SINGAPORE LABORATORY ACCREDITATION SCHEME

Accredited Laboratory SAC-SINGLAS

Schedule

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FIELD OF TESTING : Calibration and Measurement

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)	
A. Mechanical			
1. Gauge Pressure, Differential Pressure and Transmitter / transducer (Pressure output)	In-house Procedure QPR-CAL/WP-05, Rev 01		
a. Pneumatic Pressure		<u>In-House</u>	<u>On-Site</u>
-250 to 250 Pa		1.7 Pa	2.2 Pa
-4 to 4 inH2O		0.0086 inH2O	0.025 inH2O
-1 to 1 psi		0.0019 psi	0.0059 psi
1 to 10 psi		0.0025 psi	0.040 psi
10 to 30 psi		0.012 psi	0.12 psi
30 to 300 psi		0.072 psi	1.2 psi
300 to 3000 psi		0.52 psi	5.2 psi
0 to -10 psi		0.0026 psi	0.040 psi
b. Hydraulic Pressure			
0 to 10000psi		1.9 psi	18 psi
2. Pressure Switch Calibration	In-house Procedure QPR-CAL/WP-07, Rev 01		
a. Pneumatic Pressure			
-250 to 250 Pa		2.2 Pa	2.6 Pa
-4 to 4 inH2O		0.011 inH2O	0.025 inH2O
-1 to 1 psi		0.0060 psi	0.0082 psi
1 to 10 psi		0.0070 psi	0.041 psi
10 to 30 psi		0.18 psi	0.21 psi
30 psi to 300 psi		1.8 psi	2.2 psi
300 to 3000 psi		18 psi	19 psi
0 to -10 psi		0.0070 psi	0.041 psi
b. Hydraulic Pressure			
0 to 10000 psi		58 psi	61 psi

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)	
3. Pressure Transmitter & Transducer Calibration	In-house Procedure QPR-CAL/WP-06, Rev 02		
a. Pneumatic Pressure			
-250 to 250 Pa		1.7 Pa	2.2 Pa
-4 to 4 inH2O		0.0090 inH2O	0.025 inH2O
-1 to 1 psi		0.0016 psi	0.0059 psi
1 to 10 psi		0.0047 psi	0.040 psi
10 to 30 psi		0.014 psi	0.12 psi
30 psi to 300 psi		0.15 psi	1.2 psi
300 to 3000 psi		1.1 psi	5.2 psi
0 to -10 psi		0.0047 psi	0.040 psi
b. Hydraulic Pressure			
0 to 10000 psi		3.4 psi	18 psi
4. Calibration of non-contact Tachometer	In-house Procedure QPR-CAL/WP-11, Rev 00		
6 to 12 rpm		0.0063 rpm	
12 to 96 rpm		0.0067 rpm	
96 to 1200 rpm		0.065 rpm	
1200 to 6000 rpm		0.17 rpm	
6000 to 12000 rpm		0.30 rpm	
12000 to 30000 rpm		0.70 rpm	
30000 to 60000 rpm		1.4 rpm	
60000 to 99960 rpm		2.6 rpm	

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
B. Temperature		
1. RTD/Thermocouple Sensor with/ without Indicators, Transmitter, Transducer	In-house Procedure QPR-CAL/WP-08, Rev 03	
-20 to 0°C		0.092°C
0 to 20°C		0.092°C
20 to 50°C		0.14°C
50 to 100°C		0.70°C
100 to 200°C		0.70°C
200 to 300°C		0.70°C
300 to 400°C		0.70°C
400 to 500°C		0.94°C
2. Bimetallic Thermometer, Liquid filled capillary Thermometer		
-20 to 0°C		0.83°C
0 to 20°C		0.83°C
20 to 50°C		0.83°C
50 to 100°C		1.1°C
100 to 200°C		1.8°C
200 to 300°C		1.8°C
300 to 400°C		1.8°C
400 to 500°C		1.9°C
3. Thermocouple Indicator	In-house Procedure QPR-CAL/WP-18, Rev 00	
Type: K		
-200°C to -100°C		0.40°C
-100°C to 1372°C		0.20°C
Type: N		
-200°C to -100°C		0.43°C
-100°C to 1200°C		0.21°C
Type: J		
-210°C to -100°C		0.59°C
-100°C to 1200°C		0.28°C

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
Type: T		
-200°C to -100°C		0.39°C
-100°C to 400°C		0.22°C
Type: R		
-50°C to 0°C		0.87°C
0°C to 50°C		0.48°C
50°C to 300°C		0.32°C
300°C to 1768°C		0.29°C
Type: S		
-50°C to 0°C		0.84°C
0°C to 50°C		0.51°C
50°C to 300°C		0.36°C
300°C to 1768°C		0.34°C
Type: E		
-200°C to -100°C		0.28°C
-100°C to 1000°C		0.16°C
4. Thermocouple Simulator	In-house Procedure QPR-CAL/WP-18, Rev 00	
Type: K		
-200°C to -100°C		0.38°C
-100°C to 1372°C		0.20°C
Type: N		
-200°C to -100°C		0.40°C
-100°C to 1200°C		0.17°C
Type: J		
-210°C to -100°C		0.58°C
-100°C to 1200°C		0.27°C
Type: T		
-200°C to -100°C		0.38°C
-100°C to 400°C		0.21°C

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
Type: R		
-50°C to 0°C		0.74°C
0°C to 50°C		0.51°C
50°C to 300°C		0.41°C
300°C to 1768°C		0.28°C
Type: S		
-50°C to 0°C		0.73°C
0°C to 50°C		0.53°C
50°C to 300°C		0.44°C
300°C to 1768°C		0.32°C
Type: E		
-200°C to -100°C		0.27°C
-100°C to 1000°C		0.15°C
5. RTD Indicator	In-house Procedure QPR-CAL/WP-18, Rev 00	
-195°C to 0°C		0.02°C
0°C to 200°C		0.02°C
200°C to 960°C		0.03°C
6. RTD Simulator	In-house Procedure QPR-CAL/WP-18, Rev 00	
-195°C to 0°C		0.05°C
0°C to 200°C		0.12°C
200°C to 960°C		0.19°C
7. Humidity / Temperature Measuring Instruments	In-house Procedure QPR-CAL/WP-09, Rev 00	
Temperature:		
5°C to 40°C		0.33°C
Humidity:		
20% to 95%		2.9 % RH

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
C. Electrical DC/LF		
1. Calibration of DC Voltage Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
0mV to 20mV		0.0043 mV
20mV to 100mV		0.0069 mV
100mV to 199mV		0.0087 mV
0.199V to 1V		0.036mV
1V to 2V		0.13mV
2V to 10V		0.27mV
10V to19.9V		0.45mV
19.9V to 100V		0.0025V
100V to 199V		0.0046V
199 to 500V		0.019V
500V to 1010V		0.037V
2. Calibration of AC Voltage Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
1mV to 20mV	20Hz to 20kHz	0.070mV
20mV to 0.2V	20Hz to 20kHz	0.31mV
0.2V to 2V	20Hz to 20kHz	0.0025V
2V to 19.9V	20Hz to 20kHz	0.024V
19.9V to 100V	40Hz to 1kHz	0.041V
100V to 199V	40Hz to 1kHz	0.082V
199V to 1000V	40Hz to 1kHz	0.62V
3. Calibration of DC Current Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
0μA to 100μA		0.029μA
100μA to 199μA		0.039μA
199μA to 1mA		0.00013mA
1mA to 1.99mA		0.00022mA
1.99mA to 10mA		0.0011mA
10mA to 19.9mA		0.0020mA
19.9mA to 100mA		0.011mA
100mA to 199mA		0.020mA
0.199A to 1A		0.00028A
1A to 2A		0.00051A
2A to 3A		0.0022A
3A to 10A		0.0044A
10A to 19.9A		0.0076A

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
4. Calibration of DC Current Clamp Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
0A to 10A		0.26A
10A to 50A		0.42A
50A to 100A		0.68A
100A to 150A		1.1A
150A to 500A		3.1A
500A to 1100A		6.6A
5. Calibration of AC Current Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
10µA to 100µA	200Hz to 5kHz	0.65µA
100µA to 199µA	50Hz to 5kHz	0.72µA
199µA to 1.99mA	50Hz to 5kHz	0.0027mA
1.99mA to 19.9mA	50Hz to 5kHz	0.028mA
19.9mA to 199mA	50Hz to 5kHz	0.28mA
0.199A to 1A	50Hz to 500Hz	0.00074A
1A to 1.99A	50Hz to 500Hz	0.0014A
1.99A to 3A	50Hz to 500Hz	0.0051A
3A to 10A	50Hz to 500Hz	0.013A
10A to 19.9A	50Hz to 500Hz	0.025A
6. Calibration of AC Current Clamp Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
10A to 50A	50Hz	0.57A
50A to 100A	50Hz	0.84A
100A to 150A	50Hz	1.7A
150A to 500A	50Hz	3.8A
500A to 995A	50Hz	6.6A

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
7. Calibration of Resistance(2Wire) Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
1mΩ		0.12mΩ
1mΩ to 10mΩ		0.66mΩ
10mΩ to 50mΩ		1.7mΩ
50mΩ to 100mΩ		3.3mΩ
100mΩ to 1Ω		0.020Ω
1Ω to 10Ω		0.026Ω
10Ω to 21Ω		0.028Ω
21Ω to 51Ω		0.020Ω
51Ω to 100Ω		0.026Ω
100Ω to 250Ω		0.043Ω
250Ω to 500Ω		0.073Ω
500Ω to 900Ω		0.12Ω
0.9kΩ to 5kΩ		0.0018kΩ
5kΩ to 10kΩ		0.0027kΩ
10kΩ to 25kΩ		0.0043kΩ
25kΩ to 50kΩ		0.0071kΩ
50kΩ to 75kΩ		0.010kΩ
75kΩ to 110kΩ		0.025kΩ
110kΩ to 250kΩ		0.042kΩ
250kΩ to 500kΩ		0.071kΩ
500kΩ to 900kΩ		0.12kΩ
0.9MΩ to 1.1MΩ		0.00040MΩ
1.1MΩ to 2.5MΩ		0.00073MΩ
2.5MΩ to 5MΩ		0.0013MΩ
5MΩ to 7.5MΩ		0.0019MΩ
7.5MΩ to 11MΩ		0.014MΩ
11MΩ to 25MΩ		0.034MΩ
25MΩ to 50MΩ		0.064MΩ
50MΩ to 75MΩ		0.093MΩ
75MΩ to 90MΩ		0.12MΩ
90MΩ to 120MΩ		0.15MΩ
1GΩ		0.043GΩ

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
8. Calibration of Resistance(4Wire) Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
1Ω		0.0068Ω
10Ω		0.0067Ω
100Ω		0.011Ω
1kΩ		0.0058kΩ
10kΩ		0.0062kΩ
100kΩ		0.0086kΩ
1MΩ		0.012MΩ
10MΩ		0.30MΩ
100MΩ		1.2MΩ
1GΩ		0.12GΩ
9. Calibration of Frequency Measuring Instruments (Lab)	In-house Procedure QPR-CAL/WP-15, Rev 01	
0.1Hz to 50Hz		0.0059Hz
50Hz to 200Hz		0.0074Hz
0.2kHz to 10kHz		0.00063kHz
10kHz to 100kHz		0.0024kHz
100kHz to 500kHz		0.012kHz
0.5MHz to 1MHz		0.026kHz
1MHz to 10MHz		0.24kHz
10. Calibration of DC Voltage Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
0mV to 50mV		0.0079mV
50mV to 100mV		0.012mV
0.1V to 1V		0.061mV
1V to 5V		0.30mV
5V to 10V		0.53mV
10V to 50V		0.0037V
50V to 100V		0.0067V
100V to 500V		0.043V
500V to 1000V		0.072V

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
11. Calibration of AC Voltage Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
10mV to 100mV	20Hz to 1kHz	0.14mV
0.1V to 1V	20Hz to 1kHz	0.0012V
1V to 10V	20Hz to 1kHz	0.012V
10V to 100V	45Hz to 1kHz	0.12V
100V to 750V	45Hz to 1kHz	0.88V
12. Calibration of DC Current Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
0mA to 5mA		0.0059mA
5mA to 10mA		0.0091mA
10mA to 50mA		0.039mA
50mA to 100mA		0.072mA
0.1A to 0.5A		0.78mA
0.5A to 1A		0.0015A
1A to 1.5A		0.0032A
1.5A to 3A		0.0057A
13. Calibration of AC Current Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
0.1A to 0.5A	20Hz to 1kHz	0.0012A
0.5A to 1A	20Hz to 1kHz	0.0019A
1A to 3A	20Hz to 1kHz	0.0083A
14. Calibration of Resistance (2wire) Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
0Ω to 1Ω		0.015Ω
1Ω to 10Ω		0.018Ω
10Ω to 100Ω		0.039Ω
0.1kΩ to 1kΩ		0.66Ω
1kΩ to 10kΩ		0.0032kΩ
10kΩ to 100kΩ		0.032kΩ
0.1MΩ to 1MΩ		0.32kΩ
1MΩ to 10MΩ		0.011MΩ
10MΩ to 100MΩ		2.2MΩ

MEASURED QUANTITIES/ INSTRUMENT/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION AND MEASUREMENT CAPABILITY (CMC*)
15. Calibration of Resistance (4wire) Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
0Ω to 1Ω		0.0088Ω
1Ω to 10Ω		0.0097Ω
10Ω to 100Ω		0.020Ω
0.1kΩ to 1kΩ		0.00060kΩ
1kΩ to 10kΩ		0.0017kΩ
10kΩ to 100kΩ		0.016kΩ
0.1MΩ to 1MΩ		0.00017MΩ
1MΩ to 10MΩ		0.0055MΩ
10MΩ to 100MΩ		1.1MΩ
16. Calibration of Frequency Sourcing Instruments (Lab)	In-house Procedure QPR-CAL/WP-14, Rev 01	
3Hz to 10Hz		0.0070Hz
10Hz to 40Hz		0.0078Hz
40Hz to 100Hz		0.015Hz
0.1kHz to 1kHz		0.13Hz
1kHz to 100kHz		0.013kHz
100kHz to 300kHz		0.040kHz

* CMC is expressed as an expanded uncertainty estimated at a level of confidence of approximately 95%

Approved Signatories:

Mr Meyyappan Muthiah - For all items in Category A, B & C
Mr Balaji Gnanamurthi - For all items in Category A, B & C

Note:

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. A laboratory's fulfilment 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. 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.