

Thunder Scientific Corporation

Certificate of Calibration

Customer: SOUTHWEST RESEARCH INSTITUTE
6220 Culebra Rd., San Antonio, TX 78238
Purchase Order: 359043K
Item: Model 2500 Humidity Generator
Serial Number: 0210373
Date Tested: 18 Feb 03
Procedure: CL-SOP-0013
Cert. Number: 3222

This certifies that the above product was calibrated in compliance with ISO/IEC 17025 using applicable Thunder Scientific procedures.


At planned intervals, Thunder Scientific measurement and generation standards are calibrated by comparison to or measurement against national standards, natural physical constants, consensus standards, or by ratio type measurements using self-calibrating techniques.

National standards are administered by the National Institute of Standards and Technology (NIST) or other recognized national standards laboratories.

On the date tested, your instrument met its published operating specifications.

The environment in which this instrument was calibrated is maintained within the operating specifications of the instrument and the standards.

Supporting documentation relative to traceability is on file and is available for examination upon request.


Thunder Scientific Corporation

THUNDER SCIENTIFIC CORPORATION
623 Wyoming Blvd SE, Albq, NM 87123

REPORT OF HUMIDITY INTERCOMPARISON

Customer: SOUTHWEST RESEARCH INSTITUTE
6220 Culebra Rd., San Antonio, TX 78238
Purchase Order Number: 359043K

Item: Model 2500 Humidity Generator s/n 0210373
Comparison Required: As Left at 8.3, 10, 20, 50 & 80% R.H. at a test temperature of 25.0 °C.

Control Number: 3222
Procedure: CL-SOP-0013
Comparison Date: 18 Feb 03
Ambient Conditions: 24.4 °C & 39% RH
Test Gas: Air
Generator Flow Rate: 20 slpm
Sample Flow Rate: 30 L/h

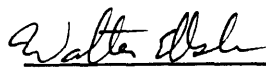
Stds. Used: MBW DP-30 EN0040 expires 08 Aug 03
±0.1 °C FP/DP uncertainty
Hart 1504/5665 EN0017 exp 19 Apr 03
±0.01 °C uncertainty
Mensor PCS400 EN0037 exp 04 Jun 03
±0.01 % FS uncertainty (100/500psiA)

Standards incorporated to establish this comparison are NIST traceable. The humidity standard (the 2500) produces an atmosphere of known humidity based on the "two-pressure" principle. The accuracy of the Model 2500 was tested using the MBW DP-30 chilled mirror hygrometer to read dewpoint and then the "MBW %RH" column was calculated using the "Hart Temp" column and "Mensor Pressure" column.

As Left Data:

MBW Dew Point °C	Hart Temp °C	Mensor Pressure psiA	2500 Saturation psiA	2500 Saturation °C	2500 Chamber psiA	2500 Chamber °C	MBW %RH	2500 %RH	Difference %RH
-11.13	24.99	12.070	149.90	25.00	12.07	25.01	8.27	8.26	0.00
-8.76	24.99	12.072	123.72	25.00	12.07	25.01	9.97	10.00	0.03
0.51	24.99	12.069	60.86	25.00	12.07	25.01	20.01	20.05	0.04
13.85	24.99	12.069	24.19	25.00	12.07	25.01	49.97	50.01	0.04
21.30	24.99	12.065	15.08	25.01	12.07	25.01	79.99	80.02	0.03

Adjustments: None. System verification only.


Walter Ellsbury, Cal Tech


Brad Bennewitz, Lab Manager

Results relate only to the items tested or calibrated.
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623 Wyoming Blvd SE, Albq, NM 87123

REPORT OF CALIBRATION

Customer: SOUTHWEST RESEARCH INSTITUTE
6220 Culebra Rd., San Antonio, TX 78238
Purchase Order Number: 359043K

Item: Model 2500 Humidity Generator s/n 0210373

Low Range Pressure Transducer s/n 884090
High Range Pressure Transducer s/n 860426

Low Pressure Calibration Required: As Left at approximately 12.5, 30, & 50 psiA.
High Pressure Calibration Required: As Left at approximately 50, 100, & 150 psiA.

Cert. Number: 3222
Procedure: CL-SOP-0013
Calibration Date: 17 Feb 03
Ambient Conditions: 24.4 °C & 39% RH
Test Gas: Nitrogen

Std's Used: Mensor PCS400 EN0037 exp 04 Jun 03
±0.01% FS uncertainty (100/500psiA)


Standards incorporated to establish this calibration are traceable to NIST thru Ruska Instrument Corp Cal # 01050916360. The Mensor PCS400 was used to calibrate the pressure transducers. Three reference pressures were generated for each transducer. The coefficients were then calculated and stored to memory.


Thunder Scientific certifies this calibration to be in compliance with ISO/IEC 17025.

As Left Data:

Low Pressure Transducer:			High Pressure Transducer:		
Test psiA	2500 psiA	Error psiA	Test psiA	2500 psiA	Error psiA
-----	-----	-----	-----	-----	-----
12.129	12.13	0.001	50.005	50.00	-0.005
20.000	20.00	0.000	75.000	75.00	0.000
30.000	30.00	0.000	100.005	100.0	-0.005
40.000	40.00	0.000	125.000	125.0	0.000
50.000	50.00	0.000	150.000	150.0	0.000

Adjustments: Calibration coefficients were calculated and saved to memory.


Walter Ellsbury, Cal Tech


Brad Bennewitz, Lab Manager

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THUNDER SCIENTIFIC CORPORATION
623 Wyoming Blvd SE, Albq, NM 87123

REPORT OF CALIBRATION

Customer: SOUTHWEST RESEARCH INSTITUTE
6220 Culebra Rd., San Antonio, TX 78238
Purchase Order Number: 359043K

Item: Model 2500 Humidity Generator s/n 0210373

Temperature Calibration Required: As Left at approximately 0, 35, & 70 °C.
Verified at 0, 20, 35, 50 & 70 °C.

Cert. Number: 3222

Std's Used: Hart 1504/5665 EN0029 exp 03 Jun 03
±0.01 °C uncertainty

Procedure: CL-SOP-0013

Calibration Date: 17 Feb 03

Ambient Conditions: 24.6 °C & 33% RH


Test Medium: FC-77 Fluorinert™

The 2500's four thermistors were compared to the Hart 1504/5665 reference thermometer in a temperature bath containing FC-77 Fluorinert™. Three known temperatures were generated. Coefficients were then calculated and stored to memory. This calibration is traceable to NIST thru Hart calibration report # A052546 and is in compliance with ISO/IEC 17025.

As Left Data:

Actual °C	Saturation °C	Error °C	Chamber °C	Error °C	Presatur °C	Error °C	Exp Valve °C	Error °C
70.064	70.06	-0.004	70.06	-0.004	70.05	-0.014	70.06	-0.004
49.967	49.98	0.013	49.97	0.003	49.97	0.003	49.98	0.013
35.021	35.03	0.009	35.02	-0.001	35.02	-0.001	35.02	-0.001
20.018	20.02	0.003	20.02	0.003	20.01	-0.007	20.02	0.003
0.152	0.149	-0.003	0.147	-0.006	0.148	-0.005	0.151	-0.001

Adjustments: Calibration coefficients were calculated and saved to memory.



Walter Ellsbury, Cal Tech



Brad Bennewitz, Lab Manager

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THUNDER SCIENTIFIC CORPORATION
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REPORT OF CALIBRATION

Customer: SOUTHWEST RESEARCH INSTITUTE
6220 Culebra Rd., San Antonio, TX 78238
Purchase Order Number: 359043K

Item: Model 2500 Humidity Generator s/n 0210373

Mass Flow Transducer s/n 56953

Calibration Required: As Left at approximately 0, 10, & 20 slpm

Cert. Number: 3222
Procedure: CL-SOP-0013
Calibration Date: 18 Feb 03
Ambient Conditions: 24.8 °C & 46% RH
Test Medium: Air

Stds Used: BIOS DC-2 EN0003 exp 09 Oct 03
uncertainty $\pm 1.4\%$ of reading

Flow output of the 2500 was monitored by a BIOS DC-2 primary flow meter. Three reference flows were generated and coefficients were calculated and stored to memory. Thunder Scientific certifies this calibration complies to ISO/IEC 17025 and is traceable to NIST through Bios International Corp. calibration report # 12629.

As Left Data:

Reference slpm	2500 slpm	Error slpm
-----	-----	-----
19.65	19.64	-0.01
10.14	10.30	0.16
0.000	0.013	0.01

Adjustments: Calibration coefficients were calculated and saved to memory.



Walter Ellsbury, Cal Tech



Brad Bennewitz, Lab Manager

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Calibration Report
for
TSC Model 2500 Humidity Generator

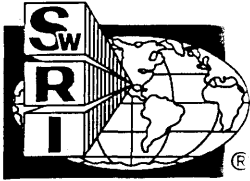
S/N 0210373
Date 02/18/03

Temperature	Zero	Span	Linearity	CalDate
Saturation Temperature	-1.39307E-01	9.95320E-03	6.32127E-09	02/17/03
PreSat Temperature	1.04580E-01	9.94137E-03	7.74850E-09	02/17/03
Ex Valve Temperature	1.91535E-01	9.94508E-03	7.03901E-09	02/17/03
Chamber Temperature	-2.14089E-02	9.94970E-03	7.48590E-09	02/17/03
Temp Reference Resistor	-2.50000E+01	1.00000E-02	0.00000E+00	02/17/03

Pressure	Zero	Span	Linearity	CalDate
Low Range (0-50 psia)	-3.36814E-02	1.99524E-03	1.92048E-11	02/17/03
Hi Range (50-150 psia)	-4.30560E-01	5.92706E-03	4.40052E-10	02/17/03

Flow	Zero	Span	Linearity	CalDate
Mass Flow Rate	0.00000E+00	1.60000E-03	0.00000E+00	02/18/03

Certified by Walter Elsh
Date 18 Feb 03



SOUTHWEST RESEARCH INSTITUTE™

6220 Culebra Road, P.O. Drawer 28510
Institute Quality Systems
Institute Calibration Laboratory
Phone: 210-522-5215 Fax 210-522-3692



Certificate of Calibration

Certificate #

0972-01

Submitted By: DIV20
Address: B57
Contact: DARRELL DUNN
Manufacturer Model: THUNDER SCIENTIFIC 2500
Description: HUMIDITY GENERATOR
Serial No: 0210373
Asset No: 010231
Procedure: CL-53, JUN/99

Work Order: 444054016
Date Issued: Jun 10, 2003
Calibration Date: Jun 10, 2003
****Calibration Due:** Jun 10, 2004
Calibration Location: Bldg. 64
Environment: Temp. 68.0°F Hum. 40 %RH
***As Found:** LIMITED CALIBRATION
***As Left:** LIMITED CALIBRATION

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 and ANSI/NCCL Z540-1-1994 which are equivalent to relevant requirements of the ISO 9000-1994 series of standards. This certificate may not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. The results of this calibration relate only to the individual instrument described above. This certificate shall not be used to claim product endorsement by the American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government

Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of k=2 to approximate a 95% confidence level. The calibration process provides a Test Uncertainty Ratio (TUR) of less than or equal to 25% (4:1) of the test limit unless otherwise stated in remarks or an attachment

*The client has sole responsibility for determination of in/out of tolerance or compliance/noncompliance. An in/out of tolerance opinion is provided for your convenience based only on the Test Instrument (TI) reading(s) and limits as reported. The reported uncertainty relates only to the results at the time of calibration and does not imply any short or long term stability of the TI.

**Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

Remarks: THE FLOW MEASUREMENT IS NOT CRITICAL TO THE ACCURACY OF THE GENERATED HUMIDITY AND IS NOT USED IN THE HUMIDITY CALCULATIONS.

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
009137	HART SCIENTIFIC, INC	1575	THERMOMETER	Jul 06, 03
008920	HART SCIENTIFIC, INC	17660-A-120-6-W	PLATINUM RTD	Jul 06, 03
003048	RUSKA	2468-758	PRESSURE CALIBRATOR	Mar 10, 05
003049	RUSKA	2465-729	PRESSURE CALIBRATOR	Mar 10, 05
002856	RUSKA	2468-714-69900	WEIGHT SET, CLASS N/S	Mar 10, 05
003216	HASTINGS	VT-6B	VACUUM CONTROLLER & GAGE TUBE	Oct 23, 03
003949	TROEMNER	5MG-100G	WEIGHT SET, CLASS 1	Jan 20, 04

Approved by: Walt Hill
Metrology Group Leader
m:\a2la1.rpt Rev date 15, August 02

Measurements by: Perry Carpenter
Metrology Technician

Southwest Research Institute
 Calibration Laboratory
 Calibration Report

Work Order	444054016	Mfr	Thunder Scientific	Technician	PWC
Asset No.	010231	Model	2500		
Serial No	210373	Type	Pressure Indicator	Cal Date	10-Jun-03
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
Pressure	PSIA	PSIA	PSIA	PSIA	PSIA	Result
	10.00	10.00	0.00	0.05	0.01	Pass
	30.00	30.00	0.00	0.05	0.01	Pass
	50.00	49.99	-0.01	0.05	0.01	Pass
	30.00	30.00	0.00	0.05	0.01	Pass
	10.00	10.00	0.00	0.05	0.01	Pass

END OF REPORT

Southwest Research Institute
 Calibration Laboratory
 Calibration Report

Work Order	444054016	Mfr	Thunder Scientific	Technician	PWC
Asset No.	010231	Model	2500		
Serial No	210373	Type	Pressure Indicator	Cal Date	10-Jun-03
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
Pressure	PSIA	PSIA	PSIA	PSIA	PSIA	Result
	50.00	49.98	-0.02	0.13	0.01	Pass
	100.00	99.98	-0.02	0.13	0.01	Pass
	150.00	149.90	-0.10	0.13	0.01	Pass
	100.00	99.98	-0.02	0.13	0.01	Pass
	50.00	49.98	-0.02	0.13	0.01	Pass

END OF REPORT

Southwest Research Institute
 Calibration Laboratory
 Calibration Report

Work Order:	444054016	Mfr.	Thunder Scientific	Technician	PWC
Asset No.	10231	Model	2500	Cal Date	10-Jun-03
Serial No.	210373	Type	Temp/Humidity Chamber		
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty
Degree C	Degree C	Degree C	Degree C	Degree C	Degree C
Sat Temp	0.127	0.126	-0.001	0.1	0.059
	35.035	35.01	-0.02	0.1	0.059
	69.994	69.99	0.00	0.1	0.059
Pr Sat Temp	0.127	0.152	0.025	0.1	0.059
	35.021	35.01	-0.01	0.1	0.059
	74.988	69.98	-5.01	0.1	0.059
Expn Temp	0.127	0.151	0.024	0.1	0.059
	35.021	35.02	0.00	0.1	0.059
	69.994	69.99	0.00	0.1	0.059
Chmb temp	0.127	0.135	0.008	0.1	0.059
	35.021	35.01	-0.01	0.1	0.059
	69.994	69.98	-0.01	0.1	0.059

END OF REPORT

Untitled
 Calibration Report
 for
 TSC Model 2500 Humidity Generator

S/N 0210373
 Date 06/11/03

Temperature	Zerc	Span	Linearity	CalDate
Saturation Temperature	-1.22580E-01	9.94940E-03	6.38748E-09	06/10/03
PreSat Temperature	1.14534E-01	9.93959E-03	7.76810E-09	06/10/03
Ex Valve Temperature	2.00052E-01	9.94199E-03	7.13789E-09	06/10/03
Chamber Temperature	-8.70601E-03	9.94704E-03	7.74808E-09	06/10/03
Temp Reference Resistor	-2.50000E+01	1.00000E-02	0.00000E+00	02/17/03

Pressure	Zerc	Span	Linearity	CalDate
Low Range (0-50 psia)	-3.33968E-02	1.99461E-03	5.96463E-11	06/09/03
Hi Range (50-150 psia)	-4.23677E-01	5.92633E-03	6.50344E-10	06/09/03

Flow	Zerc	Span	Linearity	CalDate
Mass Flow Rate	0.00000E+00	1.60000E-03	0.00000E+00	02/18/03

Certified by P.C.
 Date 10 JUN 03

Darrell Dunn

From: Perry Carpenter [Perry.Carpenter@swri.edu]
Sent: Tuesday, June 10, 2003 12:00 PM
To: darrell.dunn@swri.org
Cc: Robert Trollinger; Walt Hill
Subject: Limitation

**S O U T H W E S T R E S E A R C H
I N S T I T U T E ®**

To: Darrell Dunn, Div 20, Bld. 64
From: Institute Calibration Laboratory; Perry Carpenter
Date: June 10, 2003
Subject: **Review of Work Request Number 444054016**

The work you requested is held pending your review. Please review the information provided below and indicate "Approved" or provide other instructions to continue the work.

Unit Received: June 4, 2003 Work Requested: Calibration
Manufacturer: Thunder Scientific **Model:** 2500 **Description:** Humidity Generator
Serial Number: 0210373 **Asset Number:** 10231 User ID:

Cause of Review: The Calibration Lab Does not have the standards at the present time to calibrate flow on this instrument. I am requesting a limitation stating "Flow Not Cald." The Flow measurement is not critical to the accuracy of the generator. The flow is not used for the humidity calculations.

Approved Disapproved return unit as is () Date: 6/10/03

Instructions () please make sure there is
flow. The flow rate is not critical for the
intended work.

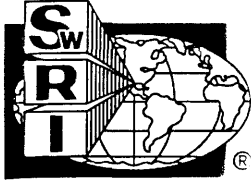
Authorized by Lietai Yang J. Yang
Print or Type Name Signature

Return this review to the Institute Calibration Laboratory Bldg 64 or FAX to (210) 522-3692. If you have questions or require additional information please call 522-5215.

Thank you for your timely response,

Walt Hill, Metrology Group Leader
Institute calibration Laboratory

6/10/2003



SOUTHWEST RESEARCH INSTITUTE™

6220 Culebra Road, P.O. Drawer 28510
Institute Quality Systems
Institute Calibration Laboratory
Phone: 210-522-5215 Fax 210-522-3692



Certificate of Calibration

0972-01

Submitted By: DIV20
Address: B57
Contact: DARRELL DUNN
Manufacturer Model: THUNDER SCIENTIFIC 2500
Description: HUMIDITY GENERATOR
Serial No: 0210373
Asset No: 010231
Procedure: CL-53, JUN/99

Work Order: 444059362
Date Issued: Jun 14, 2004
Calibration Date: Jun 14, 2004
****Calibration Due:** Jun 14, 2005
Calibration Location: Bldg. 64
Environment: Temp. 68.0°F Hum. 40 %RH
***As Found:** LIMITED CALIBRATION
***As Left:** LIMITED CALIBRATION

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Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of k=2 to approximate a 95% confidence level. See Remarks or attached Calibration Report with the same Work Order number for calibration data

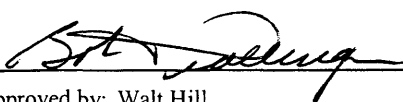
*The client has sole responsibility for determination of in/out of tolerance or compliance/noncompliance. An in/out of tolerance opinion is provided for your convenience based only on the Test Instrument (TI) reading(s) and limits as reported. The reported uncertainty relates only to the results at the time of calibration and does not imply any short or long term stability of the TI.

**Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

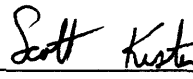
Remarks: Flow not calibrated

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
003949	TROEMNER	5MG-100G	WEIGHT SET, CLASS 1	Feb 13, 05
003049	RUSKA	2465-729	PRESSURE CALIBRATOR	May 17, 06
009137	HART SCIENTIFIC	1575	THERMOMETER	Sep 05, 04
002856	RUSKA	2468-714-69900	WEIGHT SET, CLASS N/S	Mar 10, 05
003048	RUSKA	2468-758	PRESSURE CALIBRATOR	Mar 10, 05
003220	HASTINGS	VT-6B	VACUUM CONTROLLER WITH GAGE TUBE	Oct 22, 04


Approved by: Walt Hill

Metrology Group Leader
m:\a2la1.rpt Rev date 11, May 04


Measurements by: Scott Kester

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Measurement Report

Work Order:	444059362	Mfr.	Thunder Scientific	Technician	SRK
Asset No.	10231	Model	2500		
Serial No.	210373	Type	Temp/Humidity Chamber	Cal Date	14-Jun-04

Remarks:
Calibration of all transducers was performed "in the system, as a system".
Calibration is performed on all of the transducers by solving for the coefficients A, B, and C of the formula:
 $Y=A+Bx+Cx^2$ (Y = The desired value for the transducer being calibrated. X = The new count of A/D while measuring a transducer.

Function/Range	Test Point	TI Reading	Difference	+/-Uncertainty
Degree C	Degree C	Degree C	Degree C	Degree C
Sat Temp	0.041	0.061	0.020	0.013
	35.053	35.03	-0.02	0.013
	64.982	64.97	-0.01	0.013
Pr Sat Temp	0.041	0.062	0.021	0.013
	35.053	35.03	-0.02	0.013
	64.982	64.96	-0.02	0.013
Expn Temp	0.041	0.065	0.024	0.013
	35.053	35.02	-0.03	0.013
	64.982	64.97	-0.01	0.013
Chmb temp	0.041	0.058	0.017	0.013
	35.053	35.00	-0.05	0.013
	64.982	64.91	-0.07	0.013

END OF REPORT

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444059362	Mfr	Thunder Scientific	Technician	SRK
Asset No.	010231	Model	2500 50 PSIA		
Serial No.	210373	Type	Pressure Transducer	Cal Date	14-Jun-04
Remarks:					

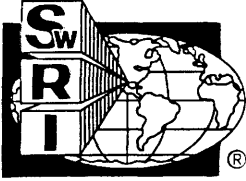
Function/Range	Test Point	TI Reading	Difference	+/-Uncertainty
Pressure	PSIA	PSIA	PSIA	PSIA
	10.00193	9.99	-0.017	0.012
	30.00193	29.99	-0.012	0.012
	50.00193	49.99	-0.012	0.012

END OF REPORT

Southwest Research Institute
 Calibration Laboratory
 Calibration Report

Work Order	444059362	Mfr	Thunder Scientific	Technician	SRK
Asset No.	010231	Model	2500 150 PSIA		
Serial No.	210373	Type	Pressure Transducer	Cal Date	14-Jun-04
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Uncertainty
Pressure	PSIA	PSIA	PSIA	PSIA
	50.00193	49.99	-0.012	0.0117
	100.00193	100.00	-0.002	0.0122
	150.00193	149.90	-0.102	0.0130
END OF REPORT				



SOUTHWEST RESEARCH INSTITUTE™

6220 Culebra Road, P.O. Drawer 28510
Institute Quality Systems
Institute Calibration Laboratory
Phone: 210-522-5215 Fax 210-522-3692



Certificate of Calibration

0972-01

Submitted By: DIV20
Address: B57
Contact: DARRELL DUNN
Manufacturer Model: THUNDER SCIENTIFIC 2500
Description: HUMIDITY GENERATOR
Serial No: 0210373
Asset No: 010231
Procedure: CL-53, JUN/99

Work Order: 444059999
Date Issued: Jul 22, 2004
Calibration Date: Jul 22, 2004
****Calibration Due:** Jul 22, 2005
Calibration Location: Bldg. 64
Environment: Temp. 68.0°F Hum. 40 %RH
***As Found:** IN TOLERANCE
***As Left:** IN TOLERANCE

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 and ANSI/NCCL Z540-1-1994 which are equivalent to relevant requirements of the ISO 9000-1994 series of standards. This certificate may not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. The results of this calibration relate only to the individual instrument described above. This certificate shall not be used to claim product endorsement by the American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government.

Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of k=2 to approximate a 95% confidence level. See Remarks or attached Calibration Report with the same Work Order number for calibration data.

*The client has sole responsibility for determination of in/out of tolerance or compliance/noncompliance. An in/out of tolerance opinion is provided for your convenience based only on the Test Instrument (TI) reading(s) and limits as reported. The reported uncertainty relates only to the results at the time of calibration and does not imply any short or long term stability of the TI.

**Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

Remarks: None

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
003949	TROEMNER	5MG-100G	WEIGHT SET, CLASS 1	Feb 13, 05
002856	RUSKA	2468-714-69900	WEIGHT SET, CLASS N/S	Mar 10, 05
003048	RUSKA	2468-758	PRESSURE CALIBRATOR	Mar 10, 05
003220	HASTINGS	VT-6B	VACUUM CONTROLLER WITH GAGE TUBE	Oct 22, 04
009137	HART SCIENTIFIC	1575	THERMOMETER	Sep 05, 04
008920	HART SCIENTIFIC	5614-17660-A-12	PLATINUM RTD	Sep 09, 04
002079	RUSKA	6200	PRESSURE GAUGE	Sep 25, 04
005144	RUSKA	2468	DEAD WEIGHT PISTON	May 17, 06
007502	SIERRA	CAL-BENCH	GAS FLOW CALIBRATION SYSTEM	Jun 04, 05

Approved by: Walt Hill
Metrology Group Leader
m:\a2la1.rpt Rev date 11, May 04

Measurements by: Scott Kester
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Measurement Report

Work Order:	444059999	Mfr.	Thunder Scientific	Technician	SRK
Asset No.	010231	Model	2500		
Serial No.	0210373	Type	Temp/Humidity Chamber	Cal Date	22-Jul-04
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Uncertainty
Degree C	Degree C	Degree C	Degree C	Degree C
Sat Temp	0.070	0.076	0.006	0.013
	35.045	35.03	-0.02	0.013
	69.988	69.99	0.00	0.013
Pr Sat Temp	0.070	0.152	0.082	0.013
	35.045	35.02	-0.02	0.013
	69.988	70.00	0.01	0.013
Expn Temp	0.070	0.151	0.081	0.013
	35.045	35.02	-0.02	0.013
	69.988	69.98	-0.01	0.013
Chmb temp	0.070	0.135	0.065	0.013
	35.045	34.99	-0.05	0.013
	69.988	69.99	0.00	0.013
END OF REPORT				

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444059999	Mfr	Thunder Scientific	Technician	SRK
Asset No.	010231	Model	2500		
Serial No.	0210373	Type	Pressure Transducer	Cal Date	22-Jul-04

Remarks:
Calibration of all transducers was performed "in the system, as a system".
Calibration is performed on all of the transducers by solving for the coefficients A, B, and C of the formula:
 $Y=A+Bx+Cx^2$ (Y = The desired value for the transducer being calibrated. X = The new count of A/D while measuring a transducer.

Function/Range	Test Point	TI Reading	Difference	+/-Uncertainty
Pressure	PSIA	PSIA	PSIA	PSIA
	50.00400	49.96	-0.044	0.0117
	100.00300	99.97	-0.033	0.0122
	50.00400	49.98	-0.024	0.0117
END OF REPORT				

Southwest Research Institute
 Calibration Laboratory
 Measurement Report

Work Order:	444059999	Mfr.	Thunder Scientific	Technician	SRK
Asset No.	010231	Model	2500	Cal Date.	22-Jul-04
Serial No.	0210373	Type.	Flow Meter		
Remarks:					
STP 70 Deg F		K Factor: 1.000		Test Gas: Air	
29.92 InHg					

Function/Range	Test Point	TI Reading	Difference	+/-Uncertainty
Flow Rate	SCCM	SCCM	SCCM	SCCM
	10.23	9.89	-0.34	2.4
	19.74	19.66	-0.08	2.4
END OF REPORT				

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

EQUIPMENT RECEIVED

Processed by MROMERO at 10:36:00AM on 6/4/2004

<u>Status</u>	<u>Asset No.</u>	<u>Charge Code</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Description</u>	<u>Serial Number</u>
N LINE	010231	00751.006 1.20	THUNDER SCIENTIFIC	2500	HUMIDITY GENERATOR	0210373
N LINE	010232	00751.006 1.20	QUADTECH	7600	LCR METER	3164285

Total Number of Instruments Processed: 2

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

EQUIPMENT RECEIVED

Processed by MROMERO at 10:36:00AM on 6/4/2004

<u>Status</u>	<u>Asset No.</u>	<u>Charge Code</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Description</u>	<u>Serial Number</u>
IN LINE	010231	00751.006 1.20	THUNDER SCIENTIFIC	2500	HUMIDITY GENERATOR	0210373
IN LINE	010232	00751.006 1.20	QUADTECH	7600	LCR METER	3164285

Total Number of Instruments Processed: 2