.5 A	45 Hz to 65 Hz	0.09 % + 5 mA
	65 Hz to 500 Hz	0.11 % + 4.4 mA
	500 Hz to 1 kHz	0.12 % + 6 mA
	1 kHz to 5 kHz	1.22 % + 36 mA
Toroidal Coil AC Clamp meters using 1:1 current coil		
0.33 to 3.29999 mA	10 Hz to 20 Hz	0.18 % + 0.1 µA
	20 Hz to 45 Hz	0.14 % + 0.1 µA
	45 Hz to 1 kHz	0.14 % + 0.1 µA
	1 kHz to 5 kHz	0.25 % + 0.15 µA
	5 kHz to 10 kHz	0.63 % + 0.2 µA
	10 kHz to 30 kHz	1.24 % + 0.3 µA
3.3 to 32.9999 mA	10 Hz to 20 Hz	0.18 % + 0.12 µA
	20 Hz to 45 Hz	0.14 % + 0.12 µA
	45 Hz to 1 kHz	0.13 % + 0.12 µA
	1 kHz to 5 kHz	0.18 % + 0.2 µA
	5 kHz to 10 kHz	0.40 % + 0.23 µA
	10 kHz to 30 kHz	0.78 % + 0.5 µA
33 to 329.999 mA	10 Hz to 20 Hz	0.17 % + 2 µA
	20 Hz to 45 Hz	0.12 % + 2 µA
	45 Hz to 1 kHz	0.11 % + 2 µA
	1 kHz to 5 kHz	0.13 % + 2 µA
	5 kHz to 10 kHz	0.18 % + 2.3 µA
	10 kHz to 30 kHz	0.33 % + 3.1 µA
0.33 to 1.09999 A	10 Hz to 45 Hz	0.17 % + 16 µA
	45 Hz to 1 kHz	0.11 % + 16 µA
	1 kHz to 5 kHz	0.48 % + 16 µA
	5 kHz to 10 kHz	1.9 % + 39 µA
1.1 to 2.99999 A	10 Hz to 45 Hz	0.17 % + 78 µA
	45 Hz to 1 kHz	0.11 % + 78 µA
	1 kHz to 5 kHz	0.48 % + 770 µA
	5 kHz to 10 kHz	1.9 % + 3.8 mA
3 to 10.9999 A	45 Hz to 100 Hz	0.11 % + 1.6 mA
	100 Hz to 1 kHz	0.13 % + 1.6 mA
	1 kHz to 5 kHz	2.3 % + 1.6 mA
11 to 20.5 A	45 Hz to 100 Hz	0.14 % + 3.9 mA

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	100 Hz to 1 kHz	0.15 % + 3.9 mA
	1 kHz to 5 kHz	2.3 % + 3.9 mA

Toroidal Coil AC clamp meters using the Fluke 50:1 current coil

16.5 A to 500 A	45 Hz to 440 Hz	0.22 %
500 A to 1025 A	45 Hz to 440 Hz	0.27 %

Rogowski Coil Clamp meters using the Fluke 50:1 current coil

16.5 A to 500 A	45 Hz to 440 Hz	0.28 %
500 A to 1025 A	45 Hz to 440 Hz	0.30 %

Hall Effect DC-AC Clamp meters using the Fluke 50:1 current coil

16.5 A to 500 A	45 Hz to 440 Hz	0.46 %
500 A to 1025 A	45 Hz to 440 Hz	0.51 %

(i) Ohmmeters

Range 4-Wire
(for 2-Wire measurements add an additional uncertainty of 5 µV per amp of stimulus current to the floor value)

0 Ω to 11 Ω	0.012 % + 0.001 Ω
11 Ω to 33 Ω	0.012 % + 0.0015 Ω
33 Ω to 110 Ω	0.009 % + 0.0014 Ω
110 Ω to 330 Ω	0.009 % + 0.002 Ω
330 Ω to 1100 Ω	0.009 % + 0.002 Ω
1.1 kΩ to 3.3 kΩ	0.009 % + 0.02 Ω
3.3 kΩ to 11 kΩ	0.009 % + 0.02 Ω
11 kΩ to 33 kΩ	0.009 % + 0.2 Ω
33 kΩ to 110 kΩ	0.011 % + 0.02 Ω
110 kΩ to 330 kΩ	0.009 % + 2 Ω
330 kΩ to 1.1 MΩ	0.012 % + 2 Ω
1.1 MΩ to 3.3 MΩ	0.012 % + 27 Ω
3.3 MΩ to 11 MΩ	0.05 % + 50 Ω
11 MΩ to 33 MΩ	0.08 % + 2.5 kΩ
33 MΩ to 110 MΩ	0.39 % + 3 kΩ
110 MΩ to 330 MΩ	0.4 % + 100 kΩ
330 MΩ to 1100 MΩ	1.2 % + 240 kΩ

5.91 Time and Frequency

By comparison with reference instrument to an in-house method based on manufacturer recommendations and/or customer requirements.

(a) Frequency meters

0.01 Hz to 119.99 Hz	0.01 Hz	20 ppm + 1 mHz
120.0 Hz to 1199.9 Hz	0.1 Hz	20 ppm + 1 mHz

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1.2 kHz to 11999 kHz	1 Hz	20 ppm + 1 mHz
12 kHz to 119.99 kHz	10 Hz	20 ppm + 15 mHz
120.0 kHz to 1199.9 kHz	100 Hz	20 ppm + 15 mHz
1.2 MHz to 2.000 MHz	1 kHz	20 ppm + 15 mHz
10 MHz (fixed sine wave)		1.0 Hz

(c) Counters

Period Measurement Square Wave AC Input range (1 mV to 3.3 V, 50 % duty cycle)

0.5 µs to 100 s	0.8 % + 100 ns

(f) Stroboscopes

Specific frequency values

1 Hz to 100 kHz	0.002 Hz to 0.02 Hz (increases with increasing measurand)

5.93 Signal Sources

By comparison with reference instrument to an in-house method based on manufacturer recommendations and/or customer requirements.

(e) Other characteristics

Signal Generators Frequency – Square or Sine Wave

71 mV to 30 V p-p	2 Hz to 500 kHz	0.001 x 10^6/f, where f is the measured frequency in Hz

Note 1:
Unless stated otherwise the CMC is based on the performance of the best available device and measurement uncertainties achieved for specific calibrations may be greater than the CMC Uncertainty. A laboratory may not report measurement uncertainties lower than its CMC. However, if the device under calibration has a greater accuracy than the device used to calculate the CMC the laboratory may be able to use the calibration data to lower its CMC Uncertainty. Please contact the laboratory to discuss your specific requirements.

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