Scope of Accreditation
For
BC Group International, Inc.

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In recognition of a successful assessment to ISO/IEC 17025:2005 and ANSI Z540-1, accreditation is granted to **BC Group International, Inc.** to perform the following Calibrations:

Accreditation granted through: **September 19, 2014**

Calibration

Electrical – Capacitance

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Capacitance – Source			Fluke 5500A
(0.33 to 11) nF	50 Hz to 1 kHz	0.4% + 0.01 nF	
(11 to 110) nF	50 Hz to 1 kHz	0.25% + 0.1 nF	
(110 to 330) nF	50 Hz to 1 kHz	0.25% + 0.3 nF	
(0.33 to 1.1) µF	50 Hz to 1 kHz	0.25% + 1 nF	
(1.1 to 3.3) µF	50 Hz to 1 kHz	0.35% + 3 nF	
(3.3 to 11) µF	(50 to 400) Hz	0.35% + 10 nF	
(11 to 33) µF	(50 to 400) Hz	0.4% + 30 nF	
(33 to 110) µF	(50 to 200) Hz	0.5% + 100 nF	
(110 to 330) µF	(50 to 100) Hz	0.7% + 300 nF	
(0.33 to 1.1) mF	(50 to 100) Hz	0.85% + 300 nF	

Electrical – Current

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Current – Source	(0 to 3.2) mA	110 µA/A + 0.05 µA	Fluke 5500A
	(0 to 32) mA	90 µA/A + 0.25 µA	
	(0 to 320) mA	90 µA/A + 3.35 µA	
	(0 to 2.1) A	275 µA/A + 44 µA	
	(0 to 11) A	550 µA/A + 330 µA	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Current – Measure	(1 to 10) µA	27 µA/A + 0.1 nA	HP 3458A
	(10 to 100) µA	27 µA/A + 0.8 nA	
	(0.1 to 1) mA	27 µA/A + 0.005 µA	
	(1 to 10) mA	27 µA/A + 0.05 µA	
	(10 to 100) mA	43 µA/A + 0.5 µA	
	(0.1 to 1) A	120 µA/A + 10 µA	
AC Current – Source			Fluke 5500A
(0.03 to 0.33) mA	(10 to 20) Hz	0.2% A + 0.15 µA	
	(20 to 45) Hz	0.1% A + 0.15 µA	
	45 Hz to 1 kHz	0.1% A + 0.15 µA	
	(1 to 5) kHz	0.3% A + 0.15 µA	
	(5 to 10) kHz	1% A + 0.15 µA	
(0.33 to 3.3) mA	(10 to 20) Hz	0.2% A + 0.3 µA	
	(20 to 45) Hz	0.1% A + 0.3 µA	
	45 Hz to 1 kHz	0.1% A + 0.3 µA	
	(1 to 5) kHz	0.2% A + 0.3 µA	
	(5 to 10) kHz	0.6% A + 0.3 µA	
(3.3 to 33) mA	(10 to 20) Hz	0.2% A + 3 µA	
	(20 to 45) Hz	0.1% A + 3 µA	
	45 Hz to 1 kHz	0.08% A + 3 µA	
	(1 to 5) kHz	0.2% A + 3 µA	
	(5 to 10) kHz	0.5% A + 3 µA	
(33 to 330) mA	(10 to 20) Hz	0.2% A + 30 µA	
	(20 to 45) Hz	0.1% A + 30 µA	
	45 Hz to 1 kHz	0.08% A + 30 µA	
	(1 to 5) kHz	0.2% A + 30 µA	
	(5 to 10) kHz	0.5% A + 30 µA	
(0.33 to 2.2) A	(10 to 45) Hz	0.16% A + 300 µA	
	45 Hz to 1 kHz	0.08% A + 300 µA	
	(1 to 5) kHz	0.6% A + 300 µA	
(2.2 to 11) A	(45 to 65) Hz	0.06% A + 2 mA	
	(65 to 500) Hz	0.1% A + 2 mA	
	500 Hz to 1 kHz	0.33% A + 2 mA	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
AC Current – Measure			HP 3458A
100 µA	(20 to 45) Hz	1.6 µA/mA + 0.03 µA	
	(45 to 100) Hz	0.8 µA/mA + 0.03 µA	
	100 Hz to 5 kHz	0.7 µA/mA + 0.03 µA	
1 mA	(20 to 45) Hz	1.6 µA/mA + 0.2 µA	
	(45 to 100) Hz	0.8 µA/mA + 0.2 µA	
	100 Hz to 5 kHz	0.5 µA/mA + 0.2 µA	
10 mA	(20 to 45) Hz	1.6 µA/mA + 2 µA	
	(45 to 100) Hz	0.8 µA/mA + 2 µA	
	100 Hz to 5 kHz	0.5 µA/mA + 2 µA	
100 mA	(20 to 45) Hz	1.6 µA/mA + 20 µA	
	(45 to 100) Hz	0.7 µA/mA + 20 µA	
	100 Hz to 5 kHz	0.4 µA/mA + 20 µA	
1 A	(20 to 45) Hz	1.7 µA/mA + 200 µA	
	(45 to 100) Hz	0.9 µA/mA + 200 µA	
	100 Hz to 5 kHz	1.1 µA/mA + 200 µA	

Electrical – Resistance

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Resistance – Source	(0 to 11) Ω	0.01% + 5 mΩ	Fluke 5500A
	(11 to 33) Ω	0.01% + 0.01 Ω	
	(33 to 330) Ω	0.008% + 0.01 Ω	
	330 Ω to 3.3 kΩ	0.008% + 0.06 Ω	
	(3.3 to 33) kΩ	0.008% + 0.6 Ω	
	(33 to 110) kΩ	0.009% + 6 Ω	
	(110 to 330) kΩ	0.01% + 6 Ω	
	330 kΩ to 3.3 MΩ	0.013% + 55 Ω	
	(3.3 to 11) MΩ	0.05% + 550 Ω	
	(11 to 33) MΩ	0.09% + 550 Ω	
	(33 to 110) MΩ	0.4% + 5.5 kΩ	
	(110 to 330) MΩ	0.4% + 17 kΩ	
Resistance – Measure	10 Ω	20 µΩ/Ω + 0.5 mΩ	HP 3458A
	100 Ω	16 µΩ/Ω + 0.5 mΩ	
	1 kΩ	14 µΩ/Ω + 0.5 mΩ	
	10 kΩ	14 µΩ/Ω + 5 mΩ	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Resistance – Measure	100 kΩ	14 μΩ/Ω + 0.05 Ω	HP 3458A
	1 MΩ	19 Ω/MΩ + 2 Ω	
	10 MΩ	54 Ω/MΩ + 100 Ω	
	100 MΩ	512 Ω/MΩ + 1 kΩ	
	1 GΩ	5.1 kΩ/MΩ + 10 kΩ	

Electrical – Voltage

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Voltage – Source	(0 to 330) mV	48 μV/V + 3 μV	Fluke 5500A
	(0 to 3.3) V	40 μV/V + 5 μV	
	(0 to 33) V	40 μV/V + 50 μV	
	(33 to 330) V	45 μV/V + 500 μV	
	(100 to 1020) V	45 μV/V + 1.5 mV	
DC Voltage – Measure	(1 to 100) mV	14 μV/V + 0.3 μV	HP 3458A
	(0.1 to 1) V	13 μV/V + 0.3 μV	
	(1 to 10) V	13 μV/V + 0.5 μV	
	(10 to 100) V	17 μV/V + 30 μV	
	(100 to 1000) V	13 μV/V + 100 μV	
	(0 to 2000) V	0.7 mV/V + 0.4 V	Vitrek 4640A
	(2000 to 40 000) V	1 mV/V + 8 V	
AC Voltage – Source			Fluke 5500A
(1 to 33) mV	(10 to 45) Hz	0.32% + 20 μV	
	45 Hz to 10 kHz	0.1% + 20 μV	
	(10 to 20) kHz	0.18% + 20 μV	
	(20 to 50) kHz	0.18% + 20 μV	
	(50 to 100) kHz	0.3% + 33 μV	
	(100 to 500) kHz	0.9% + 60 μV	
(33 to 330) mV	(10 to 45) Hz	0.25% + 50 μV	
	45 Hz to 10 kHz	0.05% + 20 μV	
	(10 to 20) kHz	0.1% + 20 μV	
	(20 to 50) kHz	0.16% + 40 μV	
	(50 to 100) kHz	0.24% + 170 μV	
	(100 to 500) kHz	0.7% + 330 μV	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
(0.33 to 3.3) V	(10 to 45) Hz	0.15% + 250 µV	Fluke 5500A
	45 Hz to 10 kHz	0.03% + 60 µV	
	(10 to 20) kHz	0.08% + 60 µV	
	(20 to 50) kHz	0.14% + 300 µV	
	(50 to 100) kHz	0.24% + 1.7 mV	
	(100 to 500) kHz	0.5% + 3.3 mV	
(3.3 to 33) V	(10 to 45) Hz	0.12% + 2.5 mV	
	45 Hz to 10 kHz	0.04% + 600 µV	
	(10 to 20) kHz	0.08% + 2.6 mV	
	(20 to 50) kHz	0.15% + 5 mV	
	(50 to 100) kHz	0.24% + 17 mV	
(33 to 330) V	45 Hz to 1 kHz	0.05% + 6.6 mV	
	(1 to 10) kHz	0.08% + 15 mV	
	(10 to 20) kHz	0.09% + 33 mV	
(330 to 1020) V	45 Hz to 1 kHz	0.05% + 80 mV	
	(1 to 5) kHz	0.2% + 100 mV	
	(5 to 10) kHz	0.2% + 500 mV	
AC Voltage – Measure 10 mV	40 Hz to 1 kHz	275 µV/V + 1.1 µV	HP 3458A
	(1 to 20) kHz	375 µV/V + 1.1 µV	
	(20 to 50) kHz	1.3 µV/mV + 1.1 µV	
100 mV	40 Hz to 1 kHz	115 µV/V + 2 µV	
	(1 to 20) kHz	175 µV/V + 2 µV	
	(20 to 50) kHz	385 µV/V + 2 µV	
1 V	40 Hz to 1 kHz	115 µV/V + 20 µV	
	(1 to 20) kHz	175 µV/V + 20 µV	
	(20 to 50) kHz	385 µV/V + 20 µV	
10 V	40 Hz to 1 kHz	115 µV/V + 200 µV	
	(1 to 20) kHz	175 µV/V + 200 µV	
	(20 to 50) kHz	385 µV/V + 200 µV	
100 V	40 Hz to 1 kHz	250 µV/V + 2 mV	
	(1 to 20) kHz	255 µV/V + 2 mV	
	(20 to 50) kHz	427 µV/V + 2 mV	
1000 V	40 Hz to 1 kHz	0.5 mV/V + 20 mV	
	(1 to 20) kHz	0.7 mV/V + 20 mV	
	(20 to 50) kHz	1.3 mV/V + 20 mV	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
2000 V	(40 to 100) Hz	2.4 mV/V + 2 V	Vitrek 4640A
	(100 to 400) Hz	13.4 mV/V + 4 V	
40 000 V	(50 to 60) Hz	6 mV/V + 60 V	
1V	(0 to 10) MHz	1.1 mV/V	BL 1395B w/ HP 3458A
	(10 to 100) MHz	11 mV/V	
Electrical Calibration of Thermocouple Indicating Systems-Source			Fluke 5500A
Type E	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.13 °C	
	(650 to 1000) °C	0.17 °C	
Type J	(-210 to -100) °C	0.16 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.12 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1200) °C	0.18 °C	
Type K	(-200 to -100) °C	0.26 °C	
	(-100 to 125) °C	0.15 °C	
	(125 to 120) °C	0.13 °C	
	(120 to 1000) °C	0.21 °C	
	(1000 to 1372) °C	0.32 °C	
Type R	(0 to 250) °C	0.45 °C	
	(250 to 400) °C	0.29 °C	
	(400 to 1000) °C	0.28 °C	
	(1000 to 1767) °C	0.31 °C	
Type S	(0 to 250) °C	0.37 °C	
	(250 to 1000) °C	0.3 °C	
	(1000 to 1400) °C	0.31 °C	
	(1400 to 1767) °C	0.31 °C	
Type T	(-250 to -150) °C	0.5 °C	
	(-150 to 0) °C	0.2 °C	
	(0 to 120) °C	0.13 °C	
	(120 to 400) °C	0.12 °C	

Mass – Force

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Force – Measure	± (0 to 100) lbf	0.16 lbf	Chatillon DFS100

Mass – Pressure / Low Vacuum

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Pressure – Measure	(-0.3 to 0.3) psi	0.000036 psi	Mensor APC600
	(-5 to 5) psi	0.00059 psi	
	(-10 to 10) psi	0.0012 psi	
	(-14.7 to 75) psi	0.0088 psi	
	(-14.7 to 100) psi	0.012 psi	

Mass – Torque

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Torque – Measure	± (4 to 50) lbf·in	0.3 % of range	Snap On Versatest w/ TTC400 Transducer
	± (30 to 400) lbf·in	0.3 % of range	
	± (80 to 1000) lbf·in	0.3 % of range	
	± (20 to 250) lbf·ft	0.31 % of range	

Time and Frequency – Frequency / Period

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Frequency – Source	0.01 Hz to 12 kHz	63 µHz/Hz + 1 mHz	Fluke 5500A
	12 kHz to 120 kHz	70 µHz/Hz + 15 mHz	
	120 kHz to 1.2 MHz	62 µHz/Hz + 15 mHz	
	1.2 MHz to 2 MHz	290 µHz/Hz + 15 mHz	
Frequency – Measure	(1 to 40) Hz	500 µHz/Hz	HP 3458A
	40 Hz to 10 MHz	101 µHz/Hz	

Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Amplitude – DC 50 Ω	(-2.2 to 2.2) V	0.2% + 100 µV	Fluke 5500A w/ SC300
1 MΩ	(-33 to 33) V	0.19% + 100 µV	
Amplitude – Square Wave 50 Ω	1.8 mV to 2.2 V (p-p)	0.23% + 100 µV	
1 MΩ	1.8 mV to 105 V (p-p)	0.27% + 100 µV	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Leveled Sine Wave	50 kHz reference	1.8% + 200 µV	Fluke 5500A w/ SC300
Amplitude	50 kHz to 100 MHz	3.4% + 300 µV	
	(100 to 300) MHz	3.6% + 300 µV	
Flatness	50 kHz to 100 MHz	1.6% + 100 µV	
	(100 to 300) MHz	1.9% + 100 µV	
Time Marker	5 s to 100 µs	(20 + 1000*t*) µs/s	
	(50 to 2) µs	(20 + 15 000*t*) µs/s	
	1 µs to 2 ns	19.4 µs/s	

Calibration and Measurement Capability (CMC) represents expanded uncertainties at approximately a 95% confidence level using a coverage factor of k=2.

Notes:

1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
2) *t* = time in seconds

Approved by: _____ Date: September 19, 2011

R. Douglas Leonard
Chief Technical Officer

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