

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory • 522-5215

WORK ORDER

WORK ORDER # 36430 ASSET # 007618 DATE 15 OCT 99

ITEM DATA:

Manufacturer Ertco Model ASTM 91C
Description Thermometer Serial # 1748
Accessories _____

ACTION REQUESTED Cal

CUSTODIAN Div. 20, Melissa August

Turned in by: _____ Phone 0565

CHARGE # 20.01402.871 Date Required _____

INSTRUMENT USED ON: (DOD/NASA) (NUCLEAR) (GLP) (SPPE) (ISO)
 OTHER _____

COPY OF CALIBRATION CERTIFICATE (Yes) (No)

NEW WORK Yes No If yes, an evaluation shall be made to verify capabilities.

By MAA Date 10-15-99

Work involves proprietary/confidential information or equipment (Yes) (No)

CONDITION RECEIVED: Out of tolerance
 In tolerance
 Damaged (Contact customer)
 Contact _____ Date _____
 Received into system, introduced or reactivated

ACTION TAKEN: (Calibration/Repair/Parts) cal over

CAL ENVIRONMENT:
Temperature 74 °F Humidity 42 %RH

CALIBRATED/REPAIRED:
By [Signature] Cal Procedure CL 9 MAY 99
Date 15 Oct 99 Accuracy ± 1.5°C
Cal Interval 6 Reliability Code 1
Next Cal Due 15 APR 00 Cal Time 1.5 Repair Time _____
Standards used (Asset #) 5213 5174

DATE COMPLETED 19 Oct 99

DATE PICKED UP _____ PICKED UP BY _____

36430
/



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

Certificate of Calibration

20 October 1999

Issued to: MELISSA NUGENT DIV20 B57
Manufacturer/Model: ERTCO ASTM 91 C
Description: THERMOMETER
Serial Number: 1748
Asset Number: 007618

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NC SL 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: 42 % RH

Calibration Date: 19 Oct 99 **Calibration Procedure:** CL-9 MAY 99

Condition as Received: IN TOLERANCE

Condition as Released: IN TOLERANCE

Remarks:

Approved by:

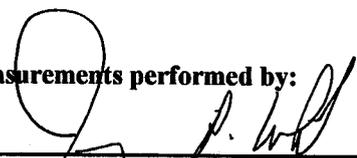


Jim Patterson, Supervisor or Walt Hill, Metrologist

Certificate # 36430

m:\nona2la.rpt Rev date 13 Apr 99

Measurements performed by:



Jerry White, Technician

Page 1 of 1

WORK ORDER 38921

Date Received 5/1/00

Asset No. 007618 Manufacturer ERTCO Model ASTM 91 C
Description THERMOMETER Serial Number 1748
Accessory Received/Required CASE
Div/CC ID NONE Accessory to Asset No. N/A
Div/CC DIV20 Location B57 Custodian MELISSA NUGENT Tel. 6565
Charge/Project No. 20.00751.0006 Proprietary/Confidential N Date Required ROUTINE
Work Requested CALIBRATION
Receiving Inspection O.K.
Delivered By MELISSA NUGENT Tel. 6565

WORK HISTORY

| Date | Start Time | Stop Time | Notes |
|------|------------|-----------|-------|
| | | | |
| | | | |
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PARTS

| Part Name | Part Number | Cost | Failure Description |
|-----------|-------------|------|---------------------|
| | | | |
| | | | |
| | | | |
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| | | | |
| | | | |
| | | | |

38921

WORK SUMMARY

Failure Description _____

Repair Action _____

Cal Procedure CL-9, 5/99 Temp 25 F Hum 44 %

Tech 8216 Cal Hrs. 2.5 Repair Hrs. _____ Part Cost _____

Action Taken Calibrated Per Procedure

Standards Used 219, 5174

Date Cal 2/1/00 Int. 6 Mo. Date Due 2/1/00 Reliability Code 2

Date Picked Up 6/7/2000 Picked Up By WVY

SOUTHWEST RESEARCH INSTITUTE

CALIBRATION LABORATORY

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

Receipt for Work Order 38921 Date Received 5/1/00

Asset No. 007618 Manufacturer ERTCO Model ASTM 91 C

Description THERMOMETER Serial Number 1748

Accessory Received/Required CASE

Div/CC ID NONE Accessory to Asset No. N/A Accuracy +/- .1DEG C

Div/CC DIV20 Location B57 Custodian MELISSA NUGENT Tel. 6565

Charge/Project No. 20.00751.0006 Proprietary/Confidential N Date Required ROUTINE

Work Requested CALIBRATION

Receiving Inspection O.K.

Delivered By MELISSA NUGENT Tel. 6565

CUSTOMER COMMENTS REQUESTED

The Calibration Laboratory staff is committed to good laboratory practice and providing our customers quality calibration services. Please rate how well we are meeting our goal and provide us with your recommendations for improvement.

| | | |
|---------------------------------|-------|-----------------------|
| Quality of service provided | _____ | Rating Scale |
| Turn-around time | _____ | 4 = Excellent |
| Certificates | _____ | 3 = Good |
| Calibration labels | _____ | 2 = Acceptable |
| Recall notification | _____ | 1 = Needs improvement |
| Condition of returned equipment | _____ | |
| Overall service | _____ | |

Please check all that apply: Equipment user Delivery person Custodian

IF WE PLEASE YOU, TELL OTHERS; IF NOT, TELL US.

COMMENTS: _____

Name _____ Tel. _____



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

Accredited



Certificate #
0972-01

Certificate of Calibration

2 May 2000

Issued to: MELISSA NUGENT DIV20 B57
Manufacturer/Model: ERTCO ASTM 91 C
Description: THERMOMETER
Serial Number: 1748
Asset Number: 007618

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: 44 % RH

Calibration Date: 2 May 00 **Calibration Procedure:** CL-9, 5/99

Condition as Received: IN TOLERANCE

Condition as Released: IN TOLERANCE

Remarks:

Approved by:

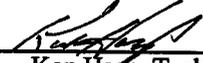


Jim Patterson, Supervisor, or Walt Hill, Metrologist

Certificate # 38921

m:\a2la.rpt Rev date 14 Dec 99

Measurements performed by:



Ken Harp, Technician

Page 1 of 1

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

WORK ORDER

Processed by RCRUZ at 3:07:03PM on 4/4/01

1 100000 0000 0000 0000 0000 0000 0000

Work Order **444043025**

Arrived 4/4/01

Asset No. 007618 Manufacturer ERTCO

Model ASTM 91 C

Instrument Type/Class THERMOMETER

Serial No. 1748

Accessory No. Calibration Procedure CL-9, 5/99

Location B57

Div/Client DIV20

Custodian MELISSA NUGENT

Mail Stop B57

Tel. 6565

Charge/Project No. 20.00751.006

Delivered By / Telephone BRADLEY X 6565

IN4CAL

Special Instructions _____

WORK NOTES

| Date | Hours | Remarks/Notes |
|-------|-------|---------------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

SwRI Cal-Lab TECH: kwh
CAL: 05/02/00 DUE: 11/02/00
AN: 007618 SN: 1748
1 100000 0000 0000 0000 0000 0000 0000

REPAIR PARTS

| Date | Hours | Part Name | Part Number | Failure Description | Cost |
|-------|-------|-----------|-------------|---------------------|-------|
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

WORK SUMMARY

Failure Description _____

Repair Action _____

Calibration Procedure _____

Temp 76 F Hum. 50 %

Tech MMW

Totals

Cal Hours 2.5

Repair Hours _____

Parts Cost _____

Standards Used 5174

Date Picked Up 4/16/2001

Picked Up By Bradley Worling

43025

7618

| Nom | Tm | Act (std) | Error |
|-----|-------|-----------|----------------|
| 20 | 20.42 | 20.321 | 0.099 0.004 |
| 30 | 30.19 | 30.186 | 0.008 |
| 40 | 40.16 | 40.152 | 0.077 |
| 50 | 49.69 | 49.613 | |

ave temp of em stem 25°C (77°F)

Max Scale error 0.1°C

Tamb 76 @ 50% RH

7618



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6220 Culebra Road
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Department of Quality Assurance
Calibration Laboratory



Certificate #
0972-01

Certificate of Calibration

6 April 2001

Issued to: MELISSA NUGENT DIV20 B57
Manufacturer/Model: ERTCO ASTM 91 C
Description: THERMOMETER
Serial Number: 1748
Asset Number: 007618
Work Order Number: 444043025

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCSL 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.

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Ambient Conditions: Temperature: 76.0 Degrees Fahrenheit Humidity: 50 % RH

Calibration Date: 6 Apr 01 **Calibration Procedure:** CL-9, 5/99

Condition as Received: SEE ATTACHED DATA

Condition as Released: SEE ATTACHED DATA

Remarks: CALIBRATION DATA ATTACHED

Approved by:

Walt Hill, Supervisor
Institute Calibration Laboratory

Measurements performed by:

Mack Wood, Technician

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

WORK ORDER

Received by RCRUZ, 10/9/01 2:36:26PM



Arrived 10/9/01

Work Order **444045532**

Asset No. 007618 Manufacturer ERTCO

Model ASTM 91 C

Instrument Type/Class THERMOMETER

Serial No. 1748

Accessory No.

Calibration Procedure CL-9, 5/99

Location B57

Div/Client DIV20

Custodian BRADLEY WERLING

Mail Stop B57

Tel. 6565

IN4CAL

Special Instructions _____

Notify before making adjustments or repairs. (Provide measurement readings ()

Charge/Project No. 00751.006 1.20

Requested By / Telephone

The above is correct for the work requested.

Bradley Werling 6565

WORK NOTES

| Date | Hours | Remarks/Notes |
|--------------|------------|---------------|
| <u>10/10</u> | <u>1.0</u> | <u>Cal</u> |
| | | |
| | | |
| | | |
| | | |

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

WORK SUMMARY

Failure Description n/a

Repair Action n/a

Calibration Procedure CL-9, 5/99

Temp 74F

Hum. 58 %

Tech R Dykstra

Totals Cal Hours 1.0

Repair Hours _____

Parts Cost _____

Standards Used 5243, 5174

Date Picked Up 10/16/01

Picked Up By Bradley Werling

444045532

Southwest Research Institute
Calibration Laboratory
Calibration Data Sheet

Workorder 444045532

Mfr. ERTCO

Technician Roger Dykstra

Asset #: 007618

Model ASTM 91 C

Procedure CL-9, 5/99

Serial #: 1748

Type Thermometer

Cal Date 10/10/01

Measurement uncertainty Budget for Temperature at any point.

| Source of uncertainty | Value +/- Deg C | Distribution | Divisor | Standard Unc. Deg C |
|-----------------------|--------------------|--------------|---------|------------------------|
| Standard | 0.06 | Normal | 2 | 0.03 |
| Instrument Resolution | 0.02 | Rectangular | Sqrt 3 | 0.01 |
| Combined Uncertainty | | | RSS | 0.03 |
| Expanded Uncertainty | | | K=2 | 0.06 |

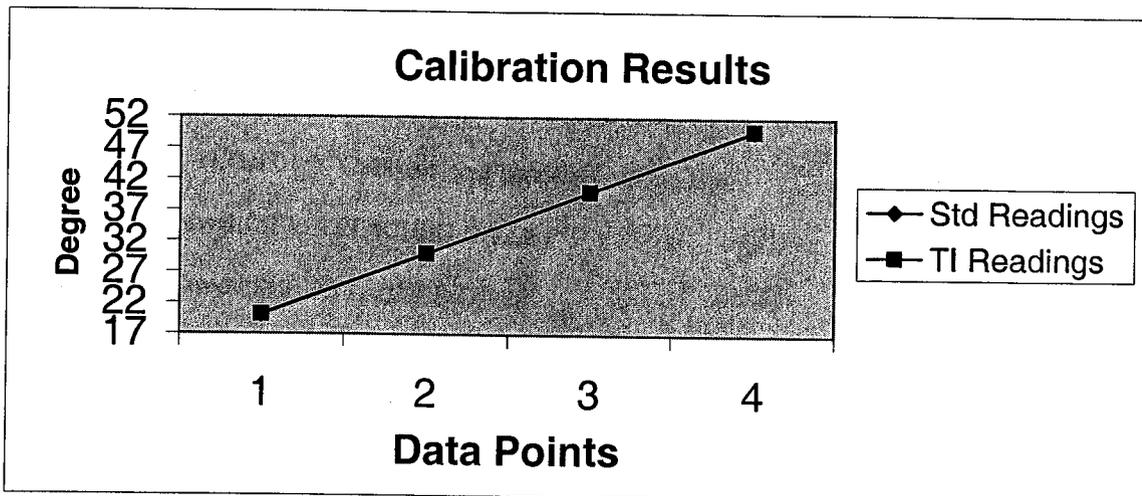
Tolerance 0.1 Degree C

Range 20 to 50 Degree C

Instrument error = TI reading - Standard reading

Results can be the following: Pass, Fail, or if blank undeterminable.

| Standard Reading Degree C | As Found Value Deg C | Instrument Error | Instrument Tolerance | Results |
|------------------------------|-------------------------|---------------------|-------------------------|---------|
| 20.024 | 20.14 | 0.116 | 0.1 | |
| 30.048 | 30.04 | -0.008 | 0.1 | Pass |
| 40.083 | 40.1 | 0.017 | 0.1 | Pass |
| 49.942 | 50 | 0.058 | 0.1 | |

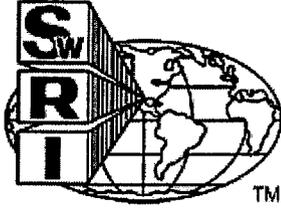


Results:

This report uncertainty is based upon a standard uncertainty multiplied by a coverage of k=2, which provides a level of confidence of approximately 95%.

For 20 & 50 C it is not possible to state a in tolerance based on a 95% level of confidence, however the results indicate that in tolerance is more probable than an out of tolerance.

The tolerance is from ASTM -91C specifications.



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Department of Quality Assurance
Calibration Laboratory



Certificate #
0972-01

Certificate of Calibration

11 October 2001

Issued to: BRADLEY WERLING DIV20 B57
Manufacturer/Model: ERTCO ASTM 91 C
Description: THERMOMETER
Serial Number: 1748
Asset Number: 007618
Work Order Number: 444045532

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCSL 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.

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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: 74.0 Degrees Fahrenheit Humidity: 58 % RH

Calibration Date: 11 Oct 01 **Calibration Procedure:** CL-9, 5/99

Condition as Received: SEE ATTACHED DATA

Condition as Released: SEE ATTACHED DATA

Remarks: SEE ATTACHED DATA SHEET.

Approved by:

Walt Hill, Supervisor
Institute Calibration Laboratory

Measurements performed by:

Roger Dykstra, Technician

SOUTHWEST RESEARCH INSTITUTE

Calibration Laboratory

WORK ORDER

Received by RCRUZ,3/20/02 1:19:18PM



Arrived 3/20/02

Work Order **444047766**

Asset No. 007618 Manufacturer ERTCO

Model ASTM 91 C

Equipment Type THERMOMETER

Serial No. 1748

Accessory No.

Interval 6 M

Calibration Procedure CL-9, 5/99

Location B57

Div/Client DIV20

Custodian BRADLEY WERLING

Mail Stop B57

Tel 6565

IN LINE

Special Instructions _____

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

Charge/Project No. 00751.006 1.20

Requester / Telephone

This information is correct for the work requested.

Bradley Werling

WORK NOTES

| Date | Hours | Remarks/Notes |
|-------|-------|---------------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

| Date | Hours | Part Name | Part Number | Failure Description | Cost |
|-------|-------|-----------|-------------|---------------------|-------|
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

WORK SUMMARY

Failure Description _____

Repair Action _____

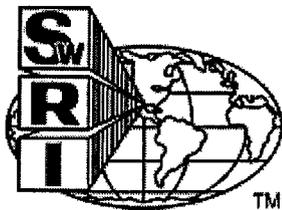
Tech 8216 Cal Hrs. 1 Repair Hrs _____ Parts Cost _____ Temp 77 F Hum. 31 %

Standards Used 6243, 5174

Date Picked Up _____

Picked Up By *Bradley Werling*

47766



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

Certificate of Calibration

21 March 2002

Issued to: BRADLEY WERLING DIV20 B57
Manufacturer/Model: ERTCO ASTM 91 C
Description: THERMOMETER
Serial Number: 1748
Asset Number: 007618
Work Order Number: 444047766

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: 77.0 Degrees Fahrenheit Humidity: 31 % RH

Calibration Date: 21 Mar 02 **Calibration Procedure:** CL-9, 5/99

Condition as Received: SEE ATTACHED DATA

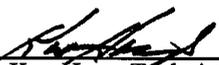
Condition as Returned: SEE ATTACHED DATA

Remarks: SEE ATTACHED AS FOUND CALIBRATION DATA SHEET.

Approved by:


Walt Hill, Metrology Group Leader
Institute Calibration Laboratory

Measurements performed by:


Ken Harp, Technician