Appendix 7

HENDRIX WIRE AND CABLE INC.

Test Object: Pin Polymer Insulator
HPI-25

Dry and Wet 60 Hz Flashover Voltage

Lightning Impulse Critical Flashover Voltage

Appendix 7-A

AC Flashover Voltages and Withstand Voltages:

Date: 03/11/05 (dry) and 03/14/05 (wet) Test Object: HPI-25
Test Description: AC Flashover and Withstand Tests, under Dry and Wet conditions.

Dry Conditions

Pressure, mm Hg	767	Air Density Correction Factor, k_1	1.001
Dry Bulb Temperature, °C	22.4	Humidity Correction Factor, k_2	1
Wet Bulb Temperature, °C	14.3	Correction Factor, $K=k_1k_2$	1.001
Air Density, δ	1.001		

Wet Conditions

Pressure, mm Hg	770	Air Density Correction Factor, k_1	1.0257
Dry Bulb Temperature, °C	21.7	Humidity Correction Factor, k_2	1
Wet Bulb Temperature, °C	16.4	Correction Factor, $K=k_1k_2$	1.0257
Air Density, δ	1.02257		

Flashover Test

	Dry		Wet	
Shot No.	**Applied Voltage [kV]**	**Corrected Voltage [kV]**	**Applied Voltage [kV]**	**Corrected Voltage [kV]**
1	84	83.9	50	48.7
2	83	82.9	52	50.7
3	85	84.9	51	49.7
4	83	82.9	51	49.7
5	85	84.9	52	50.7
Avg	84	83.9	51.2	49.9

Withstand Test

	Dry		Wet	
Shot No.	**Applied Voltage [kV]**	**Corrected Voltage [kV]**	**Applied Voltage [kV]**	**Corrected Voltage [kV]**
1	76	75.9	42	40.9
2	76	75.9	42	40.9
3	76	75.9	42	40.9

$$V_{Corrected} = V_{Applied} / K$$

Appendix 7-B

Impulse Critical Flashover Voltage (CFO):
Negative Polarity, Dry Condition

Date: 03/09/05 Test Object: HPI-25

Test Description: Negative Polarity, Std. Lightning Impulse

Pressure, mm Hg	765	Air Density Correction Factor, k_1	1.00145
Dry Bulb Temperature, °C	21.5	Humidity Correction Factor, k_2	1
Wet Bulb Temperature, °C	15.3	Total Correction Factor, $K=k_1k_2$	1.00145
Air Density, δ	1.00145	Voltage Divider Ratio: D_F, kV/V	55.09

Shot No.	Stage Voltage [kV]	Scope Voltage [V]	Applied Voltage [kV]	Corrected Voltage [kV]	Withstand (W) or Flashover (F)
1	80	-3.4	-187.3	-187.0	F
2	77	-3.44	-189.5	-189.2	F
3	74	-2.92	-160.9	-160.7	W
4	77	-3.12	-171.9	-171.7	W
5	80	-3.28	-180.7	-180.4	F
6	77	-3.32	-182.9	-182.6	F
7	74	-3.12	-171.9	-171.7	W
8	77	-3.12	-171.9	-171.7	W
9	80	-3.16	-174.1	-173.8	W
10	83	-3.2	-176.3	-176.0	W
11	86	-3.32	-182.9	-182.6	F
12	83	-3.28	-180.7	-180.4	F
13	80	-3.08	-169.7	-169.5	W
14	83	-3.28	-180.7	-180.4	F
15	80	-3.28	-180.7	-180.4	F
16	77	-3.28	-180.7	-180.4	F
17	74	-2.92	-160.9	-160.7	W
18	77	-3.08	-169.7	-169.5	W
19	80	-3.28	-180.7	-180.4	F
20	77	-3.04	-167.5	-167.3	W
Avg	78.8	-3.20	-176.1	-175.8	

Appendix 7-C

Impulse Critical Flashover Voltage (CFO):
Positive Polarity, Dry Condition

Date: 03/09/05 Test Object: HPI-25

Test Description: Positive Polarity, Std. Lightning Impulse

Pressure, mm Hg	765	Air Density Correction Factor, k_1	1.00145
Dry Bulb Temperature, °C	21.5	Humidity Correction Factor, k_2	1
Wet Bulb Temperature, °C	15.3	Total Correction Factor, $K=k_1k_2$	1.00145
Air Density, δ	1.00145	Voltage Divider Ratio, D_R, kV/V	55.09

Shot No.	Stage Voltage [kV]	Scope Voltage [V]	Applied Voltage [kV]	Corrected Voltage [kV]	Withstand (W) or Flashover (F)
1	69	2.76	152.0	151.8	F
2	66	2.64	145.4	145.2	W
3	69	2.72	149.8	149.6	F
4	66	2.72	149.8	149.6	F
5	63	2.68	147.6	147.4	F
6	60	2.68	147.6	147.4	F
7	57	2.4	132.2	132.0	W
8	60	2.44	164.4	164.2	W
9	63	2.44	134.4	134.2	W
10	66	2.6	143.2	143.0	W
11	69	2.68	147.6	147.4	F
12	66	2.64	145.4	145.2	W
13	69	2.64	145.4	145.2	F
14	66	2.6	143.2	143.0	W
15	69	2.68	147.6	147.4	F
16	66	2.72	149.8	149.6	F
17	63	2.64	145.4	145.2	F
18	60	2.44	134.4	134.2	W
19	63	2.48	136.6	136.4	W
20	66	2.76	152.0	151.8	F
Avg.	64.8	2.62	145.7	145.5	

Appendix 7-D

Lightning Impulse Withstand Voltage:

Date: 03/09/05 Test Object: HPI-25

Negative, Dry Condition

Pressure, mm Hg	765	Air Density Correction Factor, k_1	1.00145
Dry Bulb Temperature, °C	21.5	Humidity Correction Factor, k_2	1
Wet Bulb Temperature, °C	15.3	Total Correction Factor, $K=k_1k_2$	1.00145
Air Density, δ	1.00145	Voltage Divider Ratio: D_R, kV/V	55.09

Shot No.	Stage Voltage [kV]	Scope Voltage [V]	Applied Voltage [kV]	Corrected Voltage [kV]	Withstand (W) or Flashover (F)
1	70	-2.72	-149.8	-149.6	W
2	70	-2.76	-152.0	-151.8	W
3	70	-2.76	-152.0	-151.8	W

Date: 03/09/05 Test Object: HPI-25

Positive Polarity, Dry Condition

Pressure, mm Hg	765	Air Density Correction Factor, k_1	1.00145
Dry Bulb Temperature, °C	21.5	Humidity Correction Factor, k_2	1
Wet Bulb Temperature, °C	15.3	Total Correction Factor, $K=k_1k_2$	1.00145
Air Density, δ	1.00145	Voltage Divider Ratio: D_R, kV/V	55.09

Shot No.	Stage Voltage [kV]	Scope Voltage [V]	Applied Voltage [kV]	Corrected Voltage [kV]	Withstand (W) or Flashover (F)
1	58	2.32	127.8	127.6	W
2	58	2.36	130.0	129.8	W
3	58	2.32	127.8	127.6	W

Puncture Test
Per ANSI C29.1
for
Class 55-5
HPI 25 F Neck, 1" Thread

Objective
To meet requirements found in ANSI C29.1-1988, section 4.11.

Test Location
Testing was performed at Hendrix Wire & Cable Co. in June 2001.

Test Procedure
Each of 12 insulators was mounted onto a 7" long, 1" diameter thread. The pin was connected to the end of covered cable. The insulator was immersed in an insulating oil bath. A grounded 1" diameter copper bar traveled horizontally through the bath. The top insulator position rested on the bar. The other end of the covered cable was connected to high voltage to complete the circuit.
High voltage was applied at a rate of approximately 10 kV/15seconds until failure.

Equipment
Manufacturer: Hipotronics AC Dielectric Test Set
Model: 7300-100
Serial Number: 731-7701

Results

Insulator	kV	Variation	kV
V1	225	a1	2
V2	230	a2	7
V3	225	a3	2
V4	205	a4	18
V5	235	a5	12
V6	230	a6	7
V7	235	a7	12
V8	205	a8	18
V9	225	a9	2
V10	205	a10	18
V11	220	a11	3
V12	230	a12	7
V (Average)	**223**	**a (Average Variation)**	**9**

A (percent Average Variation)	**4.04**

Requirement: ANSI C 29.5, Section 8.3.5 states that three insulators should be selected at random. Hendrix has tested 12 insulators to provide additional data points.
Formula: A= 100a/V
The average puncture voltage must meet the 115 kV for a Radio Freed insulator. The percent average variation must be equal to or less than 15%.

The results of 4.04 percent average variation and 223 kV puncture exceed the ANSI requirements.

Tested by: Chris Asselin
Reported by: Gary Grenier

Date: 12/11/2008

HENDRIX

Test Report
U-Bend

Abstract

The purpose of the testing was to meet or exceed the ANSI requirement of 125 v/mil for 6 hours.

Procedure

A cable sample was bent around a mandrel which was 8x the diameter of the cable and secured in that position. The bent cable was placed on a grounded metal plate. The conductor was exposed on the two cable ends and attached to high voltage. High voltage was applied at 31 kV for 6 hours.

Specification

ANSI Standard Number S-61-402

Cable Description

Reel Numbers:	(35mm2)	LN7EXG01
	(70mm2)	LN7EXD01
	(185mm2)	LN7EXB01

Results

The cable tested meet the requirements of ANSI S-61-402. No failures occurred.

Operations Manager

Date: 12/02/2009

Volume Resistivity Test
(per ICEA S-61-402)

PURPOSE
To measure the Volume Resistivity of semi-conducting layers of power cable.

PROCEDURE
Jacket Layer tested at Room Temperature
Sample Preparation: Using a commercial ruler a 6" long length from was taken from each cable design. Electrodes were added to the surface of the each cable sample spaced 2" apart and centered on the specimen by painting thin bands, (approx. 1/8"), of silver paint across the semi-conducting strand shield layer. Allow the paint to air-dry overnight. Voltage up to 200V was applied to one electrode and the current measured on the second electrode.

Calculation: All values are in OHM centimeters

Formula: $P = 1000[(V/I)(D^2-d^2)/]$

V=voltage in Volts
I=Current in mAmps
D=Cable outside diameter
D=Conductor diameter

PASS/FAIL CRITERIA
PASS: The volume resistivity shall exceed 500 ohm-cm.

Equipment: Calibrated test set.

Results: In each sample tested the 200 volts did not allow current flow. A value of .001 milliAmps was used to indicate the limit of the equipment.

Calculated results: $35mm^2 = 1.152 \times 10^8$

$70mm^2 = 1.382 \times 10^8$

$185mm2 = 1.962 \times 10^8$

Reported by: Gary Grenier

Operations Manager

Date: 12/02/2009

HENDRIX

Environmental Stress Cracking Test
Black High Density Polyethylene
(per ASTM D 1693)

Abstract
The purpose of this test was to evaluate the Black High Density Polyethylene insulation used for the outer layer of our cable constructions.

Procedure
75 mil plaque samples were prepared from pellets. Tests were conducted following condition B of the specification.

Equipment
VWR Scientific oven set at 50 ° C for 48 hours and a test solution composed of 10% Igepal and 90% water.

Results
10 of the 10 samples tested passed with no cracking present.
Base Resin Lot: CL171219A1
Color Black masterbatch Lot: 3692696

Conclusion
Test results indicate that the material examined has environmental stress crack resistance. No cracking was observed.

Tested by:	Gary Grenier
Title:	Aerial Operations Manager
Date:	5/1/2008

HENDRIX

Environmental Stress Cracking Test
Gray High Density Polyethylene
(per ASTM D 1693)

Abstract
The purpose of this test was to evaluate the Gray High Density Polyethylene insulation used for the outer layer of our cable constructions.

Procedure
75 mil plaque samples were prepared from pellets. Tests were conducted following condition B of the specification.

Equipment
VWR Scientific oven set at 50° C for 48 hours and a test solution composed of 10% Igepal and 90% water.

Results
10 of the 10 samples tested passed with no cracking present.
Base Resin Lot: CL171219A1
Color Gray masterbatch Lot: 3801801

Conclusion
Test results indicate that the material examined has environmental stress crack resistance.

Tested by: Gary Grenier
Title: Aerial Operations Manager
Date: 5/1/2008

Weatherometer (UV) Test Report

Abstract
The purpose of this test is to demonstrate the Ultraviolet (UV) stability of the Black High Density Polyethylene material when used in an outdoor application.

This is demonstrated by measuring the percent retention of tensile strength and elongation after 3000 hours of weathering.

Procedure

Three (3) tensile samples of each were measured at each 1000 hour weathering interval and compared to original unaged results.

Weatherometer aging was performed to ASTM G 26-90 specifications, Test Method 1 (continuous light, intermittent water spray), Apparatus Type A, Optical filter type A (borosilicate), Irradiance setting .45 W/m sq. @ 340 nm.

Results (Lot 2936129)

	Tensile Original, psi	*Elongation Original, %*	*Tensile After 3000 Hrs % Retention*	*Elongation After 3000 Hrs % Retention*
Average of 3	3575	913	74	75

Hendrix Requirement: Minimum Retention 50% through 3000 hours.

Conclusion
Results are Stable through 3000 hours of weathering. These tests are examples of previous testing. Testing of current lots are in progress.

Tensile Testing Procedure
Testing was conducted using a .075" thick tensile bars and a tensile width of .100".

Tested by: Gary Grenier

Test Date: 8/23/2006

Report Date: 5/5/2008

BOSTON METROLOGY, INC.
TEST & MEASUREMENT INSTRUMENTATION SERVICES
TEL: (978) 467-4222 FAX: (978) 467-4224

B-M-I
270 Littleton Road, #13, Westford, MA 01886
www.bostonmetrology.com

CERTIFICATE OF CALIBRATION

Environmental conditions at the time of testing held to 68 Degrees F (+/- 5 F) and 20 to 60 % RH

Performed at 13 Olde Boston Square 270 Littleton Road, Westford, MA 01886

Customer ID	MARMON UTILITY - HENDRIX
	53 OLD WILTON ROAD MILFORD NH 030553119
Make	SPER SCIENTIFIC
Model	800005
Description	DIGITAL THERMOMETER
Serial Number	063405

Test Report	49720
PO Number	46948
Prodr:	20780
Rev Date:	1/6/2011
Rev #:	1
Temp (Deg C):	21
Humidity (% RH):	32
Owner ID	063405
Cal Date:	2/3/2016
Next Cal Due	2/3/2017
Employee ID	CATINO, MICHAEL

Boston Metrology, Inc. certifies the instrument or process referenced above to meet or exceed the applicable manufacturer's specifications (limits) for tested parameters with measurements and deviations recorded at the time of completion and issuance of this report and any attachments. Calibration has been performed in accordance with proprietary procedures and/or by methods of direct comparison to instrumentation maintained traceable through the N.I.S.T. to the International System of Units (SI). Accuracy ratios are a minimum of 4:1 unless noted in accordance with ANSI/NCSL-Z540-1, ISO 10012, and ISO/IEC 17025. Boston Metrology's best case measurement uncertainties are Expanded Uncertainties expressed at approximately 95% confidence level (K=2) and only applicable where "Accredited" Traceability is indicated.

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Disposition: **Unit Found To Be Within Tolerances As Received.**

FORM: CRSF-04-08

No.	PARAMETER	PARAMETER RANGE	NOMINAL	VALUE	DEVIATION	+/- LIMITS	PASS/FAIL
1	T1 ICE POINT REFERENCE	K THERMOCOUPLE: DEG C	0.0	-0.5	0.5000	0.7	pass
2	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-55.0	-55.6	0.6000	0.8	pass
3	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-25.0	-25.5	0.5000	0.7	pass
4	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	0.0	-0.5	0.5000	0.7	pass
5	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	70.0	69.4	0.6000	0.8	pass
6	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	100.0	99.3	0.7000	0.8	pass
7	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	200.0	199.3	0.7000	0.9	pass
8	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	500.0	499.3	0.7000	1.2	pass
9	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	700.0	699.0	1.0000	1.4	pass
10	T1 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	1000.0	999.0	1.0000	1.7	pass
11	T1 ICE POINT REFERENCE	J THERMOCOUPLE: DEG C	0.0	-0.4	0.4000	0.7	pass
12	T1 TYPE J TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-100.0	-100.6	0.6000	0.8	pass
13	T1 TYPE J TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-55.0	-55.5	0.5000	0.8	pass
14	T1 TYPE J TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	0.0	-0.4	0.4000	0.7	pass
15	T1 TYPE J TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	100.0	99.3	0.7000	0.8	pass
16	T1 TYPE J TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	200.0	199.2	0.8000	0.9	pass
17	T2 ICE POINT REFERENCE	K THERMOCOUPLE: DEG C	0.0	T1 ONLY		0.7	T1 ONLY
18	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-55.0	T1 ONLY		0.8	T1 ONLY
19	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-25.0	T1 ONLY		0.7	T1 ONLY
20	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	0.0	T1 ONLY		0.7	T1 ONLY
21	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	70.0	T1 ONLY		0.8	T1 ONLY
22	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	100.0	T1 ONLY		0.8	T1 ONLY
23	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	200.0	T1 ONLY		0.9	T1 ONLY
24	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	500.0	T1 ONLY		1.2	T1 ONLY
25	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	700.0	T1 ONLY		1.4	T1 ONLY
26	T2 TYPE K TC LINEARITY (+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	1000.0	T1 ONLY		1.7	T1 ONLY
27	T2 ICE POINT REFERENCE	J THERMOCOUPLE: DEG C	0.0	T1 ONLY		0.7	T1 ONLY

Approved By: Mario Guarracino — Quality Assurance

FORM: CR-06-14

INSTRUMENTATION AND TESTING TRACEABILITY

BMI ID #	Maufacturer	Model	Serial #	Due Cal	Report No.
E247	FLUKE	5520A	8870004	3/25/2016	42333
E194	AGILENT/HP	34401A	US36084569	5/22/2016	42357
E131	COLE-PARMER	8368-50	123343	3/3/2016	45736

Comments: **VERIFIED PROPER OPERATION AND ACCURACY TO MFR'S SPECS AT CUSTOMER SPECIFIED RECALL AS REQUESTED. NOTE: REPLACED DEAD 9V BATTERY. UNIT TESTING IN T1 ONLY.**

- 244 -Doscientos cuarenta y cuatro -

BOSTON METROLOGY, INC.
TEST & MEASUREMENT INSTRUMENTATION SERVICES
TEL: (978) 467-4222 FAX: (978) 467-4224

270 Littleton Road, #13, Westford, MA 01886
www.bostonmetrology.com

CERTIFICATE OF CALIBRATION

Environmental conditions at the time of testing held to 68 Degrees F (+/- 5 F) and 20 to 60 % RH

Performed at 13 Olde Boston Square 270 Littleton Road, Westford, MA 01886

Customer ID	MARMON UTILITY - HENDRIX
	53 OLD WILTON ROAD MILFORD NH 030553119
Make	SPER SCIENTIFIC
Model	800005
Description	DIGITAL THERMOMETER
Serial Number	063405

Test Report	49720
PO Number	46948
Prcdr:	20780
Rev Date:	1/6/2011
Rev #:	1
Temp (Deg C):	21
Humidity (% RH):	32
Owner ID	063405
Cal Date:	2/3/2016
Next Cal Due	2/3/2017
Employee ID	CATINO, MICHAEL

Boston Metrology, Inc. certifies the instrument or process referenced above to meet or exceed the applicable manufacturer's specifications (limits) for tested parameters with measurements and deviations recorded at the time of completion and issuance of this report and any attachments. Calibration has been performed in accordance with proprietary procedures and/or by methods of direct comparison to instrumentation maintained traceable through the N.I.S.T. to the International System of Units (SI). Accuracy ratios are a minimum of 4:1 unless noted in accordance with ANSI/NCSL-Z540-1, ISO 10012, and ISO/IEC 17025. Boston Metrology's best case measurement uncertainties are Expanded Uncertainties expressed at approximately 95% confidence level (K=2) and only applicable where "Accredited" Traceability is indicated.

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Disposition: **Unit Found To Be Within Tolerances As Received.**

28	T2 TYPE J TC LINEARITY	(+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-100.0	T1 ONLY	0.8	T1 ONLY
29	T2 TYPE J TC LINEARITY	(+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	-55.0	T1 ONLY	0.8	T1 ONLY
30	T2 TYPE J TC LINEARITY	(+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	0.0	T1 ONLY	0.7	T1 ONLY
31	T2 TYPE J TC LINEARITY	(+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	100.0	T1 ONLY	0.8	T1 ONLY
32	T2 TYPE J TC LINEARITY	(+/-0.1% RDG+ 0.7	APPLIED mV INPUT: DEG C	200.0	T1 ONLY	0.9	T1 ONLY

Approved By: Mario Guarracino Quality Assurance

FORM: CR-06-14

INSTRUMENTATION AND TESTING TRACEABILITY

BMI ID #	Maufacturer	Model	Serial #	Due Cal	Report No.
E247	FLUKE	5520A	8870004	3/25/2016	42333
E194	AGILENT/HP	34401A	US36084569	5/22/2016	42357
E131	COLE-PARMER	8368-50	123343	3/3/2016	45736

Comments: **VERIFIED PROPER OPERATION AND ACCURACY TO MFR'S SPECS AT CUSTOMER SPECIFIED RECALL AS REQUESTED. NOTE: REPLACED DEAD 9V BATTERY. UNIT TESTING IN T1 ONLY.**

Certificate of Calibration

KON-SULT

An ISO-IEC 17025 Accredited Company
www.wecalibrate.com

Performed at Kon-Sult, Inc.

For Marmon Utility LLC
53 Old Wilton Road
Milford NH, 03055

ANAB ACCREDITED CALIBRATION LABORATORY

Certificate No. 436703

Form: 203Rev.1.

Gage ID : 095410

Manufacturer : Mitutoyo

Description : 9 Pc. Gage Block Set

Model : 516-935

Tolerance : ±See Comments

Cal Date : 01/11/2017

Next Due Date : 1/11/2018

Procedure Used : K-S 004

Reference Standard : KS-2, KS-221

Uncertainty : ±2+2Lμin

Temperature : 20°C

Rel. Humidity : 27%

This certifies that the above-named equipment has been calibrated with proprietary procedures using standards traceable to the National Institute of Standards and Technology. Our calibration system complies with ANSI/NCSL Z540-1 and ISO 17025 and is accredited by ANSI-ASQ National Accreditation Board/ANAB with reference to our certificate and scope of accreditation AC-1243.

This gage block set was found to be IN TOLERANCE when calibrated.

Comments:

Tolerance: +8/-4 millionths thru 1in., 2in.=+16/-8 millionths.

Serial	Nominal	As Found	As Left
790059	0.0625in.	0.062496in.	0.062496in.
801298	0.1000	0.100002	0.100002
790251	0.1250	0.124996	0.124996
801002	0.2000	0.200002	0.200002
790064	0.2500	0.250003	0.250003
810710	0.3000	0.300003	0.300003
800296	0.5000	0.500008	0.500008
790319	1.0000	0.999998	0.999998
810805	2.0000	2.000003	2.000003

Calibrated By: Kim Febonio

Approved By: Sabrina Sellers
Sabrina Sellers

Reported uncertainties represent expanded uncertainties expressed at approximately 95% confidence level using a coverage factor of k=2. Since on-site conditions are more variable than in the laboratory, larger uncertainties are expected in the field than what is reported on our scope. This certificate cannot be reproduced except in full, without prior written approval of Kon-Sult, Inc.

Phone: (603) 882-7464
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6 Birch Street, Hudson, NH 03051-0480
Email : info@wecalibrate.net

BOSTON METROLOGY, INC.
TEST & MEASUREMENT INSTRUMENTATION SERVICES
TEL: (978) 467-4222 FAX: (978) 467-4224

B-M-I
270 Littleton Road, #13, Westford, MA 01886
www.bostonmetrology.com

CERTIFICATE OF CALIBRATION

FORM: CF0-06-14

Prcdr:	CHAR.
Rev Date:	8/31/2016
Rev #:	1
Temp (Deg C):	21
Humidity (% RH):	36

Customer MARMON UTILITY - HENDRIX

53 OLD WILTON ROAD MILFORD NH 030553119

Manufacturer EMPRO
Model HA100 50
Description CURRENT SHUNT
Serial Number NSN

Test Report 52498
Owner ID CS002
PO Number 050371
Cal Date: 8/31/2016
Next Cal Due 8/31/2017
Cal Data By CATINO, MICHAEL

Boston Metrology, Inc. certifies the instrument or process referenced above to meet or exceed the applicable manufacturer's specifications (limits) for tested parameters with measurements and deviations recorded at the time of completion and issuance of this report and any attachments. Calibration has been performed in accordance with proprietary procedures and/or by methods of direct comparison to instrumentation maintained traceable through the N.I.S.T. to the International System of Units (SI). Accuracy ratios are a minimum of 4:1 unless noted in accordance with ANSI/NCSL-Z540-1, ISO 10012, and ISO/IEC 17025.

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Services performed at 13 Olde Boston Square, 270 Littleton Road, Westford, MA 01886
Environmental conditions at the time of testing held to 68 Degrees F (+/- 5 F) and 20 to 60 % RH

Disposition as Received:

Characterization Measurement to Stated Uncertainty

UNIT RECEIVED IN GOOD CONDITION AND FREE FROM PHYSICAL ABERRATIONS. CHARACTERIZED SHUNT VALUE AT 10.00 Adc INPUT FOR 5.0021 mVdc DROP. CALCULATED RESISTANCE = 0.50021 mOHMS +/- 60 uOHMS BEST CASE ESTIMATED UNCERTAINTY.

INSTRUMENTATION AND TESTING TRACEABILITY

BMI ID #	Maufacturer	Model	Serial #	Due Cal	Report No.
E193	AGILENT/HP	3458A	2823A22955	6/30/2017	51465
E247	FLUKE	5520A	8870004	4/29/2017	237659-FLUKE
E213	FLUKE	5220A	3148111	3/30/2017	50556
E188	AGILENT / HP	6030A	3023A02085	2/2/2017	49697
E246	VAISALLA	HMI41/HMP46	V0530019	6/7/2017	51469
/					

Approved By:

Mario Guarracino
Quality Assurance

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ATLAS

AMETEK
MEASUREMENT & CALIBRATION TECHNOLOGIES

Certificate of Calibration

Certificate number	Calibration date
2016CW-9314470	**05/18/2016**

Customer	Marmon Utility LLC
Website	www.hendrix-wc.com
Phone	(603) 249-1307
Contact person	Mr. Gary Grenier
Address	53 Old Wilton Road
	03055 Milford
	US
Operating hours	14,689
Filter system used for calibration	
Instrument model	Others Chicago
Serial number	CW-931
Calibrated by	Will Lavallee Service Technician will.lavallee@ametek.com (773) 682-4947

Atlas Material Testing Technology LLC is certified to:
ISO 9001:2008 Registration no. 295036 QM08
ISO/IEC 17025:2005

ACCREDITED
CALIBRATION CERT #2101.01

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Exposure equipment (Others Chicago)
The Atlas instrument listed on page 1 is used for the exposure testing of materials.

Calibration procedure
Calibration is performed by comparing the values of the testing instrument with the values of the reference instrument and in accordance with Atlas Calibration Procedure. The reference instrument used is linked to National and/or International approved standards.

Measurement conditions
Measurements are obtained after a warm up period of 15 minutes.

Laboratory conditions

Temperature (°C)	Humidity (% RH)
22.0	30.0

Measurement results
The calibration and/or measurement are done in measurable variables as UV irradiance intensity, Wattage, Temperature and Relative Humidity.

Measurement results / data sheet
Temperature calibrations may be done as low as 65% of the machines operating range. The measurement results are as follows (see attached pages).

Calibration and measurement capability
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

Irradiance	+/- 6.5 % narrow band, 4.7 % broad band
Surface Temperature	+/- 0.7 °C
Chamber temperature	+/- 0.7 °C
Relative humidity	+/- 3.9 % RH
Wattage	+/- 0.12 KW

Measurement 1 - Irradiance340 nm (W/m².nm)

Set value	As found	As left	Deviation as found	Deviation as left
0.36	0.37	0.36	0.01	0.00

Dry bulb temperature (°C)

Set value	As found	As left	Deviation as found	Deviation as left
17.0	30.0	17.0	13.0	0.0

Wet bulb temperature (°C)

Set value	As found	As left	Deviation as found	Deviation as left
17.0	26.0	17.0	9.0	0.0

Documentos cuarentenados

Lamp power(kW)

Set value	Display value	Reference value as found	Reference value as left	Deviation as found	Deviation as left
3.00	3.00	3.00	3.00	0.0	0.0

Calibration Reference Lamp

Serial number	Date calibrated	Lamp Power (kW)	Reference value	Wave length
B-32572	07/17/2014	3.00	0.36	340 nm (W/m².nm)

Traceability

Parameter	Measurement device	Serial number	Date of calibration	Date due	Traceable to
Temperature	Fluke 51Thermometer	25690329WS	01/20/2016	01/20/2017	NIST
% Relative Humidity	Vaisala HM41 w/HMP 46	T2130232/T204004	01/21/2016	01/21/2017	NIST
Wattage	Hioki 3286-20 Power Meter	131206534	01/21/2016	01/21/2017	NIST

Date: 05/18/2016

Signature:

*This calibration certificate shall not be reproduced except in full, without written approval of the laboratory.

End of report.

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HENDRIX

Marmon Utility LLC
53 Old Wilton Road, Milford, New Hampshire 03055-3119

Kerite

J. Douglas Batty
Quality Manager
P: 603 249 1262
C: 603 903 2085

2/17/17

Ing. Diego González
Gerente Comercial
ESCAN S.A.
Tel.: (595-21) 611-230
Cel.: (595-981) 86 22 22
Fax: (595-21) 613-027

Per your request regarding ISO 17025 and the quality control testing. The manufacturing location is registered to ISO9001:2008. Because it is not an independent testing lab; it is not registered to the ISO 17025 standard. However the 3rd party vendors used for calibration of quality control equipment are registered to ISO 17025 and certifications provide by them for the equipment meet that requirement. Please let us know if there are any questions or comments.

Respectfully,

J. Douglas Batty

Test Report
Liquid Contaminant, Inclined-PlaneTracking and Erosion Test Report
(Per ASTM D 2303)

Abstract
The purpose of this test is to demonstrate the Resistance to Tracking of the Gray High Density Polyethylene (GHDPE) material which is used in an outdoor application. This is determined by measuring the material's "Time to Track" in an Incline Plane test fixture.

Procedure
Five (5), 125 mil thick plaque specimen were produced and tested as specified by the ASTM standard. Continuous voltage was applied for the duration of the test. The test was stopped at 1500 minutes.
Incline Plane Testing was performed in accordance to ASTM D 2303 specifications, "Time to Track Method". Specific test settings were; Voltage = 2.5 kV, Resistance = 10 k-ohms, Contaminant Flow Rate = .15 ml/min.

Equipment

Beckman Industrial Test Unit.
Model Number TERT 1A-10
Serial Number 41978
Calibrated: 6/19/2007 and is due 6/19/2008

Results

Material	Blend No.	*Specimen No.*	*Time Under Test*
Hendrix Gray	3689366	1	1540
		2	1540
		3	1540
		4	1540
		5	1540
		Average	1540

Note: No tracking, melting, or burning was present on any of the test specimens.
Hendrix Requirement: The test average must be 1500 minutes or greater with no tracking, melting, or burning present.

Conclusion
Results are stable through 1500 minutes of track testing.

Tested by: Chris Asselin
Reported by: Gary Grenier
Aerial Operations Manager
Reported: December 11, 2007

HENDRIX

Test Report
U-Bend

Abstract

The purpose of the testing was to meet or exceed the ANSI requirement of 125 v/mil for 6 hours.

Procedure

A cable sample was bent around a mandrel which was 8x the diameter of the cable and secured in that position. The bent cable was placed on a grounded metal plate. The conductor was exposed on the two cable ends and attached to high voltage. High voltage was applied at 31 kV for 6 hours.

Specification

ANSI Standard Number S-61-402

Cable Description

Reel Numbers:	(35mm2)	LN7EXG01
	(70mm2)	LN7EXD01
	(185mm2)	LN7EXB01

Results

The cable tested meet the requirements of ANSI S-61-402. No failures occurred.

Operations Manager

Date: 12/02/2009

Volume Resistivity Test
(per ICEA S-61-402)

PURPOSE
To measure the Volume Resistivity of semi-conducting layers of power cable.

PROCEDURE
Jacket Layer tested at Room Temperature
Sample Preparation: Using a commercial ruler a 6" long length from was taken from each cable design. Electrodes were added to the surface of the each cable sample spaced 2" apart and centered on the specimen by painting thin bands, (approx. 1/8"), of silver paint across the semi-conducting strand shield layer. Allow the paint to air-dry overnight. Voltage up to 200V was applied to one electrode and the current measured on the second electrode.

Calculation: All values are in OHM centimeters

Formula: $P = 1000[(V/I)(D^2-d^2)/]$

V=voltage in Volts
I=Current in mAmps
D=Cable outside diameter
D=Conductor diameter

PASS/FAIL CRITERIA
PASS: The volume resistivity shall exceed 500 ohm-cm.

Equipment: Calibrated test set.

Results: In each sample tested the 200 volts did not allow current flow. A value of .001 milliAmps was used to indicate the limit of the equipment.

Calculated results: $35mm^2 = 1.152 \times 10^8$

$70mm^2 = 1.382 \times 10^8$

$185mm2 = 1.962 \times 10^8$

Reported by: Gary Grenier

Operations Manager

Date: 12/02/2009

CERTIFIED TEST REPORT NUMBER 28610
INSULATED POWER CABLE RATED 5 TO 35 KV

PURCHASER	ANDE
PURCHASER'S ORDER #	OCI7686-LPI385/2009
PURCHASER'S SPECIFICATION #	Hendrix Special requirements per Gary Grenier Quality Plan as of 10-15-09: to Test Plan
PURCHASER'S PART #	S0035PA25B3-00
CABLE DESCRIPTION	Al 35 mm2 7X PACT 25kV 75 3LYR 0.38 3.183.18 BTRHDPEBLK
CABLE QUANTITY	5051 Meters
NUMBER OF REELS	5
DOCUMENT ID	208201000587000
HENDRIX ORDER NUMBER	030333
REPORT DATE	December 1st, 2009

CERTIFICATION OF TESTS

Gordon D. Estabrook Jr. Mgr. QA & Prod. Eng.
Typewritten Name and Title

Reel #	Tensile Cond Shield (MPa)	Elongation Cond Shield (psi)	Tensile Insulation (MPa)	Elongation Insulation (%)	Tensile Jacket (MPa)	Elongation Jacket (%)
Specs	Min=8.27	Min=200	Min=12.41	Min=500	Min=19.3	Min=400
LN7EXE01	13.5	608	16	720	21	675

Reel #	Bonding layers	Concentricity (%)	SS Wall Avg (mm)	Ins Wall Avg (mm)	Jacket Wall Avg (mm)	Jacket OD (mm)	Spark 25 KV	DC Resistance Ohm/Km @ 20C
LN7EXE01	Pass	93.8	.0215	.1301	.116	20.422	Pass	.854
LN7EXE01	Pass	96.0	.0213	.1240	.124	20.472	Pass	
LN7EXE01	Pass	94.6	.0221	.1247	.123	20.447	Pass	
LN7EXE01	Pass	96.6	.0249	.1231	.124	20.472	Pass	
LN7EXE01	Pass	95.4	.0221	.1217	.126	20.371	Pass	

Inventory Report			
Reel #	Total Ftg	Top	Drum
LN7EXE01	1019	6920558	6919539
LN7EXE02	1008	6921568	6920560
LN7EXE03	1008	6922583	6921575
LN7EXE04	1008	6923593	6922585
LN7EXE05	1008	6924602	6923594

CERTIFIED TEST REPORT NUMBER 28602
INSULATED POWER CABLE RATED 5 TO 35 KV

PURCHASER	ANDE
PURCHASER'S ORDER #	OCI7686-LPI385/2009
PURCHASER'S SPECIFICATION #	Hendrix Special requirements per Gary Grenier Quality Plan
PURCHASER'S PART #	Matricula 403-5030
CABLE DESCRIPTION	Al 70mm2 7X PACT 25kV 75 3LYR 0.38 3.183.18 BTRHDPEBLK
CABLE QUANTITY	31140 Meters
NUMBER OF REELS	16
DOCUMENT ID	208203000587000
HENDRIX ORDER NUMBER	030333
REPORT DATE	November 30th, 2009

CERTIFICATION OF TESTS

Gordon D. Estabrook Jr. Mgr. QA & Prod. Eng.
Typewritten Name and Title

Table2						
Reel #	Tensile Cond Shield (MPa)	Ten Unaged Jacket (MPa)	Tensile Unaged Insulation (MPa)	Elon Unaged Jacket (psi)	Elongation Cond Shield (%)	Elongation Unaged Insulation (%)
Specs	Min=8.27	Min=19.3	Min=12.41	Min=400	Min=200	Min=600
LN7EXC01	13.5	21	16	675	608	720

Reel #	Bonding layers	Concentricity (%)	SS Wall Avg (mm)	Ins Wall Avg (mm)	Jacket Wall Avg (mm)	Jacket OD (mm)	Spark (KV)	DC Resistance Ohm/km @20C
Specs		Min=85 Max=100					25	
LN7EXC01	Pass	91.90	.5080	3.5662	2.6822	23.3680	Pass	.422
LN7EXC02	Pass	93.10	.5080	3.5230	2.7711	23.3172	Pass	
LN7EXC03	Pass	98.90	.5182	3.3452	2.9235	23.2664	Pass	
LN7EXC04	Pass	94.50	.5131	3.3731	2.8677	23.2664	Pass	
LN7EXC05	Pass	96.20	.5156	3.2258	3.0556	23.3172	Pass	
LN7EXC06	Pass	94.00	.5334	3.2817	3.0226	23.3680	Pass	
LN7EXC07	Pass	93.50	.4978	3.2614	3.0175	23.3172	Pass	
LN7EXC08	Pass	94.80	.5486	3.3198	2.8727	23.2156	Pass	
LN7EXC09	Pass	93.30	.5258	3.2436	2.9870	23.2918	Pass	
LN7EXC10	Pass	95.60	.5131	3.3198	2.9642	23.2918	Pass	
LN7EXC11	Pass	95.00	.5080	3.2791	3.0455	23.3172	Pass	
LN7EXC12	Pass	96.60	.5004	3.3325	3.0785	23.3680	Pass	
LN7EXC13	Pass	95.20	.5182	3.1369	3.1521	23.3680	Pass	
LN7EXC14	Pass	96.00	.5512	3.1547	3.1852	23.3680	Pass	
LN7EXC15	Pass	97.90	.5436	3.1496	3.1826	23.3934	Pass	
LN7EXC16	Pass	97.20	.5105	3.1445	3.1953	23.3680	Pass	

Inventory Report			
Reel #	Total Ftg	Top	Drum
LN7EXC01	1014	6890195	6889181
LN7EXC02	1008	6891205	6890197
LN7EXC03	1008	6892215	6891207
LN7EXC04	1008	6893225	6892217
LN7EXC05	1008	6894234	6893226
LN7EXC06	1008	6895243	6894235
LN7EXC07	1008	6896252	6895244
LN7EXC08	1009	6897262	6896253
LN7EXC09	1009	6898272	6897263
LN7EXC10	1009	6899282	6898273
LN7EXC11	1006	6900289	6899283
LN7EXC12	1009	6901304	6900295
LN7EXC13	1009	6902314	6901305

LN7EXC14	1009	6903324	6902315
LN7EXC15	1009	6904334	6903325
LN7EXC16	1009	6905344	6904335