

# GEOSCIENCES AND ENGINEERING DIVISION NONCONFORMANCE REPORT

Project No. 20.00751.006

NCR No. 2005-33

**PART 1: DESCRIPTION OF NONCONFORMANCE**

Keithley 617 Electrometer, s/n 0579628, AN003400, D.C. voltage section is out of tolerance per SwRI Cal. Lab. Unit was adjusted back into tolerance by Rothe Development, Inc.

Initiated by: Don Bannon

Date: 23Sep05

Action Required by: Xihua He

Response Due Date: 7Oct05

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

**Disposition:** Accept data obtained in tests using this electrometer as is.

**Basis of Disposition:** The electrometer was found to be out of tolerance in DC voltage with ranges of 200 mV, 2 V, 20 V, and 200 V. DC voltage ranges of 200 mV and 2 V were used in laboratory tests to check open circuit potential before actual tests starting. At 200 mV and 2 V ranges the electrometer had measurement error of 0.16 mV and 1.7 mV, respectively. Open circuit potential measurements have requirements of +/- 5 mV and measurement error of 0.16 mV and 1.7 mV would not have a significant effect on corrosion 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:** The electrometer was adjusted and recalibrated. This electrometer will continue to be included on the calibration recall list.

Proposed by: Xihua He



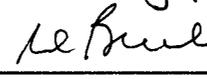
Target date for completion: 7Oct05

Date: 9/30/05

**PART 3: APPROVAL**

Manager: 

Date: 9/30/05

Director of QA: 

Date: 9/30/05

Comments/Instructions:

**PART 4: CLOSE OUT**

Comments:

*No action is necessary*

**Distribution:**

Original-CENTER QA Records

ORIGINATOR 

PRINCIPAL INVESTIGATOR X. He

MANAGER J. Spin

ASSISTANT DIRECTOR S. molten r.

Verified by: 

Date: 9/30/05

**SOUTHWEST RESEARCH INSTITUTE  
CALIBRATION LABORATORY  
MEMORANDUM**

**September 21, 2005**

**To:** DON BANNON DIV20 B57

**From:** Institute Calibration Laboratory

**Subject:** Status of Calibration Supplier

**Manufacturer/Model:** KEITHLEY 617

**Description:** ELECTROMETER

**Serial Number:** 0579628

**Asset Number:** 003400

**Work Order Number:** 303065788

**Date Calibrated:** September 14, 2005

**Supplier:** ROTHE DEVELOPMENT, SAN ANTONIO TX - AUDIT - 648-3

**Remarks:** ROTHE CERT. # 19349:1126692985.

Supplier is on the Approved Suppliers List (ASL).

Supplier is not on the Approved Suppliers List.

Calibration is ISO 17025 accredited.

Calibration is not ISO 17025 accredited.

There is no known supplier to meet ISO 17025 accreditation at this time.

Please contact the Institute Calibration Laboratory, extension 5215, if you have any questions about the condition of this equipment or calibration documentation. Please do not remove or damage any of the calibration seals.

Attachment(s) 6

**To:** Dpn Bannon, Div 20, Bldg 57

**From:** Walt Hill, Metrology Group Leader  
Institute Calibration Laboratory

**Date:** Sep. 21, 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:** 0579628

**Asset Number:** 3400 **User ID Number:**

**Last Calibration:** September 13, 2004

**Date Received for Service:** Sep. 09, 2005 **Work Order Number:** 303065788

**Service Requested:** Scheduled calibration

**Remarks:** See 'Found Data'.

OUT OF TOLERANCE

OUT OF TOLERANCE



*Rothe Development, Inc.*

METROLOGY SERVICES DIVISION

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 PH:210-648-3131

**CERTIFICATE OF CALIBRATION**

**ISSUED TO:** Southwest Research Institute (30)  
6220 Culebra  
San Antonio, TX 78284

**MFG:** Keithley  
**MODEL:** 617  
**NOMEN:** PROG ELECTROMETER  
**S/N:** 0579628  
**CUST. ID:** 3400  
**CAL DATE:** 9/14/05  
**DUE DATE:**

**CONTROL NO:** 103 - 19349

**TECHNICIAN:** 4

**SPECIFICATIONS:** MFG

**PROCEDURE:** MFG

**WORK ORDER:** 002046703

**CUSTOMER P.O.:** 01571R/ST443835/1.20.00755.000

**RECEIVED CONDITION:** OUT OF TOLERANCE

**RETURNED CONDITION:** IN TOLERANCE

**CALIBRATION PERFORMED AT:** RDMSD

**CALIBRATION INTERVAL:** 0

**TEMPERATURE:** 72.0°F

**RELATIVE HUMIDITY:** 41%

**DATE RECEIVED:** 9/12/05

**COMMENTS:**

**ATTACHMENTS:** CALIBRATION DATA 4 SHEETS

All calibrations performed at Rothe Development, Inc. Metrology Services Division meet the requirements of ANSI / NCSL Z540-1-1994, ANSI / ISO / IEC 17025, ISO / IEC GUIDE 25, and ISO 10012-1, and are traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement(s) does not exceed 25% (TUR ≥ 4:1) of the instrument specification(s) unless noted in the COMMENTS section.

TR#	MFG	MODEL	SERIAL NO.	DUE DATE
20	FLUKE	5700A/EP	4605002	11/23/2005
258	FLUKE	5725A	6585002	11/23/2005
75	JRL	NMN	75	2/28/2006
235	GUILDLINE	6500A	59660	2/7/2006
30	HP	3458A	2823A01926	10/26/2005

APPROVED BY:

*Will B. Wright*

CMS

QCO

DATE: 9/15/05

RDMSD 1001  
11/03

This certificate may not be reproduced, except in full, without written approval of Rothe Development, Inc. Metrology Services Division

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 617 ELECTROMETER

CUSTOMER: SWRI  
 WO NUMBER: 002046703  
 SERIAL: 0529628  
 CUST ID: 3400

DATE: 14 Sep 05  
 TECH: John Thomas  
 INST NO: 19349

CALIBRATION DATA TAKEN

INCOMING ✓  
 OUTGOING \_\_\_\_\_

CONDITION OF EQUIPMENT

IN TOLERANCE \_\_\_\_\_  
 OUT OF TOLERANCE ✓ \*  
 DC Voltage Section

INPUT CURRENT VERIFICATION

SET-UP: 2PA RANGE, INPUT CAPPED, TOLERANCE <66 C      READING  
 \_\_\_\_\_ - .0057 pA

CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
20 mA	ZERO CHECK	-0.001	<u>0.000</u>	+0.001 mA
	19 mA	18.970	<u>19.002</u>	19.030
2 mA	1.9 mA	1.8967	<u>1.9000</u>	1.9033
200 uA	190 uA	189.70	<u>189.81</u>	190.30 uA
20 uA	19 uA	18.970	<u>18.984</u>	19.030
2 uA	1.9 uA	1.8967	<u>1.8980</u>	1.9033
200 nA	190 nA	189.51	<u>189.81</u>	190.49 nA
20 nA	19 nA	18.951	<u>18.985</u>	19.049
2 nA	1.9 nA	1.8947	<u>1.8985</u>	1.9053
200 pA	190 pA	186.95	<u>189.59</u>	193.05 pA
20 pA	19 pA	18.689	<u>18.968</u>	19.311
2 pA	1.9 pA	1.8630	<u>1.8960</u>	1.9370

COULOMB ACCURACY

RANGE	INPUT	MIN	READING	MAX
2nC	1V / 1000pF	0.9949	<u>1.0004</u>	1.0051 nC

DC VOLTAGE ACCURACY

RANGE	INPUT	MIN	READING	MAX	
200 mV	+190 mV	189.87	<u>189.84</u>	190.13	mV
	-190 mV	189.87	<u>189.84</u>	190.13	
2 V	+1.9 V	1.8990	<u>1.8983</u>	1.9010	V
	-1.9 V	1.8990	<u>1.8985</u>	1.9010	
20 V	+19 V	18.990	<u>18.980</u>	19.010	
	-19 V	18.990	<u>18.982</u>	19.010	
200 V	+190 V	189.86	<u>189.80</u>	190.14	
	-190 V	189.86	<u>189.82</u>	190.14	

RESISTANCE ACCURACY

RANGE	ACUTAL INPUT	TOLERANCE		READING	
2 kΩ (19)	<u>1.8999 k</u>	±0.2% +4C	(P) / F	<u>1.8986</u>	kΩ
20 kΩ	<u>18.999 k</u>	±0.15% +1C	(P) / F	<u>18.983</u>	
200 kΩ	<u>190.00 k</u>	±0.25% +1C	(P) / F	<u>189.82</u>	
2 MΩ	<u>1.9000 M</u>	±0.25% +1C	(P) / F	<u>1.8983</u>	MΩ
20 MΩ	<u>18.997 M</u>	±0.25% +1C	(P) / F	<u>18.977</u>	
200 MΩ (1)	<u>100.00 M</u>	±0.3% +1C	(P) / F	<u>99.92</u>	
2 GΩ	<u>.99596</u>	±1.5% +1C	(P) / F	<u>.9964</u>	GΩ
20 GΩ	<u>9.9786</u>	±1.5% + 1C	(P) / F	<u>9.971</u>	
200 GΩ	<u>98.856</u>	±1.5% + 1C	(P) / F	<u>98.36</u>	

OUTPUT VOLTAGE SOURCE ACCURACY

OUTPUT SETTING	MIN	READING	MAX	
00.00V	-0.050	<u>0.016</u>	+0.050	V
+01.00 V	0.948	<u>1.016</u>	1.052	
-01.00 V	0.948	<u>0.984</u>	1.052	
+10.00 V	9.930	<u>10.02</u>	10.07	
-10.00 V	9.930	<u>9.988</u>	10.07	
+25.00 V	24.90	<u>25.03</u>	25.10	
-25.00 V	24.90	<u>24.99</u>	25.10	
+50.00 V	49.85	<u>50.04</u>	50.15	
-50.00 V	49.85	<u>50.00</u>	50.15	
+100.00 V	99.75	<u>100.05</u>	100.25	
-100.00 V	99.75	<u>100.02</u>	100.25	

INST NO: 19349

INCOMING  
 OUTGOING

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 617 ELECTROMETER

CUSTOMER: SWRI  
 WO NUMBER: 002046703  
 SERIAL: 0579628  
 CUST ID: 3400

DATE: 14 Sep 05  
 TECH: Peter Steiner  
 INST NO: 19349

CALIBRATION DATA TAKEN

INCOMING \_\_\_\_\_  
 OUTGOING ✓

CONDITION OF EQUIPMENT

IN TOLERANCE ✓  
 OUT OF TOLERANCE \_\_\_\_\_

INPUT CURRENT VERIFICATION

SET-UP: 2PA RANGE, INPUT CAPPED, TOLERANCE <66 C      READING  
 .0009 pA

CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX	
20 mA	ZERO CHECK	-0.001	<u>0.000</u>	+0.001	mA
	19 mA	18.970	<u>19.001</u>	19.030	
2 mA	1.9 mA	1.8967	<u>1.9001</u>	1.9033	
200 uA	190 uA	189.70	<u>190.01</u>	190.30	uA
20 uA	19 uA	18.970	<u>19.001</u>	19.030	
2 uA	1.9 uA	1.8967	<u>1.9002</u>	1.9033	
200 nA	190 nA	189.51	<u>189.96</u>	190.49	nA
20 nA	19 nA	18.951	<u>18.994</u>	19.049	
2 nA	1.9 nA	1.8947	<u>1.8994</u>	1.9053	
200 pA	190 pA	186.95	<u>190.08</u>	193.05	pA
20 pA	19 pA	18.689	<u>19.009</u>	19.311	
2 pA	1.9 pA	1.8630	<u>1.9012</u>	1.9370	

COULOMB ACCURACY

RANGE	INPUT	MIN	READING	MAX	
2nC	1V / 1000pF	0.9949	<u>1.0005</u>	1.0051	nC

DC VOLTAGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 mV	+190 mV	189.87	<u>190.00</u>	190.13 mV
	-190 mV	189.87	<u>190.01</u>	190.13
2 V	+1.9 V	1.8990	<u>1.9000</u>	1.9010 V
	-1.9 V	1.8990	<u>1.9001</u>	1.9010
20 V	+19 V	18.990	<u>19.000</u>	19.010
	-19 V	18.990	<u>19.001</u>	19.010
200 V	+190 V	189.86	<u>190.00</u>	190.14
	-190 V	189.86	<u>190.03</u>	190.14

RESISTANCE ACCURACY

RANGE	ACTUAL INPUT	TOLERANCE	P / F	READING	
2 kΩ (19)	<u>1.8999 K</u>	±0.2% +1C	P / F	<u>1.9000</u>	kΩ
20 kΩ	<u>18.999 K</u>	±0.15% +1C	P / F	<u>18.999</u>	
200 kΩ	<u>190.00 K</u>	±0.25% +1C	P / F	<u>190.00</u>	
2 MΩ	<u>1.9000 M</u>	±0.25% +1C	P / F	<u>1.9000</u>	MΩ
20 MΩ	<u>18.997 M</u>	±0.25% +1C	P / F	<u>18.996</u>	
200 MΩ (1)	<u>100.00 M</u>	±0.3% +1C	P / F	<u>100.00</u>	
2 GΩ	<u>.9959 G</u>	±1.5% +1C	P / F	<u>.9965</u>	GΩ
20 GΩ	<u>9.9786</u>	±1.5% +1C	P / F	<u>9.976</u>	
200 GΩ	<u>98.856</u>	±1.5% +1C	P / F	<u>98.53</u>	

OUTPUT VOLTAGE SOURCE ACCURACY

OUTPUT SETTING	MIN	READING	MAX
00.00V	-0.050	<u>0.016</u>	+0.050 V
+01.00 V	0.948	<u>1.015</u>	1.052
-01.00 V	0.948	<u>0.984</u>	1.052
+10.00 V	9.930	<u>10.02</u>	10.07
-10.00 V	9.930	<u>9.984</u>	10.07
+25.00 V	24.90	<u>25.02</u>	25.10
-25.00 V	24.90	<u>24.98</u>	25.10
+50.00 V	49.85	<u>50.02</u>	50.15
-50.00 V	49.85	<u>49.98</u>	50.15
+100.00 V	99.75	<u>100.01</u>	100.25
-100.00 V	99.75	<u>99.98</u>	100.25

INST NO: 19349

INCOMING  
 OUTGOING