Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

42678

CAL DATE: 03/19/96

DUE DATE: 03/19/97

ISSUED TO: Southwest Research Institute (30)
6220 Culebra, Bldg. 64/Division 30
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 6517

SERIAL # 0599913

TYPE Electometer/High Resistan

CONTROL: 103 - 21652
TECHNICIAN #: 4
SPECIFICATIONS: MFG
PROCEDURE: MFG
WORK ORDER #: 51335
CUSTOMER PO #: 03602/ST278203/20-0760

RECEIVED **IN-SPECS** ☐
OUT-OF-SPECS ☒

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 73°F **, Relative Humidity** 33% **.**

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfgr	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	03/04/96	3	06/04/96
TR 235	6500A	GUILDLINE	59660	TERAOHMETER	09/01/95	12	09/01/96
TR 100	5500A	Fluke	6320016	Calibrator	06/06/95	12	06/06/96
TR 75	NMN	JRL	75	RESISTANCE BOX	07/11/95	12	07/11/96

------- Test Report Numbers -------
DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
OHM NIST TEST# 255675
TEMP NIST TEST# 253806
Hz WWVB Transmission

INSPECTED BY Joe A Mendoza
COMMENTS:

RDI 1001

SOUTHWEST RESEARCH INSTITUTE

Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
03/20/96

Issued to: DARRELL DUNN DIV20 ,B57
Manufacturer/Model: KEITH/6517
Nomenclature: ELECTROMETER/HIGH RESISTANCE SYSTEM
Serial Number: 0599913
Asset Number: 004313
Notes:

ENVIRONMENTAL CONDITIONS

Temperature: 73.0F

Relative Humidity: 33%

CALIBRATION INFORMATION

Procedure Number: MFG
Remarks: CAL BY ROTHE DEV., SA, TX, CERT# 42678
NO OUT OF TOL. REPT. GEN. NEW IN SYSTEM

Accuracy: MFG
Received OUT Tolerance

Calibration was in accordance with requirements of MIL-STD-45662A. Measurements are traceable to the National Institute of Standards and Technology. Inspection and test data are on file and available for inspection.

STANDARDS USED FOR CERTIFICATION

Asset #	Serial #	Mfg	Model #	Nomenclature	Cal Date	Int. Cal Due
VENDOR						

Certified by : _____

Calibration Date: 03/19/96
Interval: 12 months
Next Calibration Due: 03/19/97

Certificate#: 19545

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY MODEL 6517 ELECTROMETER

CUSTOMER: SwRI
WO NUMBER: 51335
SERIAL: 0599913
CUST ID:

DATE: 19 Mar 96
TECH: RJS
INST NO: 21652

CALIBRATION DATA TAKEN

INCOMING
OUTGOING ✓

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
OUT OF TOLERANCE

DC VOLTAGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 V	+1.9 V	1.89949	1.90009	1.90052
	-1.9 V	1.89949	1.90009	1.90052
20 V	+19 V	18.9950	18.9997	19.0050
	-19 V	18.9950	18.9996	19.0050
200 V	+190 V	189.883	189.994	190.117
	-190 V	189.883	189.993	190.117

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
20 pA	19 pA	18.8070	18.9947	19.1930
200 pA	190 pA	188.095	190.170	191.905
2 nA	1.9 nA	1.89590	1.89908	1.90410
20 nA	19 nA	18.9615	18.9921	19.0385
200 nA	190 nA	189.615	189.994	190.385
2 uA	1.9 uA	1.89800	1.89976	1.90200
20 uA	19 uA	18.9805	18.9962	19.0195
200 uA	190 uA	189.805	189.984	190.195
2 mA	1.9 mA	1.89800	1.89988	1.90200
20 mA	19 mA	18.9805	18.9994	19.0195

COULOMBS ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.9 nC	1.89235	1.89796	1.90765
20 nC	19 nC	18.9235	18.9830	19.0765
200 nC	190 nC	189.235	190.250	190.765
2 uC	1.9 uC	1.89235	1.90577	1.90765

RESISTANCE ACCURACY

RANGE	INPUT	READING TOLERANCES >1.00000	<.999999	READING
2 MΩ	1.00000 M	±126 C	±1260 C	1.00007
20 MΩ	10.0000 M	±126 C	±1260 C	10.0022
200 MΩ	100.236 M	±151 C	±1510 C	100.228
2 GΩ	1.00198 G	±226 C	±2260 C	1.00190
20 GΩ	9.97984 G	±226 C	±2260 C	9.97696
200 GΩ	98.8990 G	±351 C	±3510 C	98.7590
2 TΩ	.995529 T	±351 C	±3510 C	.995602

VOLTAGE SOURCE ACCURACY

SOURCE RANGE	OUTPUT	MIN	READING	MAX
±100 V	0.000 V	-0.01	-.0026	0.01
	+25.000 V	24.9525	24.9958	25.0475
	+50.000 V	49.915	49.9965	50.085
	+75.000 V	74.8775	74.9981	75.1225
	+100.000 V	99.840	99.9994	100.160
	-25.000 V	24.9525	25.0011	25.0475
	-50.000 V	49.915	50.0031	50.085
	-75.000 V	74.8775	75.0031	75.1225
	-100.000 V	99.840	100.006	100.160
±1000 V	+250.00 V	249.525	249.980	250.475
	+500.00 V	499.150	499.960	500.850
	+750.00 V	748.775	749.982	751.225
	+1000.00 V	998.40	999.951	1001.60
	-250.00 V	249.525	250.017	250.475
	-500.00 V	499.150	500.007	500.850
	-750.00 V	748.775	750.021	751.225
	-1000.00 V	998.40	1000.002	1001.60

____ INCOMING
✓ OUTGOING

TEMPERATURE AND HUMIDITY TURN ON = MENU / GENERAL / A/D CONTROLS / DATE-STAMP / ∧ OR ∨

TEMPERATURE ACCURACY

TEMP	MIN	READING	MAX
-25° C	-23.4	25.0	-26.6
0° C	-1.5	0.0	+1.5
50° C	48.35	49.9	51.65
100° C	98.2	99.7	101.8
150° C	148.05	149.8	151.95

HUMIDITY ACCURACY

VOLTAGE INPUT	MIN	READING	MAX
0.000 V	0	0	1 %
0.250 V	24	25	26
0.500 V	49	50	51
0.750 V	74	75	76
1.000 V	99	100	101

___ INCOMING
✓ OUTGOING

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY MODEL 6517 ELECTROMETER

CUSTOMER: SwRI
WO NUMBER: 51335
SERIAL: 0599913
CUST ID:

DATE:
TECH: PJS
INST NO: 21652

CALIBRATION DATA TAKEN

INCOMING ✓
OUTGOING

CONDITION OF EQUIPMENT

IN TOLERANCE
OUT OF TOLERANCE ✓ *
Resistance Section

DC VOLTAGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 V	+1.9 V	1.89949	1.89998	1.90052
	-1.9 V	1.89949	1.89997	1.90052
20 V	+19 V	18.9950	19.0000	19.0050
	-19 V	18.9950	19.0000	19.0050
200 V	+190 V	189.883	189.981	190.117
	-190 V	189.883	189.980	190.117

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
20 pA	19 pA	18.8070	18.9567	19.1930
200 pA	190 pA	188.095	190.136	191.905
2 nA	1.9 nA	1.89590	1.90007	1.90410
20 nA	19 nA	18.9615	19.0048	19.0385
200 nA	190 nA	189.615	189.990	190.385
2 uA	1.9 uA	1.89800	1.89966	1.90200
20 uA	19 uA	18.9805	18.9976	19.0195
200 uA	190 uA	189.805	189.976	190.195
2 mA	1.9 mA	1.89800	1.89975	1.90200
20 mA	19 mA	18.9805	18.9999	19.0195

COULOMBS ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.9 nC	1.89235	1.89738	1.90765
20 nC	19 nC	18.9235	18.9502	19.0765
200 nC	190 nC	189.235	190.274	190.765
2 uC	1.9 uC	1.89235	1.90468	1.90765

RESISTANCE ACCURACY

RANGE	INPUT	READING TOLERANCES >1.00000	<.999999	READING	
2 MΩ	1.00000 M	±126 C	±1260 C	1.00012	
20 MΩ	10.0000 M	±126 C	±1260 C	10.0005	
200 MΩ	100.238 M	±151 C	±1510 C	100.063	*
2 GΩ	1.002076	±226 C	±2260 C	1.00197	
20 GΩ	9.976586	±226 C	±2260 C	9.97348	
200 GΩ	98.84626	±351 C	±3510 C	98.5953	
2 TΩ	.994723 T	±351 C	±3510 C	.993921	

VOLTAGE SOURCE ACCURACY

SOURCE RANGE	OUTPUT	MIN	READING	MAX
±100 V	0.000 V	-0.01	+.001	0.01
	+25.000 V	24.9525	24.9985	25.0475
	+50.000 V	49.915	49.9982	50.085
	+75.000 V	74.8775	74.9989	75.1225
	+100.000 V	99.840	99.9993	100.160
	-25.000 V	24.9525	24.9999	25.0475
	-50.000 V	49.915	49.9978	50.085
	-75.000 V	74.8775	74.9997	75.1225
	-100.000 V	99.840	100.0015	100.160
±1000 V	+250.00 V	249.525	249.975	250.475
	+500.00 V	499.150	499.981	500.850
	+750.00 V	748.775	749.994	751.225
	+1000.00 V	998.40	999.946	1001.60
	-250.00 V	249.525	250.001	250.475
	-500.00 V	499.150	500.016	500.850
	-750.00 V	748.775	749.996	751.225
	-1000.00 V	998.40	999.990	1001.60

✓ INCOMING
____ OUTGOING

TEMPERATURE AND HUMIDITY TURN ON = MENU / GENERAL / A/D CONTROLS / DATE-STAMP / ∧ OR ∨

TEMPERATURE ACCURACY

TEMP	MIN	READING	MAX
-25° C	-23.4	-24.8	-26.6
0° C	-1.5	+0.2	+1.5
50° C	48.35	50.0	51.65
100° C	98.2	99.8	101.8
150° C	148.05	149.9	151.95

HUMIDITY ACCURACY

VOLTAGE INPUT	MIN	READING	MAX
0.000 V	0	0	1 %
0.250 V	24	25	26
0.500 V	49	50	51
0.750 V	74	75	76
1.000 V	99	100	101

✓ INCOMING
____ OUTGOING

Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
Department of Quality Assurance
Calibration Laboratory

Certificate of Calibration

24 March 1997

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 6517
Description: ELECTROMETER/HIGH RESISTANCE SY
Serial Number: 0599913
Asset Number: 004313

Environmental Conditions

Temperature: 72.0 Deg. F **Humidity:** 32%

Calibration Information

Calibration was in accordance with requirements of MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Measurements are traceable to the National Institute of Standards and Technology (NIST). This report may not be reproduced except in full without written approval of the originator. Inspection and test data are on file and available for inspection.

Calibration Date: 20 Mar 97 **Calibration Procedure:** MFG

Interval: 12 months **Accuracy:** MFG

Next Calibration Due: 20 Mar 98 **Received:** In Tolerance

Remarks: CALIBRATED BY ROTHE DEV., SAN ANTONIO, TX.
CERT. #47349.

Certificate # 24577 **Signed:**

LAST PAGE OF REPORT
Total Pages Printed: 1

6220 Culebra Road
San Antonio, TX 78238
Department of Quality Assurance
Calibration Laboratory

ACCREDITED

Certificate of Calibration

18 May 1998

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 6517
Description: ELECTROMETER/HIGH RESISTANCE SYSTEM
Serial Number: 0599913
Asset Number: 004313

Environmental Conditions

Temperature: 72 Deg. F **Humidity:** 41 % RH

Calibration Information

Calibration was in accordance with requirements of MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Measurements are traceable to the National Institute of Standards and Technology (NIST). This report may not be reproduced except in full without written approval of the originator. Inspection and test data are on file and available for inspection.

The uncertainty of the calibration was sufficient to determine that the instrument met the manufacturer's specifications.

Calibration Date: 17 May 98 **Calibration Procedure:** MFG

Interval: 12 months **Received:** Out of Tolerance

Next Calibration Due: 17 May 99

Remarks: CALIBRATED BY ROTHE DEV., SAN ANTONIO, TX.
ROTHE CERT. #52829.

Out of Tolerance Data

The unit was found to be in an Out of Tolerance condition as indicated below. An evaluation should be made by the user to determine any adverse impact that may have occurred.

ADJUSTED TO SPECIFICATIONS: RECEIVED UNIT WITH DC VOLTAGE OUT OF TOLERANCE.
SENT TO MFG FOR ADJUSTMENT. CALIBRATED WHEN RETURNED.
DC VOLTAGE ACCURACY

RANGE	INPUT	TOL	READING BEFORE	READING AFTER
2 V	+1.9 V	1.89949-1.90052	1.89907*	1.90015
	-1.9 V	1.89949-1.90052	-1.89905*	-1.90014
200 V	+190 V	189.883-190.117	189.824*	189.987
	-190 V	189.883-190.117	-189.822*	189.986

* INDICATES OUT OF TOLERANCE CONDITION.

OUT OF TOLERANCE

Certificate of Calibration

18 May 1998

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 6517
Description: ELECTROMETER/HIGH RESISTANCE SYSTEM
Serial Number: 0599913
Asset Number: 004313

Signed:
Title:

Checked By:
Title:

LAST PAGE OF REPORT
Total Pages Printed: 2

Certificate # **29193**

6220 Culebra Road
San Antonio, TX 78238
Department of Quality Assurance
Calibration Laboratory

Out of Tolerance Notice

22 November 1999

The following asset was found to be out of tolerance when submitted for calibration. Please be aware measurements made with this instrument may be inaccurate.

Instrument Information

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 6517
Description: ELECTROMETER
Serial Number: 0599913
Asset Number: 004313
SwRI Cap No.: NONE
Accuracy: MFG SPECS
Calibration Interval: 12 months
Calibration Procedure: MFG
Remarks: CALIBRATED BY ROTHE DEVELOPMENT, SAN ANTONIO, TX.

Calibration Results

Out of Tolerance Date: 8 Jun 99
Last Valid Calibration Date: 17 May 98

DC VOLTAGE ACCURACY

RANGE	INPUT	AS FOUND	LIMITS
2 V	+1.9 V	* 1.89943	1.89949 TO 1.90052
	-1.9 V	* 1.89943	1.89949 TO 1.90052

Signed: _____

Checked by: _____

SOUTHWEST RESEARCH INSTITUTE
CALIBRATION LABORATORY
MEMORANDUM

November 22, 1999

To: DARRELL DUNN DIV20 B57

From: Jim Patterson

Subject: Calibration by an approved supplier

Manufacturer/Model: KEITHLEY 6517A
Description: ELECTROMETER
Serial Number: 0735984
Asset Number: 007670
Calibration Due: November 19, 2000
Remarks: ROTHE DEV. CERTIFICATE NO.: 60973.
REPLACED KEITHLEY 6517 ELECTROMETER S/N 0599913.

Supplier: ROTHE DEVELOPMENT, INC., SAN ANTONIO, TX

The above item was sent to an approved supplier who is listed on the SwRI Approved Suppliers List (ASL). This supplier is qualified to supply a product or service in support of project activities that require the use of approved suppliers. Please notify Mark Romero, extension 5215, of any discrepancies with the item or calibration documentation.

Attachment(s) 4

m:\asl1.rpt Rev 17 Nov 99