

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

Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION

Issued to: DIV20 B57 NARASI SRIDHAR

Device No: 1997

Manufacturer: OMEGA

Model: HH22

Nomenclature: MICROPROCESSOR THERMOMETER

Serial Number: T-94140

SwRI No: NONE

Cal interval 6 Mo.

Remarks

Accuracy: MFG

Procedure: MFGR

ENVIRONMENT

Temperature: 70 Humidity: 42 Location: ROOM A11 B68 SWRI

CONCLUSION

Tolerance/Remarks: Received in tolerance, no adjustments made

Calibration was in accord 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.

Signed Anthony P. Lerner

Calibration Date: 07/07/93

Cal interval: 6 Months

Record Number: 00011687

Next Calibration Due: 01/07/94

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

Department of Quality Assurance
Calibration Laboratory

Device Serial No: T-94140

Calibration Date: 07/07/93

STANDARDS

Standard No: 131 Manufacturer: ESI Model: RV622A
Nomenclature: DECADE VOLTAGE DIVIDER
Serial No: 826004 Cal.Due: 03/11/94 Cal.Rec.No: 00010443

Standard No: 168 Manufacturer: JOHN FLUKE Model: 335A
Nomenclature: DC VOLTAGE STANDARD/DIFFERENTIAL VOLTMETER/NULL DET.
Serial No: 775024 Cal.Due: 10/06/93 Cal.Rec.No: 00011020

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

Department of Quality Assurance
Calibration Laboratory

Device Serial No: T-94140

Calibration Date: 01/12/94

STANDARDS

Standard No: 131 Manufacturer: ESI Model: RV622A
Nomenclature: DECADE VOLTAGE DIVIDER
Serial No: 826004 Cal.Due: 03/11/94 Cal.Rec.No: 00010443

Standard No: 182 Manufacturer: JOHN FLUKE Model: 5700A
Nomenclature: CALIBRATOR
Serial No: 5200003 Cal.Due: 01/26/94 Cal.Rec.No: 00012595

Standard No: 2868 Manufacturer: KAY Model: X0251
Nomenclature: ICE POINT REFERENCE
Serial No: 311210 Cal.Due: 12/30/94 Cal.Rec.No: 00013042

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

Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION

Issued to: DIV20 B57 NARASI SRIDHAR

Device No: 1997

Manufacturer: OMEGA

Model: HH22

Nomenclature: MICROPROCESSOR THERMOMETER

Serial Number: T-94140

SwRI No: NONE

Cal interval 6 Mo.

Remarks

*Accuracy .1% of rdg + 1 deg F

Accuracy: *

Procedure: MFGR

ENVIRONMENT

Temperature: 69 Humidity: 34 Location: SWRI ROOM B4 BLDG. 64

CONCLUSION

Tolerance/Remarks: Received in tolerance, no adjustments made

Calibration was in accord 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.

Signed



Calibration Date: 07/29/94

Cal interval: 6 Months

Record Number: 00014690

Next Calibration Due: 01/29/95

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

Department of Quality Assurance
Calibration Laboratory

Device Serial No: T-94140

Calibration Date: 07/29/94

STANDARDS

Standard No: 131 Manufacturer: ESI Model: RV622A
Nomenclature: DECADE VOLTAGE DIVIDER
Serial No: 826004 Cal.Due: 05/03/95 Cal.Rec.No: 00013588

Standard No: 132 Manufacturer: JOHN FLUKE Model: 5100B
Nomenclature: CALIBRATOR
Serial No: 2730017 Cal.Due: 11/13/94 Cal.Rec.No: 00014058

Standard No: 2868 Manufacturer: KAYE Model: X0251
Nomenclature: ICE POINT REFERENCE
Serial No: 311210 Cal.Due: 12/30/94 Cal.Rec.No: 00013042

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
02/08/95

Issued to: DARRELL DUNN DIV20 ,B57
Manufacturer: OMEGA
Nomenclature: MICROPROCESSOR THERMOMETER
Serial Number: T-94140

Asset Number: 001997
Model Number: HH22
SwRI Capital Number: NONE

ENVIRONMENTAL CONDITIONS

Temperature: 75.0F

Relative Humidity: 30 %

CALIBRATION INFORMATION

Location: CAL1
Procedure Number: MFGR
Remarks:

Technician: 10004
Accuracy: *
Received IN 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
000182	5200003	FLUKE	5700A	CALIBRATOR	12/14/94	3	03/14/95
002868	311210	KAYE	X0251	ICE POINT REFERENCE	01/03/95	12	01/03/96

Certified by :



Certificate#: 16279

Calibration Date: 02/08/95
Interval: 6 months
Next Calibration Due: 08/08/95

SOUTHWEST RESEARCH INSTITUTE

Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
08/24/95

Issued to: DARRELL DUNN DIV20 ,B57 Asset Number: 001997
Manufacturer: OMEGA Model Number: HH22
Nomenclature: MICROPROCESSOR THERMOMETER
Serial Number: T-94140 SwRI/Div. I.D. #: NONE
Notes: *ACCURACY .1% OF RDG + 1 DEG F

ENVIRONMENTAL CONDITIONS

Temperature: 74.0F Relative Humidity: 36%

CALIBRATION INFORMATION

Procedure Number: MFGR Accuracy: *
Remarks: Received IN 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
000182	5200003	FLUKE	5700A	CALIBRATOR	06/07/95	3	09/07/95
002868	311210	KAYE	X0251	ICE POINT REFERENCE	01/03/95	12	01/03/96

Certified by : 

Certificate#: 18257

Calibration Date: 08/24/95
Interval: 6 months
Next Calibration Due: 02/24/96

SOUTHWEST RESEARCH INSTITUTE

**Department of Quality Assurance
Calibration Laboratory**

**CERTIFICATE OF CALIBRATION
03/26/96**

Issued to: DARRELL DUNN DIV20 ,B57
Manufacturer/Model: OMEGA/HH22
Nomenclature: MICROPROCESSOR THERMOMETER
Serial Number: T-94140
Asset Number: 001997
Notes: *ACCURACY .1% OF RDG + 1 DEG F

ENVIRONMENTAL CONDITIONS

Temperature: 70.0F

Relative Humidity: 26%

CALIBRATION INFORMATION

Procedure Number: TP0044

Accuracy: *

Remarks: LIMITED CALIBRATION - CH T1 T/C J,K FULL RANGE;
CH T2 T/C K FULL RANGE, T/C J RESTRICTED TO -260 DEG.F TO 1400 DEG.F

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
000182	5200003	FLUKE	5700A	CALIBRATOR	02/02/96	3	05/02/96
002868	311210	KAYE	X0251	ICE POINT REFERENCE	01/15/96	12	01/15/97

Certified by :



Certificate#: 20158

Calibration Date: 03/26/96
Interval: 6 months
Next Calibration Due: 09/26/96

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

OUT OF TOLERANCE NOTICE

03/26/96

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

INSTRUMENT INFORMATION

Issued to: DARRELL DUNN DIV20 B57 Asset Number: 001997
Manufacturer: OMEGA Model Number: HH22
Nomenclature: MICROPROCESSOR THERMOMETER
Serial Number: T-94140 SwRI Capital Number: NONE
Accuracy: +/- 0.1% of Reading + 1 Deg.F Calibration Interval: 6 months

DEVIATION

Out of Tolerance Date: 02/12/96 Last Valid Calibration Date: 08/24/95

REMARKS

Received instrument for calibration out of tolerance. Instrument under test was compared to the Calibration standard with the following measurements recorded. Adjustment of the instrument was attempted but all values within the specified ranges could not be achieved. Limited calibration was given for valid ranges.

STANDARD	INSTRUMENT UNDER TEST	
	(FUNCTION)	
	AS FOUND	AS RELEASED
	(CH T1 TYPE J T/C)	
-340 DEG.F	-343.6	-341.4
-300 DEG.F	-303.2	-301.2
-200 DEG.C	-201.2	-200.5
	(CH T2 TYPE K T/C)	
-325 DEG.F	-323.3	(LIMITED CAL TO -260 DEG.F)

Signed 
OUT OF TOLERANCE
Checked by 

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

NONCONFORMANCE REPORT

Project No. 20-5708-573

NCR No. 96-03

PART 1: DESCRIPTION OF NONCONFORMANCE

The Omega Microprocessor Thermometer model HH22, serial number T-94140, was found out of tolerance at temperatures below -300 degrees F when recalibrated.

Initiated by: R.D. Brient *RDB*

Date: 3/27/96

PART 2: PROPOSED DISPOSITION AND CORRECTIVE ACTION

Disposition: Accept test results that used this instrument as-is.

Basis of Disposition: The instrument has not and will never be used at the low temperatures where the out of tolerance was identified. All high-level waste related materials investigations will be conducted at room temperature and above.

Action to correct nonconformance: Instrument was limited in its calibration to -260 degrees F and above. see attached out of tolerance notice.

Proposed by: Darrell Dunn *DD*

Target date for completion: 3/27/96

Date: 3/27/96

PART 3: APPROVAL

Element Manager: *Peter Lichtner for N.S.* Date: 3/27/96

Director of QA: *Gene Malabuta* Date: 3/27/96

Comments/Instructions:

PART 4: CLOSE OUT

Comments: *N/A BSW 3/27/96*

Distribution: EMS
B. Sagar
H. Garcia
R. Brient
P. Lichtner

Verified by: *N/A*

Date: 3/27/96

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

OUT OF TOLERANCE NOTICE

03/26/96

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

INSTRUMENT INFORMATION

Issued to: DARRELL DUNN DIV20 B57 Asset Number: 001997
Manufacturer: OMEGA Model Number: HH22
Nomenclature: MICROPROCESSOR THERMOMETER
Serial Number: T-94140 SwRI Capital Number: NONE
Accuracy: +/- 0.1% of Reading + 1 Deg.F Calibration Interval: 6 months

DEVIATION

Out of Tolerance Date: 02/12/96 Last Valid Calibration Date: 08/24/95

REMARKS

Received instrument for calibration out of tolerance. Instrument under test was compared to the Calibration standard with the following measurements recorded. Adjustment of the instrument was attempted but all values within the specified ranges could not be achieved. Limited calibration was given for valid ranges.

STANDARD	INSTRUMENT UNDER TEST	
	AS FOUND	AS RELEASED
	(FUNCTION)	
	(CH T1 TYPE J T/C)	
-340 DEG.F	-343.6	-341.4
-300 DEG.F	-303.2	-301.2
-200 DEG.C	-201.2	-200.5
	(CH T2 TYPE K T/C)	
-325 DEG.F	-323.3	(LIMITED CAL TO -260 DEG.F)

Signed

OUT OF TOLERANCE

Checked by



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

Certificate of Calibration

9 December 1997

Issued to: DARRELL DUNN DIV20 B57
 Manufacturer/Model: OMEGA HH22
 Description: MICROPROCESSOR THERMOMETER
 Serial Number: T-94140
 Asset Number: 001997

Environmental Conditions

Temperature: 75 Deg. F Humidity: 40 % 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: 9 Dec 97 Calibration Procedure: MFG MAN.#M739A/0789

Interval: 6 months Received: Out of Tolerance

Next Calibration Due: 9 Jun 98

Remarks:

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.

CAL STD	UNIT UNDER TEST		UNCERTAINTY
	AS RECEIVED	AS RELEASED	
	(T1 - J T/C)		
-340.0 DEG.F	-342.1 DEG.F	-341.3 DEG.F	+/- 1.42 DEG.F
-300.0 DEG.F	-301.8 DEG.F	-300.6 DEG.F	+/- 1.38 DEG.F
-200.0 DEG.F	-201.5 DEG.F	-200.7 DEG.F	+/- 1.28 DEG.F
-100.0 DEG.F	-101.3 DEG.F	-100.5 DEG.F	+/- 1.18 DEG.F
-10.0 DEG.F	-11.1 DEG.F	-10.6 DEG.F	+/- 1.09 DEG.F
10.0 DEG.F	8.9 DEG.F	9.9 DEG.F	+/- 1.09 DEG.F
-200.0 DEG.C	-201.2 DEG.C	-200.2 DEG.C	+/- 0.8 DEG.C
10.0 DEG.C	9.3 DEG.C	9.7 DEG.C	+/- 0.6 DEG.C

UNIT ADJUSTED TO MANUFACTURER SPECIFICATIONS.

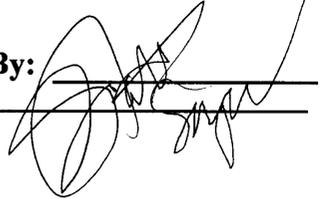
Certificate # 27653

Certificate of Calibration

9 December 1997

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: OMEGA HH22
Description: MICROPROCESSOR THERMOMETER
Serial Number: T-94140
Asset Number: 001997

Signed: 
Title: _____

Checked By: 
Title: _____

LAST PAGE OF REPORT Total Pages Printed: 2



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

Out of Tolerance Notice

13 April 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: OMEGA HH22
Description: MICROPROCESSOR THERMOMETER
Serial Number: T-94140
Asset Number: 001997
SwRI Cap No.: NONE
Calibration Interval: 6 months
Remarks:

Accuracy: *
Calibration Procedure: T.O. 33K5-4-282-1 30 OCT 97

Calibration Results

Out of Tolerance Date: 31 Mar 99

Last Valid Calibration Date: 9 Dec 97

Type "K" TC T1 and T2

Applied:	Reading:	error:	Limits:
-200 deg.C.	-199.0	-1 deg.C.	+/- .6 deg.C.

Certificate # 33572

Signed: 

Checked by: 

Page 1 of 1

Out of Tolerance Notice



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

13 April 1999

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: OMEGA HH22
Description: MICROPROCESSOR THERMOMETER
Serial Number: T-94140
Asset Number: 001997

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.

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: 74.0 Degrees Fahrenheit Humidity: 30 % RH

Calibration Date: 31 Mar 99 **Calibration Procedure:** T.O. 33K5-4-282-1 30 OCT 97

Condition as Received: OUT OF TOLERANCE

Condition as Released: IN TOLERANCE, ADJUSTED

Remarks:

Approved by:

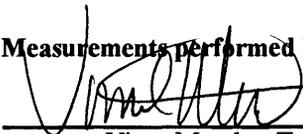


Jim Patterson, Supervisor or Walt Hill, Metrologist

Certificate # 33572

m:\a2la.rpt Rev date 10 Mar 99

Measurements performed by:



Vince Morales, Technician

Page 1 of 1

SOUTHWEST RESEARCH INSTITUTE

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

To: Darrell Dunn, Div 20, And Bldg 57.

From: Walt Hill
Metrology Group Leader
Institute Calibration Laboratory

Date: March 22, 2002

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: Omega **Model:** HH22

Description: Digital Thermometer **Serial Number:** T-94140

Asset Number: 001997 **User ID Number:**

Last Calibration: Aug 23, 2001

Date Received for Service: Mar. 18, 2002 **Work Order Number:** 444047711

Service Requested: Scheduled calibration

Remarks: OOT at -200 and -50 degree C for both channels.

OUT OF TOLERANCE



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

Submitted By: DIV20

Address: B57

Contact: DARRELL DUNN

Manufacturer Model: OMEGA HH22

Description: THERMOCOUPLE THERMOMETER

Serial No: T-94140

Asset No: 001997

Procedure: CL-681, 10/02

Work Order: 444050893

Date Issued: Oct 31, 2002

Calibration Date: Oct 29, 2002

****Calibration Due:** Apr 29, 2003

Calibration Location: N/A

Environment: Temp. 72.0°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/NC SL 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: See Data Sheet

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
004164	FLUKE	5500A/SC300	CALIBRATOR	Jul 25, 03

Approved by: Walt Hill

Metrology Group Leader

m:\Nona2\al.rpt Rev date 15, August 02

Measurements by: Vince Morales

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Data Sheet

Workorder	444050893	Mfr.	OMEGA	Technician	V Morales
Asset #.	1997	Model	HH22	Procedure	CL-681, 10/02
Serial #.	T-94140	Type	Digital Thermometer	Cal Date	29-Oct-02

.1 Deg Resolution

Function/Range	Test Point	TI Reading	Difference	Test Limits+/-	Uncertainty	Found/Left
Type J Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
-7.5194 mV	-300	-300.0	0.0	1.3	2:1	Pass
2.2339 mV	110	109.9	0.1	1.1	3:1	Pass
14.8806 mV	525	525.5	0.5	1.5	3:1	Pass
27.6416 mV	940	941.0	1.0	1.9	3:1	Pass
41.1522 mV	1350	1350.5	0.5	2.4	3:1	Pass

	Ambient	TI Reading	Difference	Test Limits+/-	Uncertainty	
T1-T2	24	24.3	0.3	1.0	2:1	Pass

Function/Range	Test Point	TI Reading	Difference	Test Limits+/-	Uncertainty	Result
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
-7.8905 mV	-200	-200.2	-0.2	0.8	2.1:1	Pass
2.0588 mV	40	40.0	0.0	0.6	3.2:1	Pass
14.9422 mV	275	275.3	0.3	0.9	2.9:1	Pass
27.9534 mV	510	510.5	0.5	1.1	2.9:1	Pass
42.2805 mV	750	750.3	0.3	1.4	2.9:1	Pass

Function/Range	Test Point	TI Reading	Difference	Test Limits+/-	Uncertainty	
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
-5.6322 mV	-300	-299.3	0.7	1.3	2:1	Pass
8.0941 mV	390	390.5	0.5	1.4	3:1	Pass
24.031 mV	1075	1076.2	1.2	2.1	3:1	Pass
39.708 mV	1760	1761.6	1.6	2.8	3:1	Pass
53.9095 mV	2450	2452.0	2.0	3.5	3:1	Pass

Function/Range	Test Point	TI Reading	Difference	Test Limits+/-	Uncertainty	
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
-4.9127 mV	-150	-149.8	0.2	0.8	2.1:1	Pass
8.5386	210	210.1	0.1	0.8	3.2:1	Pass
23.8418 mV	575	575.5	0.5	1.2	2.9:1	Pass
38.918 mV	940	940.7	0.7	1.5	2.9:1	Pass
52.4103 mV	1300	1301.1	1.1	1.9	2.9:1	Pass



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

Submitted By: DIV20

Address: B57

Contact: DARRELL DUNN

Manufacturer Model: OMEGA HH22

Description: THERMOCOUPLE THERMOMETER

Serial No: T-94140

Asset No: 001997

Procedure: TEMPERATURE METERS, MAR/03

Work Order: 444053504

Date Issued: May 12, 2003

Calibration Date: May 8, 2003

****Calibration Due:** Nov 8, 2003

Calibration Location: Bldg. 64

Environment: Temp. 72.0°F Hum. 42 %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. 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: None

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
006413	FLUKE	5520A/SC1100	MULTI-PRODUCT CALIBRATOR	Jan 17, 04

Approved by: Walt Hill

Metrology Group Leader

m:\Nona2\al.rpt Rev date 15, August 02

Measurements by: Mark Romero

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444053504	Mfr.	OMEGA	Technician	Mark Romero
Asset #.	001997	Model	HH22	Cal Date	08-May-03
Serial #.	T-94140	Type	Digital Thermometer		

Remarks:

Function/Range T1	Test Point	TI Reading	Difference	+/-Limits	+/-Uncertainty	Found/Left
Type J Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Result
	-300	-299.4	0.6	1.3	.56	Pass
	110	110.0	0.0	1.1	.30	Pass
	525	525.8	0.8	1.5	.35	Pass
	940	941.1	1.1	1.9	.35	Pass
	1350	1351.0	1.0	2.4	.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.0	0.0	0.8	.3	Pass
	40	39.8	-0.2	0.6	.19	Pass
	275	275.4	0.4	0.9	.31	Pass
	510	510.9	0.9	1.1	.31	Pass
	750	750.6	0.6	1.4	.31	Pass
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
	-300	-298.8	1.2	1.3	.69	Pass
	390	390.6	0.6	1.4	.54	Pass
	1075	1076.4	1.4	2.1	.54	Pass
	1760	1761.7	1.7	2.8	.54	Pass
	2450	2452.2	2.2	3.5	.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-149.6	0.4	0.8	.38	Pass
	210	210.2	0.2	0.8	.31	Pass
	575	575.7	0.7	1.2	.31	Pass
	940	940.8	0.8	1.5	.31	Pass
	1300	1301.1	1.1	1.9	.46	Pass
T1-T2		TI Reading	Difference	+/-Test Limits	+/-Uncertainty	
		-0.2	-0.2	1.0	0.5	Pass

Southwest Research Institute
Calibration Laboratory
Calibration Report

Function/Range T2	Test Point	TI Reading	Difference	+/-Limits	+/-Uncertainty	Found/Left
Type J Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Result
	-300	-299.6	0.4	1.3	.56	Pass
	110	110.1	0.1	1.1	.30	Pass
	525	525.6	0.6	1.5	.35	Pass
	940	940.3	0.3	1.9	.35	Pass
	1350	1351.0	1.0	2.4	.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.2	-0.2	0.8	.3	Pass
	40	39.8	-0.2	0.6	.19	Pass
	275	275.2	0.2	0.9	.31	Pass
	510	511.0	1.0	1.1	.31	Pass
	750	751.0	1.0	1.4	.31	Pass
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
	-300	-299.7	0.3	1.3	.69	Pass
	390	389.9	0.1	1.4	.54	Pass
	1075	1075.1	0.1	2.1	.54	Pass
	1760	1761.8	1.8	2.8	.54	Pass
	2450	2451.0	1.0	3.5	.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-150.1	-0.1	0.8	.38	Pass
	210	210.2	0.2	0.8	.31	Pass
	575	575.0	0.0	1.2	.31	Pass
	940	941.0	1.0	1.5	.31	Pass
	1300	1301.0	1.0	1.9	.46	Pass

END OF REPORT



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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: OMEGA HH22

Description: THERMOCOUPLE THERMOMETER

Serial No: T-94140

Asset No: 001997

Procedure: TEMPERATURE METERS, MAR/03

Work Order: 444056170

Date Issued: Nov 5, 2003

Calibration Date: Nov 5, 2003

****Calibration Due:** May 5, 2004

Calibration Location: Bldg. 64

Environment: Temp. 72.0°F Hum. 36 %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/NCSL 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: None

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
006413	FLUKE	5520A/SC1100	MULTI-PRODUCT CALIBRATOR	Jan 17, 04

Approved by: Walt Hill

Metrology Group Leader

m:\a2\al.rpt Rev date 15, August 02

Measurements by: Vince Morales

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444056170	Mfr.	OMEGA	Technician	Vmorales
Asset #.	1997	Model	HH22	Cal Date	05-Nov-03
Serial #.	T-94140	Type	Digital Thermometer		
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
T1 Input	Deg F	Deg F	Deg F	Deg F	Deg F	Result
Type J Deg F	-300	-300.8	0.8	1.3	.56	Pass
	110	109.8	0.2	1.1	.30	Pass
	525	525.6	0.6	1.5	.35	Pass
	940	940.7	0.7	1.9	.35	Pass
	1350	1350.5	0.5	2.4	.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.3	-0.3	0.8	.3	Pass
	40	39.9	-0.1	0.6	.19	Pass
	275	275.2	0.2	0.9	.31	Pass
	510	510.4	0.4	1.1	.31	Pass
	750	750.2	0.2	1.4	.31	Pass
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
	-300	-299.8	0.2	1.3	.69	Pass
	390	390.3	0.3	1.4	.54	Pass
	1075	1076.1	1.1	2.1	.54	Pass
	1760	1761.6	1.6	2.8	.54	Pass
	2450	2452.0	2.0	3.5	.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-149.9	0.1	0.8	.38	Pass
	210	210.2	0.2	0.8	.31	Pass
	575	575.5	0.5	1.2	.31	Pass
	940	940.7	0.7	1.5	.31	Pass
	1300	1301.1	1.1	1.9	.46	Pass
T1Input -T2 Input		TI Reading	Difference	+/-Test Limits		Pass
		-0.2	-0.2	1.0		

Southwest Research Institute
Calibration Laboratory
Calibration Report

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
T2 Input	Deg F	Deg F	Deg F	Deg F	Deg F	Result
Type J Deg F	-300	-300.6	0.6	1.3	.56	Pass
	110	110.0	0.0	1.1	.30	Pass
	525	525.5	0.5	1.5	.35	Pass
	940	940.6	0.6	1.9	.35	Pass
	1350	1350.4	0.4	2.4	.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.4	-0.4	0.8	.3	Pass
	40	39.9	-0.1	0.6	.19	Pass
	275	275.2	0.2	0.9	.31	Pass
	510	510.4	0.4	1.1	.31	Pass
	750	750.2	0.2	1.4	.31	Pass
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
	-300	-299.3	0.7	1.3	.69	Pass
	390	390.4	0.4	1.4	.54	Pass
	1075	1076.1	1.1	2.1	.54	Pass
	1760	1761.5	1.5	2.8	.54	Pass
	2450	2451.9	1.9	3.5	.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-149.8	0.2	0.8	.38	Pass
	210	210.2	0.2	0.8	.31	Pass
	575	575.7	0.6	1.2	.31	Pass
	940	940.5	0.5	1.5	.31	Pass
	1300	1301.0	1.0	1.9	.46	Pass

END OF REPORT



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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: OMEGA HH22
Description: THERMOCOUPLE THERMOMETER
Serial No: T-94140
Asset No: 001997
Procedure: TEMPERATURE METERS, MAR/03

Work Order: 444058717
Date Issued: Apr 27, 2004
Calibration Date: Apr 27, 2004
****Calibration Due:** Oct 27, 2004
Calibration Location: Bldg. 64
Environment: Temp. 73.0°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/NCSL 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.

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**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
006413	FLUKE	5520A/SC1100	MULTI-PRODUCT CALIBRATOR	Feb 19, 05

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

Measurements by: Bob Trollinger
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444058717	Mfr.	OMEGA	Technician	bit
Asset #.	001997	Model	HH22	Cal Date	27-Apr-04
Serial #.	T-94140	Type	Digital Thermometer		
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
T1 Input	Deg F	Deg F	Deg F	Deg F	Deg F	Result
Type J Deg F	-300	-301.2	1.2	1.3	0.56	Pass
	110	109.5	0.5	1.1	0.30	Pass
	525	525.2	0.2	1.5	0.35	Pass
	940	940.5	0.5	1.9	0.35	Pass
	1350	1350.2	0.2	2.4	0.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.6	-0.6	0.8	0.30	Pass
	40	39.9	-0.1	0.6	0.19	Pass
	275	275.2	0.2	0.9	0.30	Pass
	510	510.3	0.3	1.1	0.30	Pass
	750	750.1	0.1	1.4	0.30	Pass
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
	-300	-299.9	0.1	1.3	0.69	Pass
	390	390.2	0.2	1.4	0.54	Pass
	1075	1076.0	1.0	2.1	0.54	Pass
	1760	1761.0	1.0	2.8	0.54	Pass
	2450	2451.6	1.6	3.5	0.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-150.0	0.0	0.8	0.38	Pass
	210	210.1	0.1	0.8	0.30	Pass
	575	575.4	0.4	1.2	0.30	Pass
	940	940.6	0.6	1.5	0.30	Pass
	1300	1300.7	0.7	1.9	0.46	Pass
T1Input -T2 Input		1.0	1.0	1.0		Pass
T2 Input	Deg F	Deg F	Deg F	Deg F	Deg F	
Type J Deg F	-300	-300.8	0.8	1.3	0.56	Pass
	110	109.8	0.2	1.1	0.30	Pass
	525	525.5	0.5	1.5	0.35	Pass
	940	940.7	0.7	1.9	0.35	Pass
	1350	1350.4	0.4	2.4	0.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.4	-0.4	0.8	0.30	Pass
	40	40.0	0.0	0.6	0.19	Pass
	275	275.3	0.3	0.9	0.30	Pass
	510	510.3	0.3	1.1	0.30	Pass
	750	750.2	0.2	1.4	0.30	Pass

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444058717	Mfr.	OMEGA	Technician	bt
Asset #.	001997	Model	HH22		
Serial #.	T-94140	Type	Digital Thermometer	Cal Date	27-Apr-04

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Result
	-300	-299.7	0.3	1.3	0.69	Pass
	390	390.1	0.1	1.4	0.54	Pass
	1075	1075.9	0.9	2.1	0.54	Pass
	1760	1761.4	1.4	2.8	0.54	Pass
	2450	2451.6	1.6	3.5	0.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-150.0	0.0	0.8	0.38	Pass
	210	210.0	0.0	0.8	0.30	Pass
	575	575.4	0.4	1.2	0.30	Pass
	940	940.5	0.5	1.5	0.30	Pass
	1300	1300.8	0.8	1.9	0.46	Pass

END OF REPORT



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Certificate #
0972-01

Certificate of Calibration

Submitted By: DIV20	Work Order: 444061390
Address: B57	Date Issued: Nov 4, 2004
Contact: DARRELL DUNN	Calibration Date: Nov 4, 2004
Manufacturer Model: OMEGA HH22	**Calibration Due: May 4, 2005
Description: THERMOCOUPLE THERMOMETER	Calibration Location: Bldg. 64
Serial No: T-94140	Environment: Temp. 73.0°F Hum. 40 %RH
Asset No: 001997	*As Found: IN TOLERANCE
Procedure: TEMPERATURE METERS, OCT/03	*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.

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**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
006413	FLUKE	5520A/SC1100	MULTI-PRODUCT CALIBRATOR	Feb 19, 05

Approved by: Walt Hill
Metrology Group Leader

m:\a21a1.rpt Rev date 11, May 04

Measurements by: Scott Kester
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444061390	Mfr.	OMEGA	Technician	SRK
Asset #.	001997	Model	HH22	Cal Date	04-Nov-04
Serial #.	T-94140	Type	Digital Thermometer		
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
T1 Input	Deg F	Deg F	Deg F	Deg F	Deg F	Result
Type J Deg F						
	-300	-301.1	1.1	1.3	0.56	Pass
	110	109.9	0.1	1.1	0.30	Pass
	525	525.4	0.4	1.5	0.35	Pass
	940	940.6	0.6	1.9	0.35	Pass
	1350	1350.6	0.6	2.4	0.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.3	-0.3	0.8	0.30	Pass
	40	39.9	-0.1	0.6	0.19	Pass
	275	275.3	0.3	0.9	0.30	Pass
	510	510.4	0.4	1.1	0.30	Pass
	750	750.3	0.3	1.4	0.30	Pass
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	
	-300	-300.0	0.0	1.3	0.69	Pass
	390	390.1	0.1	1.4	0.54	Pass
	1075	1075.8	0.8	2.1	0.54	Pass
	1760	1761.4	1.4	2.8	0.54	Pass
	2450	2451.9	1.9	3.5	0.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-150.0	0.0	0.8	0.38	Pass
	210	210.1	0.1	0.8	0.30	Pass
	575	575.5	0.5	1.2	0.30	Pass
	940	940.7	0.7	1.5	0.30	Pass
	1300	1301.0	1.0	1.9	0.46	Pass
T1Input -T2 Input		0.1	0.1	1.0		Pass
T2 Input	Deg F	Deg F	Deg F	Deg F	Deg F	
Type J Deg F						
	-300	-300.7	0.7	1.3	0.56	Pass
	110	110.0	0.0	1.1	0.30	Pass
	525	525.6	0.6	1.5	0.35	Pass
	940	941.0	1.0	1.9	0.35	Pass
	1350	1350.6	0.6	2.4	0.35	Pass
Type J Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-200	-200.2	-0.2	0.8	0.30	Pass
	40	40.0	0.0	0.6	0.19	Pass
	275	275.3	0.3	0.9	0.30	Pass
	510	510.4	0.4	1.1	0.30	Pass
	750	750.3	0.3	1.4	0.30	Pass

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444061390	Mfr.	OMEGA	Technician	SRK
Asset #.	001997	Model	HH22	Cal Date	04-Nov-04
Serial #.	T-94140	Type	Digital Thermometer		

Function/Range	Test Point	TI Reading	Difference	+/-Limit	+/-Uncertainty	Found/Left
Type K Deg F	Deg F	Deg F	Deg F	Deg F	Deg F	Result
	-300	-299.8	0.2	1.3	0.69	Pass
	390	390.1	0.1	1.4	0.54	Pass
	1075	1075.8	0.8	2.1	0.54	Pass
	1760	1761.3	1.3	2.8	0.54	Pass
	2450	2451.7	1.7	3.5	0.83	Pass
Type K Deg C	Deg C	Deg C	Deg C	Deg C	Deg C	
	-150	-150.0	0.0	0.8	0.38	Pass
	210	210.1	0.1	0.8	0.30	Pass
	575	575.5	0.5	1.2	0.30	Pass
	940	940.6	0.6	1.5	0.30	Pass
	1300	1301.0	1.0	1.9	0.46	Pass

END OF REPORT