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) 4

SOUTHWEST RESEARCH INSTITUTE

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

OUT OF TOLERANCE

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

CERT. NUMBER: 19349:1126692985

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 R 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: 0020467 03
SERIAL: 0579628
CUST ID: 3400

DATE: 14 Sep 05
TECH: [illegible]
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	0.000	+0.001 mA
	19 mA	18.970	19.002	19.030
2 mA	1.9 mA	1.8967	1.9000	1.9033
200 uA	190 uA	189.70	189.81	190.30 uA
20 uA	19 uA	18.970	18.984	19.030
2 uA	1.9 uA	1.8967	1.8980	1.9033
200 nA	190 nA	189.51	189.81	190.49 nA
20 nA	19 nA	18.951	18.985	19.049
2 nA	1.9 nA	1.8947	1.8985	1.9053
200 pA	190 pA	186.95	189.59	193.05 pA
20 pA	19 pA	18.689	18.968	19.311
2 pA	1.9 pA	1.8630	1.8960	1.9370

COULOMB ACCURACY

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

DOC. DATE: 9/12/2004

DC VOLTAGE ACCURACY

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

RESISTANCE ACCURACY

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

OUTPUT VOLTAGE SOURCE ACCURACY

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

INST NO: 19349

DOC. DATE: 9/12/2004

✓ 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: [illegible]
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	0.000	+0.001	mA
	19 mA	18.970	19.001	19.030	
2 mA	1.9 mA	1.8967	1.9001	1.9033	
200 uA	190 uA	189.70	190.01	190.30	uA
20 uA	19 uA	18.970	19.001	19.030	
2 uA	1.9 uA	1.8967	1.9002	1.9033	
200 nA	190 nA	189.51	189.96	190.49	nA
20 nA	19 nA	18.951	18.994	19.049	
2 nA	1.9 nA	1.8947	1.8994	1.9053	
200 pA	190 pA	186.95	190.08	193.05	pA
20 pA	19 pA	18.689	19.009	19.311	
2 pA	1.9 pA	1.8630	1.9012	1.9370	

COULOMB ACCURACY

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

DOC. DATE: 9/12/2004

DC VOLTAGE ACCURACY

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

RESISTANCE ACCURACY

RANGE	ACUTAL INPUT	TOLERANCE		READING	
2 kΩ (19)	1.8999 k	±0.2% +4C	P / F	1.9000	kΩ
20 kΩ	18.999 k	±0.15% +1C	P / F	18.999	
200 kΩ	190.00 k	±0.25% +1C	P / F	190.00	
2 MΩ	1.9000 M	±0.25% +1C	P / F	1.9000	MΩ
20 MΩ	18.997 M	±0.25% +1C	P / F	18.996	
200 MΩ (1)	100.00 M	±0.3% +1C	P / F	100.00	
2 GΩ	.9959 G	±1.5% +1C	P / F	.9965	GΩ
20 GΩ	9.978 G	±1.5% + 1C	P / F	9.976	
200 GΩ	98.856	±1.5% + 1C	P / F	98.53	

OUTPUT VOLTAGE SOURCE ACCURACY

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

INST NO: 19349

DOC. DATE: 9/12/2004

___ INCOMING
✓ OUTGOING