

# GEOSCIENCES AND ENGINEERING DIVISION NONCONFORMANCE REPORT

Project No. 20.00751.006

NCR No. 2005-37

**PART 1: DESCRIPTION OF NONCONFORMANCE**

Keithley 617 Electrometer, s/n 537418, AN001044, D.C. amps section, 2 mA and 20 mA ranges, are out of tolerance per SwRI Cal. Lab. Ranges were adjusted back into tolerance by SwRI Cal. Lab.

Triaxial input cable (Keithley p/n 6011) lacks continuity on black lead.

Initiated by: Don Bannon

Date: 29Nov05

Action Required by: Xihua He

Response Due Date: 14Dec05

**PART 2: PROPOSED DISPOSITION AND CORRECTIVE ACTION**

**Disposition:** No measurements are affected by this out of tolerance condition. Replace the triaxial input cable.

**Basis of Disposition:** The electrometer was found to be out of tolerance in the 2 and 20 mA DC current ranges. At these two ranges the electrometer had measurement error of 5  $\mu$ A and 52  $\mu$ A, respectively. In laboratory tests only DC voltage was used to check open circuit potential before actual tests starting. The error in DC current that is less than 1-percent would not have any effect on corrosion potential measurements. In addition, electrometer is used for checking potential and is not used for recording any test data. Potentials recorded from laboratory tests are obtained from potentiostats, verified per TOP-022.

**Action to Correct Nonconformance:** According to the calibration specification of the Keithley 617 electrometer, the calibration of the electrometer is not dependent on the cable. The electrometer was adjusted and recalibrated with a calibration laboratory cable. This electrometer will be supplied with a new cable and will continue to be included on the calibration recall list.

Target date for completion: 14Dec05

Proposed by: Xihua He

*Xihua He*

Date: 12/02/05

**PART 3: APPROVAL**

Manager: *[Signature]*

Date: 12/5/05

Director of QA: *[Signature]*

Date: 12/5/05

Comments/Instructions:

**PART 4: CLOSE OUT**

Comments:

*No additional verification was needed*

**Distribution:**

Original-CENTER QA Records

ORIGINATOR *BANNON*

PRINCIPAL INVESTIGATOR *He*

MANAGER *SMIN*

ASSISTANT DIRECTOR *MORTANTY*

Verified by: *[Signature]*

Date: 12/5/05

# SOUTHWEST RESEARCH INSTITUTE

6220 CULEBRA ROAD • POST OFFICE DRAWER 28510 • SAN ANTONIO, TEXAS 78228-0510 • TEL (210) 522-0215 • FAX (210) 522-3695

To: Don Bannon

From: Walt Hill, Metrology Group Leader  
Institute Calibration Laboratory

Date: Nov. 22, 2005

Subject: Out-of-tolerance Notice

## OUT OF TOLERANCE

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, and are 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: 537118

Asset Number: 1044 User ID Number:

Last Calibration: May 27, 2005

Date Received for Service: Oct. 31, 2005 Work Order Number: B-306544

Service Requested: Scheduled calibration

Remarks: See data sheet for Out Of Tolerance values.

## OUT OF TOLERANCE

OUT OF TOLERANCE

## 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 (X) Disapproved return unit as is ( ) Date: 11/22/05

Instructions (X) 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

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.

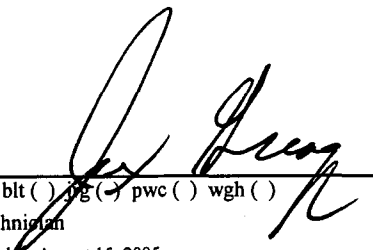
\*Determined by the customer, does not imply the instrument will remain within tolerance as any number of factors may cause an out-of-tolerance condition before this date. \*\*Found/Left = adjustment and/or repair was not required, As Left = adjusted and/or repaired was required. The client has sole 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.

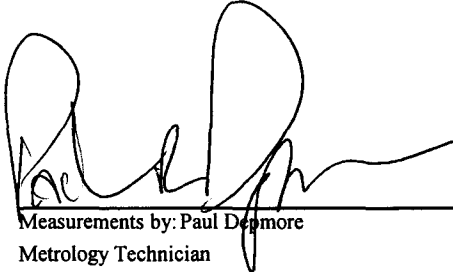
Reported uncertainty calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM) and represents an expanded uncertainty with a coverage factor of k=2 to approximate a 95% confidence level.

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:   
Metrology Technician

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	Left
DC Amps	pAmps	pAmps	pAmps	pAmps	pAmps	Result
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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	
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Resistance	MOhm	MOhm	MOhm	MOhm	MOhm	
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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
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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

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

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	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