

# SOUTHWEST RESEARCH INSTITUTE

## Calibration Laboratory

### WORK ORDER

Processed by RCRUZ at 2:12:18PM on 6/29/01



Work Order **444044223**

Arrived 6/29/01

Asset No. 008788 Manufacturer COLE-PARMER

Model 03313-66

Instrument Type/Class THERMO-HYGRO

Serial No. 21189381

Accessory No.

Calibration Procedure

Location

Div/Client DIV20

Custodian DARRELL DUNN

Mail Stop B57

Tel. 6090

Charge/Project No. 00751.006 1.20 R C

Delivered By / Telephone LIETAI ZYANG X2483

**IN4CAL**

Special Instructions \_\_\_\_\_

### WORK NOTES

Date	Hours	Remarks/Notes
<u>7/3</u>	<u>1.0</u>	<u>Cal</u>
<u>7/5</u>	<u>1.0</u>	<u>Cal</u>

### REPAIR PARTS

Date	Hours	Part Name	Part Number	Failure Description	Cost

### WORK SUMMARY

Failure Description N/A

Repair Action N/A

Calibration Procedure Pending Temp 75 F Hum. 50 %

Tech R Dykstra Totals Cal Hours 2.0 Repair Hours \_\_\_\_\_ Parts Cost \_\_\_\_\_

Standards Used 0219, 6404

Date Picked Up 7/9/01

Picked Up By B. P. J.

**44223**

**SWRI Calibration Laboratory Data Sheet**

<b>Work Order:</b> 444044223	<b>Manufacturer:</b> Cole-Parmer	<b>Technician:</b> R Dykstra
<b>Asset Number:</b> 008788	<b>Model:</b> 03313-66	<b>Procedure:</b> Pending
<b>Serial Number:</b> 21189381	<b>Type:</b> Thermo-hygro	<b>Calibration Date:</b> 7/3/01

**Remarks:** The instrument error of this unit did not exceed the specified limit of +/- 1.5 % R.H. with a combined uncertainty (K=2) of 0.5 % RH and a confidence level of approximately 95%.  
 The instrument error of this unit did not exceed +/-0.2 degree C with a combined uncertainty (K=2) of 0.2 degree C and a confidence level of approximately 95%.

**Humidity Tolerance: 1.5**  
**Range: 10 to 95 % RH**

Applied Value % RH	As Found Ind. Value (% RH)	Instrument Error	Instrument Tolerance	Measurement Uncertainty
24.99	23.53	1.46	1.5	0.5
50.78	49.71	1.07	1.5	0.5
75.03	74.15	0.88	1.5	0.5

Applied Value % RH	As Left Ind. Value (% RH)	Instrument Error	Instrument Tolerance	Measurement Uncertainty
24.99	23.53	1.46	1.5	0.5
50.78	49.71	1.07	1.5	0.5
75.03	74.15	0.88	1.5	0.5

**Temperature Tolerance: 0.2**  
**Range: -40 to 60 Degree C**

Applied Value Deg C	As Found Ind. Value (Deg C)	Instrument Error	Instrument Tolerance	Measurement Uncertainty
24.97	25.10	-0.13	0.2	0.2

Applied Value Deg C	As Left Ind. Value (Deg C)	Instrument Error	Instrument Tolerance	Measurement Uncertainty
24.97	25.10	-0.13	0.2	0.2

## Digital display uncertainty

### Measurement uncertainty Budget for Cole-Parmer Temperature/Humidity model 03313-66.

UUT Characteristics

Humidity

Temperature

Performance Specifications

Range: 0 to 100 %RH

Tolerance: 1.5%RH.(10 to 95), 2%RH (90 to 100)

Range: -40 to 60 degree C

Tolerance: 0.2 Degree C @ 20 Degree C

Resolution: 0.01 on all readings below 100

0.1 on all readings above 100.

**UUT Tolerance**                      1.5 % RH

### Measurement uncertainty Budget for Relative Humidity at 25 % RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.25
Expanded Uncertainty			K=2	0.50

TUR            3.0 to 1

**UUT Tolerance**                      1.5 % RH

### Measurement uncertainty Budget for Relative Humidity at 50% RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.25
Expanded Uncertainty			K=2	0.50

TUR            3.0 to 1

**UUT Tolerance**                      1.5 % RH

### Measurement uncertainty Budget for Relative Humidity at 75% RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.25
Expanded Uncertainty			K=2	0.50

TUR            3.0 to 1

# Digital display uncertainty

UUT Tolerance

0.2 Degree C

## Measurement uncertainty Budget for temperature @ 20 Deg C.

Source of uncertainty	Value +/- Deg C	Distribution	Divisor	Standard Uncertainty Deg C
Standard	0.03	Rectangular	Sqrt 3	0.02
Chamber uniformity	0.1	Rectangular	Sqrt 3	0.06
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.06
Expanded Uncertainty			K=2	0.1

Prepared By: R Dykstra  
Verified By:

Date: 7/3/01  
Date:

TUR 2.0 to 1



Southwest Research Institute  
6220 Culebra Road  
San Antonio, TX 78238  
(210) 522-5215  
Department of Quality Assurance  
Calibration Laboratory



Certificate #  
0972-01

## Certificate of Calibration

5 July 2001

**Issued to:** DARRELL DUNN DIV20 B57  
**Manufacturer/Model:** COLE-PARMER 03313-66  
**Description:** THERMOHYGROMETER  
**Serial Number:** 21189381  
**Asset Number:** 008788  
**Work Order Number:** 444044223

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NC SL Z540-1-1994. The results of this calibration relate only to the individual item as described above. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results of this calibration certificate were determined in accordance with the terms of accreditation unless stated otherwise below.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

**Ambient Conditions:** Temperature: 75.0 Degrees Fahrenheit Humidity: 50 % RH

**Calibration Date:** 5 Jul 01 **Calibration Procedure:**

**Condition as Received:** SEE ATTACHED DATA

**Condition as Released:** SEE ATTACHED DATA

**Remarks:** SEE ATTACHED DATA SHEET FOR INSTRUMENT ERROR AND UNCERTAINTY.

Approved by:

Walt Hill, Supervisor  
Institute Calibration Laboratory

Measurements performed by:

Roger Dykstra, Technician

# SOUTHWEST RESEARCH INSTITUTE

## Calibration Laboratory

### WORK ORDER

Processed by JIBARRA at 8:52:46AM on 8/3/01



**Work Order 444044659**

Arrived 8/3/01

Asset No. 008788 Manufacturer COLE-PARMER

Model 03313-66

Instrument Type/Class THERMOHYGROMETER

Serial No. 21189381

Accessory No.

Calibration Procedure

Location

Div/Client DIV20

Custodian DARRELL DUNN

Mail Stop B57

Tel. 6090

Charge/Project No. 00751.006 1.20

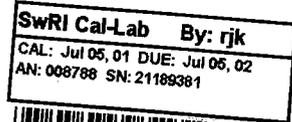
Delivered By / Telephone LIETAI YANG/ X2483

**IN4CAL**

Special Instructions \_\_\_\_\_

### WORK NOTES

Date	Hours	Remarks/Notes
<u>8.6</u>	<u>2.0</u>	<u>Calibration</u>



### REPAIR PARTS

Date	Hours	Part Name	Part Number	Failure Description	Cost
<u>8.6</u>	<u>2.0</u>	<u>Adjustments &amp; Clean</u>	<u> </u>	<u>probe</u>	<u> </u>

### WORK SUMMARY

Failure Description Humidity out-of-spec

Repair Action Clean probe

Calibration Procedure \_\_\_\_\_ Temp 76 F Hum. 49 %

Tech R Dykstra Totals Cal Hours 2.0 Repair Hours 2.0 Parts Cost \_\_\_\_\_

Standards Used 0002R, 00640A

Date Picked Up 08/08/01

Picked Up By J. Yang

**44659**

# SOUTHWEST RESEARCH INSTITUTE

6220 CULEBRA ROAD • POST OFFICE DRAWER 28510 • SAN ANTONIO, TEXAS, 78228-0510 • TEL (210) 522-5215 • FAX (210) 522-3692

**To:** Lietai Yang, Div 20, Bld 189  
**From:** Walt Hill, Institute Calibration Laboratory Supervisor  
**CC:** Rodney Weber, Institute Quality Assurance Manager  
**Date:** Aug. 6, 01  
**Subject:** Out-of-tolerance Notice

The purpose of this notice is to alert you of a condition, which could have caused erroneous measurements. The as-found readings are provided for your evaluation to determine if the instrument had any impact on your operations and if further action is required. If we can be of assistance, please contact the Calibration Laboratory at 522-5215.

**Manufacturer:** Cole Parmer                      **Model:** 03313-66  
**Description:** Thermohygrometer                      **Serial Number:** 21189381

**Asset Number:** 008788                      **User ID Number:**

**Last Calibration:** 7/03/01

**Date Received for Service:** Aug. 3, 01                      **Work Order Number:** 444044659

**Service Requested:** Calibrate before use

Remarks: TI probe was contaminated. Cleaned and recalibrated TI. E-mail was sent to Mr. Yang on 8/3/01.

### AS-FOUND DATA

PARAMETER OR FUNCTION	APPLIED OR NOMINAL VALUE	INSTRUMENT READING	INSTRUMENT ERROR	INSTRUMENT TOLERANCE
Humidity	39.95 % RH	46.9 % RH	6.9 % RH	0.5 % RH
	55.05 % RH	65.8 % RH	10.8 % RH	0.5 % RH
	70.07 % RH	85.1 % Rh	15.1 % RH	0.5 % RH
	77.39 % RH	94.7 % RH	17.3 % RH	0.5 % RH

502

Reviewed by Walt Hill



## Roger Dykstra

---

**From:** Lietai Yang [LYang@swri.org]  
**Sent:** Friday, August 03, 2001 2:47 PM  
**To:** 'Roger Dykstra'  
**Subject:** RE: Data points for cole-palmer instrument

Roger,

Thank you so much for the data and the promptness.

Lietai

-----Original Message-----

**From:** Roger Dykstra [mailto:RDykstra@swri.edu]  
**Sent:** Friday, August 03, 2001 11:50 AM  
**To:** Lietai Yang  
**Subject:** Data points for cole-palmer instrument

Lietai, here are the following data points at 50 Degree C.

Standard reading	TI reading
39.95 % RH	46.88 % RH
55.05 % RH	65.83 % RH
70.07 % RH	85.08 % RH
77.39 % RH	94.67 % RH

I am going to try and clean the probe with DI water and recalibrate.  
I will also try and calibrate the other TI you brought in.

R Dykstra  
X 5076.



Southwest Research Institute  
6220 Culebra Road  
San Antonio, TX 78238  
(210) 522-5215  
Department of Quality Assurance  
Calibration Laboratory



Certificate #  
0972-01

## Certificate of Calibration

7 August 2001

**Issued to:** DARRELL DUNN DIV20 B57  
**Manufacturer/Model:** COLE-PARMER 03313-66  
**Description:** THERMOHYGROMETER  
**Serial Number:** 21189381  
**Asset Number:** 008788  
**Work Order Number:** 444044659

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NC SL Z540-1-1994. The results of this calibration relate only to the individual item as described above. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results of this calibration certificate were determined in accordance with the terms of accreditation unless stated otherwise below.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

**Ambient Conditions:** Temperature: 76.0 Degrees Fahrenheit Humidity: 49 % RH

**Calibration Date:** 6 Aug 01 **Calibration Procedure:**

**Condition as Received:** OUT OF TOLERANCE

**Condition as Released:** IN TOLERANCE

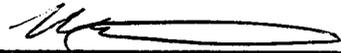
**Remarks:**

**Approved by:**

  
\_\_\_\_\_

Walt Hill, Supervisor  
Institute Calibration Laboratory

**Measurements performed by:**

  
\_\_\_\_\_

Roger Dykstra, Technician

# SOUTHWEST RESEARCH INSTITUTE

## Calibration Laboratory

### WORK ORDER

Received by AANDERSON, 6/24/02 11:30:55AM



Arrived 6/24/02

Work Order **444049111**

Asset No. 008788 Manufacturer COLE-PARMER

Model 03313-66

Equipment Type THERMOHYGROMETER

Serial No. 21189381

Accessory No.

Interval 12 M

Calibration Procedure \_\_\_\_\_ Location \_\_\_\_\_

Div/Client DIV20

Custodian DARRELL DUNN

Mail Stop B57

Tel 6090

**IN LINE**

Special Instructions Calibrate at ~~25°~~, ~~50°~~, ~~80°~~ See Attached

Notify before adjustments or repairs. ( ) Provide data with certificate ( ) Certificate Typ. \_\_\_\_\_

Charge/Project No. 01402.561 1.20

Requester / Telephone JUSTIN LANDRY X2293

This information is correct for the work requested. Justin Landry

### WORK NOTES

Date	Hours	Remarks/Notes
<u>6/25</u>	<u>1.0</u>	<u>Cal</u>
<u>6/26</u>	<u>1.0</u>	<u>Cal</u>
<u>6/27</u>	<u>1.0</u>	<u>Cal</u>

Date	Hours	Part Name	Part Number	Failure Description	Cost
<u>n/a</u>					

### WORK SUMMARY

Failure Description n/a

Repair Action n/a

Tech RDXSN Cal Hrs. 3.0 Repair Hrs. \_\_\_\_\_ Parts Cost \_\_\_\_\_ Temp 76 F Hum. 54 %

Standards Used GA04

Date Picked Up 7/10/2002

Picked Up By [Signature]

**444049111**

Southwest Research Institute  
Calibration Laboratory  
Calibration Data Sheet

Work Order: 444049111	Manufacturer: Cole-Parmer	Technician: R Dykstra
Asset Number: 008788	Model: 03313-66	Procedure: Per Customer
Serial Number: 21189381	Type: Thermo-hygro	Calibration Date: 6/27/02

**Remarks:** The calibration points for this calibration were requested by the customer.

The measurement uncertainty for temperatures in the chamber that exceed +/- 10 C from ambient in the room cannot be determined. This is stated in the operations manual for the humidity standard. Ambient temperature for this test was 24.4 Degree C.

Temperature Tolerance: 0.2  
Range: -40 to 60 Degree C

Applied Value Deg C	As Found Ind. Value (Deg C)	Difference	Instrument Tolerance	Measurement Uncertainty
25.2	25.11	-0.09	0.2	0.2

Humidity Tolerance: 1.5  
Range: 10 to 95 % RH

	Applied Value % RH	As Found Ind. Value (% RH)	Difference	Instrument Tolerance	Measurement Uncertainty
@ above	25	24.09	-0.91	1.5	0.5
Temperature	90	90.76	0.76	1.5	0.5

Temperature Tolerance: 0.2  
Range: -40 to 60 Degree C

Applied Value Deg C	As Found Ind. Value (Deg C)	Difference	Instrument Tolerance	Measurement Uncertainty
49.2	47.70	-1.50	0.2	See Remarks

Humidity Tolerance: 1.5  
Range: 10 to 95 % RH

	Applied Value % RH	As Found Ind. Value (% RH)	Difference	Instrument Tolerance	Measurement Uncertainty
@ above	25	25.29	0.29	1.5	0.5
Temperature	50	51.54	1.54	1.5	0.5
	75	77.12	2.12	1.5	0.5
	90	88.26	-1.74	1.5	0.5

Southwest Research Institute  
 Calibration Laboratory  
 Calibration Data Sheet

Work Order: 444049111	Manufacturer: Cole-Parmer	Technician: R Dykstra
Asset Number: 008788	Model: 03313-66	Procedure: Per Customer
Serial Number: 21189381	Type: Thermo-hygro	Calibration Date: 6/27/02

Temperature Tolerance: 0.2  
 Range: -40 to 60 Degree C

Applied Value Deg C	As Found Ind. Value (Deg C)	Difference	Instrument Tolerance	Measurement Uncertainty
68.8	67.50	-1.30	0.2	See Remarks

Humidity Tolerance: 1.5  
 Range: 10 to 95 % RH

	Applied Value % RH	As Found Ind. Value (% RH)	Difference	Instrument Tolerance	Measurement Uncertainty
@ above	25	28.57	3.57	1.5	0.5
Temperature	90	86.60	-3.40	1.5	0.5

## Digital display uncertainty

### Measurement uncertainty Budget for Cole-Parmer Temperature/Humidity model 03313-66.

UUT Characteristics  
Humidity

Performance Specifications  
Range: 0 to 100 %RH

Tolerance: 1.5%RH.(10 to 95), 2%RH (90 to 100)

Temperature

Range: -40 to 60 degree C

Tolerance: 0.2 Degree C @ 20 Degree C

Resolution: 0.01 on all readings below 100

0.1 on all readings above 100.

UUT Tolerance                      1.5 % RH

### Measurement uncertainty Budget for Relative Humidity at 25 % RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.25
Expanded Uncertainty			K=2	0.50

TUR            3.0 to 1

UUT Tolerance                      1.5 % RH

### Measurement uncertainty Budget for Relative Humidity at 50% RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.25
Expanded Uncertainty			K=2	0.50

TUR            3.0 to 1

UUT Tolerance                      1.5 % RH

### Measurement uncertainty Budget for Relative Humidity at 75% RH point.

Source of uncertainty	Value +/- % RH	Distribution	Divisor	Standard Uncertainty % RH
Standard	0.5	Normal	2	0.25
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.25
Expanded Uncertainty			K=2	0.50

TUR            3.0 to 1

Digital display uncertainty

UUT Tolerance

0.2 Degree C

Measurement uncertainty Budget for temperature @ 20 Deg C.

Source of uncertainty	Value +/- Deg C	Distribution	Divisor	Standard Uncertainty Deg C
Standard	0.1	Rectangular	Sqrt 3	0.06
Chamber uniformity	0.1	Rectangular	Sqrt 3	0.06
Display Resolution.	0.01	Rectangular	Sqrt 3	0.01
Combined Uncertainty			RSS	0.08
Expanded Uncertainty			K=2	0.2

TUR 2.0 to 1

Prepared By: R Dykstra  
Verified By:

Date: 7/3/01  
Date:

A/N: 8788

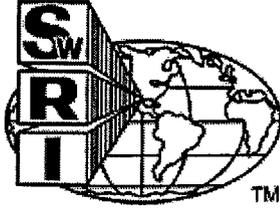
W/W: 49111

Special Instructions for Calibration.

Calibrations of Thermohygrometers are to be done at these specific temperatures and humidity points.

TEMPERATURE ( C )	% HUMIDITY	% HUMIDITY	% HUMIDITY	% HUMIDITY
25	25	90		
50	25	50	75	90
<del>70</del> <del>80</del> RSD	25	90		

*Changed  
Per  
phone  
call*



Southwest Research Institute  
6220 Culebra Road  
San Antonio, TX 78238  
(210) 522-5215  
Department of Quality Assurance  
Calibration Laboratory

## Certificate of Calibration

27 June 2002

**Issued to:** DARRELL DUNN DIV20 B57  
**Manufacturer/Model:** COLE-PARMER 03313-66  
**Description:** THERMOHYGROMETER  
**Serial Number:** 21189381  
**Asset Number:** 008788  
**Work Order Number:** 444049111

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

**Ambient Conditions:** Temperature: 76.0 Degrees Fahrenheit Humidity: 54 % RH

**Calibration Date:** 27 Jun 02 **Calibration Procedure:** PER CUSTOMER.

**Condition as Received:** SEE ATTACHED DATA

**Condition as Returned:** SEE ATTACHED DATA

**Remarks:** SEE ATTACHED DATA SHEET FOR DATA AND UNCERTAINTY.

**Approved by:**

  
Walt Hill, Metrology Group Leader  
Institute Calibration Laboratory

**Measurements performed by:**

  
Roger Dykstra, Technician