

SOUTHWEST RESEARCH INSTITUTE

6220 CULEBRA ROAD • POST OFFICE DRAWER 28510 • SAN ANTONIO, TEXAS, 78228-0510 • TEL (210) 522-5215 • FAX (210) 522-369

To: Don Bannon
From: Walt Hill, Metrology Group Leader
Institute Calibration Laboratory

Date: Nov. 22, 2005
Subject: Out-of-tolerance Notice

The purpose of this notice is to alert you of a condition, which may have caused erroneous measurements affecting safety or the quality of products or services your organization provides. The attached as-found readings are provided for your evaluation to determine if the instrument listed below had an impact and if further action is required.

When the as-found results are near the specification limit, +/- a margin less than the measurement uncertainty, it is not possible to state in-tolerance or out-of-tolerance with a 95% level of confidence. It is the Institute Calibration Laboratory policy that the client is made aware of this situation because the end-user is taking some of the risk that the instrument listed below may not meet the end-user measurement requirements.

Your review/evaluation should be conducted in accordance with your organizational quality policy and procedural requirements. If we can be of further assistance, please contact the Calibration Laboratory at 522-5215.

Manufacturer: Keithley **Model:** 617

Description: Electrometer **Serial Number:** 537418

Asset Number: 1044 **User ID Number:**

Last Calibration: May 27, 2005

Date Received for Service: Oct. 31, 2005 **Work Order Number:** 303066544

Service Requested: Scheduled calibration

Remarks: See data sheet for Out Of Tolerance values.

OUT OF TOLERANCE

SOUTHWEST RESEARCH INSTITUTE®

To: Don Bannon, Div20, B57
From: Institute Calibration Laboratory; Paul Depmore
Date: November 22, 2005
Subject: Review of Work Request Number 303066544

The work you requested is held pending your review. Please review the information provided and respond with your approval or further instructions for work to proceed. Return a signed copy via mail to Cal Lab Bldg 64, FAX (522-4834) or reply to this email. If you have questions or require additional information please call 522-5215.

Unit Received: Oct. 31, 2005 Work Requested: Scheduled Calibration
Manufacturer: Keithley Model: 617 Description: Electrometer
Serial Number: 537418 Asset Number: 1044 User ID:

Cause of Review: Unit Fails mAmp Meter reading test in the 2 and 20 mAmp ranges. Also cable provided with unit is broken; no continuity on the triax cable low. All other tests and ranges are within tolerance and pass. Suggest authorization for internal adjustment or authorization to send unit to Manufacturer for repair. Please provide any publication for adjustment procedure.

If no reply has been received by Dec. 5, 2005 the unit will be returned without action.

Approved Disapproved return unit as is ()

Date: 11/22/05

Instructions PERFORM SOFTWARE CALIBRATION/MAINTENANCE/ADJUSTMENT

Authorized by DON BANNON
Print or Type Name

Signature

Thank you for your timely response,

Walt Hill, Metrology Group Leader
Institute calibration Laboratory

Southwest Research Institute
Calibration Laboratory
Measurement Report

| | | | | | |
|-------------|-----------|-------|--------------|------------|-----------|
| Work Order: | 303066544 | Mfr. | KEITHLEY | Technician | PRD |
| Asset No. | 001044 | Model | 617 | Cal Date. | 22-Nov-05 |
| Serial No. | 537418 | Type. | ELECTROMETER | | |

Remarks:

| Function/Range | Test Point | TI Reading | Difference | +/-Test Limits | +/-Uncertainty | Found |
|----------------|------------|------------|------------|----------------|----------------|--------|
| DC Amps | pAmps | pAmps | pAmps | pAmps | pAmps | Result |
| 200 pA | 190.00 | 189.00 | -1.00 | 3.05 | 0.031 | Pass |
| | nAmps | nAmps | nAmps | nAmps | nAmps | |
| 2 nA | 1.9000 | 1.8980 | -0.0020 | 0.0053 | 0.00022 | Pass |
| 20 nA | 19.000 | 18.998 | -0.002 | 0.049 | 0.0022 | Pass |
| 200 nA | 190.00 | 189.99 | -0.01 | 0.49 | 0.031 | Pass |
| | uAmps | uAmps | uAmps | uAmps | uAmps | |
| 2 uA | 1.9000 | 1.9000 | 0.0000 | 0.0033 | 0.00019 | Pass |
| 20 uA | 19.000 | 19.003 | 0.003 | 0.030 | 0.0019 | Pass |
| 200 uA | 190.00 | 190.02 | 0.02 | 0.30 | 0.019 | Pass |
| | mAmps | mAmps | mAmps | mAmps | mAmps | |
| 2 mA | 1.9000 | 1.9050 | 0.0050 | 0.0033 | 0.00014 | Fail |
| 20 mA | 19.000 | 19.052 | 0.052 | 0.030 | 0.0014 | Fail |
| | nC | nC | nC | nC | nC | |
| 20 nC | 19.000 | 18.973 | -0.027 | 0.077 | 0.0012 | Pass |
| DCV | mVolts | mVolts | mVolts | mVolts | mVolts | |
| 200 mVolt | 190.00 | 190.01 | 0.01 | 0.14 | 0.012 | Pass |
| | Volts | Volts | Volts | Volts | Volts | |
| 2 Volt | 0.4000 | 0.4000 | 0.0000 | 0.0003 | 0.00012 | Pass |
| | 0.8000 | 0.8000 | 0.0000 | 0.0005 | 0.00012 | Pass |
| | 1.2000 | 1.2000 | 0.0000 | 0.0007 | 0.00012 | Pass |
| | 1.6000 | 1.6000 | 0.0000 | 0.0009 | 0.00012 | Pass |
| | 1.9000 | 1.9000 | 0.0000 | 0.0011 | 0.00012 | Pass |
| 20 Volt | 19.000 | 19.000 | 0.000 | 0.011 | 0.0012 | Pass |
| 200 Volt | 190.00 | 190.02 | 0.02 | 0.14 | 0.012 | Pass |
| Resistance | MOhm | MOhm | MOhm | MOhm | MOhm | |
| 20 GOhm | 110 | 111 | 1 | 4 | 1.2 | Pass |
| 2 GOhm | 100.0 | 100.0 | 0.0 | 1.6 | 0.16 | Pass |
| 200 MOhm | 100.00 | 99.99 | -0.01 | 0.31 | 0.10 | Pass |
| 20 MOhm | 10.000 | 10.002 | 0.002 | 0.026 | 0.0012 | Pass |
| 2 MOhm | 1.0000 | 1.0001 | 0.0001 | 0.0026 | 0.00012 | Pass |
| | kOhm | kOhm | kOhm | kOhm | kOhm | |
| 200 kOhm | 100.00 | 99.99 | -0.01 | 0.26 | 0.012 | Pass |
| 20 kOhm | 10.000 | 10.001 | 0.001 | 0.016 | 0.0017 | Pass |
| 2 kOhm | 1.0000 | 1.0000 | 0.0000 | 0.00211 | 0.00010 | Pass |

Southwest Research Institute
Calibration Laboratory
Measurement Report

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|-------------|-----------|-------|--------------|------------|-----------|
| Work Order: | 303066544 | Mfr. | KEITHLEY | Technician | PRD |
| Asset No. | 001044 | Model | 617 | | |
| Serial No. | 537418 | Type. | ELECTROMETER | Cal Date. | 22-Nov-05 |

| Function/Range | Test Point | TI Reading | Difference | +/-Test Limits | +/-Uncertainty | Found |
|----------------|------------|------------|------------|----------------|----------------|--------|
| Voltage Source | Volts | Volts | Volts | Volts | Volts | Result |
| | 0.000 | 0.032 | 0.032 | 0.050 | 0.0012 | Pass |
| | 10.000 | 10.013 | 0.013 | 0.070 | 0.0012 | Pass |
| | 50.000 | 50.022 | 0.022 | 0.150 | 0.0012 | Pass |
| | 100.000 | 100.036 | 0.036 | 0.250 | 0.0015 | Pass |
| | -100.000 | -100.005 | -0.005 | 0.250 | 0.0015 | Pass |
| | -50.000 | -49.980 | 0.020 | 0.150 | 0.0012 | Pass |
| | -10.000 | -9.972 | 0.028 | 0.070 | 0.0012 | Pass |

END OF REPORT



SOUTHWEST RESEARCH INSTITUTE®

6220 Culebra Road, P.O. Drawer 28510
Institute Quality Systems
Institute Calibration Laboratory
Phone: 210-522-5215 Fax 210-522-4834



Certificate of Calibration

0972-01

Submitted By: DIV20
Address: B57
Contact: DON BANNON
Manufacturer Model: KEITHLEY 617
Description: ELECTROMETER
Serial No: 537418
Asset No: 001044
Procedure: CL-658, MAR/02

Work Order: 303066544
Date Issued: Nov 23, 2005
Calibration Date: Nov 23, 2005
***Calibration Due:** May 23, 2006
Calibration Location: Bldg. 64
Environment: Temp. 72.0°F Hum. 42 %RH
****Data Type:** AS-LEFT

This certificate documents traceability to the National Institute of Standards and Technology (NIST) and the International System of Units (SI). The Laboratory quality system conforms to ISO/IEC 17025, 1999, ANSI/NCSL Z540-1-1994 and relevant requirements of the ISO 9000-2000 standard. This certificate shall not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. This certificate shall not be used to claim product endorsement by Southwest Research Institute, American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government. Results of this calibration relate only to the instrument described above at the time of calibration and does not imply any long term stability of the instrument.

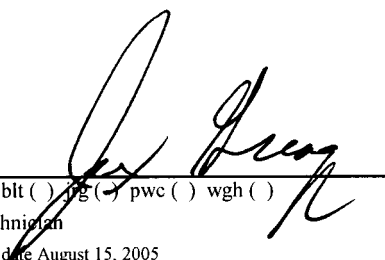
*Determined by the customer, does not imply the instrument will remain within tolerance as any number of factors may cause an out-of-tolerance condition before this date. **Found/Left = adjustment and/or repair was not required, As Left = adjusted and/or repaired was required. The client has sole responsibility for determination of in-/out-of-tolerance or compliance/noncompliance. See Remarks or attached Measurement Report with the same Work Order number for data.

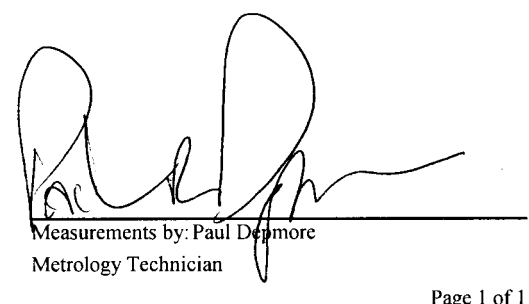
Reported uncertainty calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM) and represents an expanded uncertainty with a coverage factor of k=2 to approximate a 95% confidence level.

Remarks: None

Standards Used

| Asset No. | Serial No. | Manufacturer | Model | Description | Cal Due |
|-----------|------------|--------------|----------|-------------|------------|
| 000182 | 5200003 | FLUKE | 5700A/EP | CALIBRATOR | Dec 27, 05 |

Reviewed by: 
Metrology Technician
m:\a2la1.rpt Rev date August 15, 2005


Measurements by: Paul Depmore
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Measurement Report

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|-------------|-----------|-------|--------------|------------|-----------|
| Work Order: | 303066544 | Mfr. | KEITHLEY | Technician | PRD |
| Asset No. | 001044 | Model | 617 | Cal Date. | 22-Nov-05 |
| Serial No. | 537418 | Type. | ELECTROMETER | | |
| Remarks: | | | | | |

| Function/Range | Test Point | TI Reading | Difference | +/-Test Limits | +/-Uncertainty | Left |
|----------------|------------|------------|------------|----------------|----------------|--------|
| DC Amps | pAmps | pAmps | pAmps | pAmps | pAmps | Result |
| 200 pA | 190.00 | 189.00 | -1.00 | 3.05 | 0.031 | Pass |
| | nAmps | nAmps | nAmps | nAmps | nAmps | |
| 2 nA | 1.9000 | 1.8980 | -0.0020 | 0.0053 | 0.00022 | Pass |
| 20 nA | 19.000 | 18.998 | -0.002 | 0.049 | 0.0022 | Pass |
| 200 nA | 190.00 | 189.99 | -0.01 | 0.49 | 0.031 | Pass |
| | uAmps | uAmps | uAmps | uAmps | uAmps | |
| 2 uA | 1.9000 | 1.9000 | 0.0000 | 0.0033 | 0.00019 | Pass |
| 20 uA | 19.000 | 19.003 | 0.003 | 0.030 | 0.0019 | Pass |
| 200 uA | 190.00 | 190.02 | 0.02 | 0.30 | 0.019 | Pass |
| | mAmps | mAmps | mAmps | mAmps | mAmps | |
| 2 mA | 1.9000 | 1.8990 | -0.0010 | 0.0033 | 0.00014 | Pass |
| 20 mA | 19.000 | 18.996 | -0.004 | 0.030 | 0.0014 | Pass |
| | nC | nC | nC | nC | nC | |
| 20 nC | 19.000 | 18.973 | -0.027 | 0.077 | 0.0012 | Pass |
| DCV | mVolts | mVolts | mVolts | mVolts | mVolts | |
| 200 mVolt | 190.00 | 190.01 | 0.01 | 0.14 | 0.012 | Pass |
| | Volts | Volts | Volts | Volts | Volts | |
| 2 Volt | 0.4000 | 0.4000 | 0.0000 | 0.0003 | 0.00012 | Pass |
| | 0.8000 | 0.8000 | 0.0000 | 0.0005 | 0.00012 | Pass |
| | 1.2000 | 1.2000 | 0.0000 | 0.0007 | 0.00012 | Pass |
| | 1.6000 | 1.6000 | 0.0000 | 0.0009 | 0.00012 | Pass |
| | 1.9000 | 1.9000 | 0.0000 | 0.0011 | 0.00012 | Pass |
| 20 Volt | 19.000 | 19.000 | 0.000 | 0.011 | 0.0012 | Pass |
| 200 Volt | 190.00 | 190.02 | 0.02 | 0.14 | 0.012 | Pass |
| Resistance | MOhm | MOhm | MOhm | MOhm | MOhm | |
| 20 GOhm | 110 | 111 | 1 | 4 | 1.2 | Pass |
| 2 GOhm | 100.0 | 100.0 | 0.0 | 1.6 | 0.16 | Pass |
| 200 MOhm | 100.00 | 99.99 | -0.01 | 0.31 | 0.10 | Pass |
| 20 MOhm | 10.000 | 10.002 | 0.002 | 0.026 | 0.0012 | Pass |
| 2 MOhm | 1.0000 | 1.0001 | 0.0001 | 0.0026 | 0.00012 | Pass |
| | kOhm | kOhm | kOhm | kOhm | kOhm | |
| 200 kOhm | 100.00 | 99.99 | -0.01 | 0.26 | 0.012 | Pass |
| 20 kOhm | 10.000 | 10.001 | 0.001 | 0.016 | 0.0017 | Pass |
| 2 kOhm | 1.0000 | 1.0000 | 0.0000 | 0.00211 | 0.00010 | Pass |

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Measurement Report

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|-------------|-----------|-------|--------------|------------|-----------|
| Work Order: | 303066544 | Mfr. | KEITHLEY | Technician | PRD |
| Asset No. | 001044 | Model | 617 | Cal Date. | 22-Nov-05 |
| Serial No. | 537418 | Type. | ELECTROMETER | | |

| Function/Range | Test Point | TI Reading | Difference | +/-Test Limits | +/-Uncertainty | Left |
|----------------|------------|------------|------------|----------------|----------------|--------|
| Voltage Source | Volts | Volts | Volts | Volts | Volts | Result |
| | 0.000 | 0.032 | 0.032 | 0.050 | 0.0012 | Pass |
| | 10.000 | 10.013 | 0.013 | 0.070 | 0.0012 | Pass |
| | 50.000 | 50.022 | 0.022 | 0.150 | 0.0012 | Pass |
| | 100.000 | 100.036 | 0.036 | 0.250 | 0.0015 | Pass |
| | -100.000 | -100.005 | -0.005 | 0.250 | 0.0015 | Pass |
| | -50.000 | -49.980 | 0.020 | 0.150 | 0.0012 | Pass |
| | -10.000 | -9.972 | 0.028 | 0.070 | 0.0012 | Pass |

END OF REPORT