

Appendix C: Radiation thermometer sample calibration report

In reply refer to: 844/123456-95

Radiometric Systems Inc.
Attn: John Doe
123 Calibration Court
Measurement City, MD 00000-0000

Subject: Radiation Thermometer Report of Test

Order No.: AB1234 dated January 1, 1995

Dear Mr. Doe:

Enclosed are results of the test you requested for Test Number 35070S Special Test of Radiation Thermometer. Please refer to the above file number in any further communication concerning this test.

Sincerely,

Albert C. Parr, Chief
Optical Technology Division
Physics Laboratory

Enclosure:

One Report of Test

ACP/jah

NIST Cost Center 8443600

REPORT OF TEST

35070S Special Test of Radiation Thermometer

for

Model # [Minolta-Land Cyclops 52](#), Serial # [00000000](#)

Submitted by:

[John Doe](#)
[Radiometric Systems Inc.](#)
[123 Calibration Court](#)
[Measurement City, MD 00000-0000](#)

(See your Purchase Order No. [AB1234](#) dated [January 1, 1995](#))

1. Description of Test Item

A radiation thermometer was tested by the National Institute of Standards and Technology (NIST) as a standard of radiance temperature from [800 °C](#) to [2300 °C](#). The test unit was measured with clear filter (Serial Number 0) and dark filter (Serial Number 0).

2. Description of Test

The test thermometer was measured in the NIST Radiance Temperature Calibration Facility using the equipment and procedures described in Ref. [1]. The NIST Photoelectric Pyrometer, which has a mean effective wavelength of [655.3 nm](#), was used to spectrally compare the variable-temperature blackbody to working standard SL20 to determine the radiance temperature of the blackbody at each calibration temperature. The test thermometer display panel value was recorded at each calibration temperature. The NIST Photoelectric Pyrometer is described in the Ref. [1]

The variable-temperature blackbody has an estimated emissivity of [0.99](#). The blackbody cavity is a single piece of graphite, specially tapered for temperature uniformity. This graphite tube is cylindrically hollow on both ends to form two [2.54 cm](#) diameter cavities with a common partition in the center. One cavity is used for temperature control and the other as a blackbody source.

Laboratory Environment:

Temperature: [23 °C ± 1 °C](#)

Relative Humidity: [46% ± 5%](#)

Test Date: [January 2, 1995](#)

NIST Test No.: [844/123456-95](#)

Page 1 of 5

REPORT OF TEST

35070S Special Test of Radiation Thermometer
Radiometric Systems Inc.

Model #: [Minolta-Land Cyclops 52](#)
Serial #: [00000000](#)

The thermometer was aligned so that its optical axis, when viewing the variable-temperature blackbody, coincided with the geometrical center of the blackbody. The test thermometer was operated according to the manufacturer's operating instructions and measured with the following conditions.

Temperatures measured: [800 °C to 1200 °C with the clear filter](#)
[1200 °C to 2300 °C with the dark filter](#)

Distance: [100 cm from the thermometer alignment mark](#) to the blackbody cavity partition

Operating mode: [continuous mode](#)

Calculated target size: [5.6 mm diameter](#) focused on the center of the blackbody cavity partition

Emissivity setting: [1](#)

3. Results of Test

Table 1 gives the radiance temperature at [1000 nm](#) versus the [test thermometer display panel value](#).

Table 2 gives the test uncertainties relative to the International System of Units (SI Units). The expanded uncertainties $U = ku_c(T)$ (coverage factor $k = 2$) are two standard deviation estimates. Details on the estimation of these uncertainties are given in Ref. [1]. The NIST policy on uncertainty statements is described in Ref. [3].

4. General Information

The temperatures described in this report are radiance temperatures. The temperatures are stated with respect to the 1990 NIST Radiance Temperature Scale and correspond to temperatures when sighting on a Planckian radiator. See Ref. [2] for further details on the 1990 NIST Radiance Temperature Scale.

To maintain the highest accuracy, keep the optical components clean and have the thermometer recalibrated periodically. Appropriate calibration schedules vary with instrument and application and are best determined by the user.

The results of this test apply only to the thermometer referenced in this report. This report shall not be reproduced, except in full, without the written approval of the Radiance Temperature Measurements Calibration Service.

Test Date: [January 2, 1995](#)
NIST Test No.: [844/123456-95](#)

Page 2 of 5

REPORT OF TEST

35070S Special Test of Radiation Thermometer
Radiometric Systems Inc.

Model #: [Minolta-Land Cyclops 52](#)
Serial #: [00000000](#)

Prepared by:

Approved by:

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Optical Technology Division
Physics Laboratory
(301) 975-2329

Robert D. Saunders
For the Director,
National Institute of
Standards and Technology
(301) 975-2355

References

- [1] C. E. Gibson, B. K. Tsai, and A. C. Parr, "Radiance Temperature Calibrations," *NIST Special Publication* **250-43** (1997).
- [2] K. D. Mielenz, R. D. Saunders, A. C. Parr, and J. J. Hsia, "The 1990 NIST Scales of Thermal Radiometry," *J. Res. Natl. Inst. Stand. Technol.*, **95**, 621-629, (1990).
- [3] B. N. Taylor and C. E. Kuyatt, "Guidelines for Evaluating and Expressing the Uncertainty of the NIST Measurement Results," *NIST Technical Note* **1297** (2nd ed., 1994).

REPORT OF TEST35070S Special Test of Radiation Thermometer
Radiometric Systems Inc.Model #: **Minolta-Land Cyclops 52**
Serial #: **00000000****TABLE 1**
Radiance Temperature at 1000 nm

Nominal Temperature [°C]	Blackbody Temperature (1990 NIST) [°C]	Thermometer Display Panel Value [°C]	Thermometer Correction [°C]
Clear Filter			
800	798.7	801	-2.3
900	899.1	900	-0.9
1000	1000.2	1000.5	-0.3
1100	1100.6	1100.5	0.1
1200	1200.5	1199.5	1.0
Dark filter			
1200	1200.4	1200	0.4
1300	1299.4	1298	1.4
1400	1399.6	1396.5	3.1
1500	1500.3	1497	3.3
1600	1600.6	1597	3.6
1700	1700.5	1696.5	4.0
1800	1801.7	1797	4.7
1900	1899.5	1894	5.5
2000	1999.9	1992	7.9
2100	2099.9	2091.5	8.4
2200	2200.7	2191	9.7
2300	2301.2	2290	11.2

Test Date: **January 2, 1995**
NIST Test No.: **844/123456-95**

Page 4 of 5

REPORT OF TEST35070S Special Test of Radiation Thermometer
Radiometric Systems Inc.Model #: [Minolta-Land Cyclops 52](#)
Serial #: [00000000](#)**TABLE 2**
Radiance Temperature Test Uncertainties

Source of Uncertainty	Type	Expanded Uncertainties ($k = 2$) [°C]				
		800 °C	1100 °C	1500 °C	1900 °C	2300 °C
1. Calibration of the variable temperature blackbody relative to the 1990 NIST Radiance Temperature Scale	B	0.3	0.3	0.4	0.6	0.9
2. Mean effective wavelength measurement for the NIST Photoelectric Pyrometer	B	0.1	0.0	0.1	0.3	0.5
3. Blackbody temperature correction	B	0.1	0.2	0.4	0.6	0.8
4. Blackbody uniformity	B	0.2	0.2	0.2	0.2	0.2
5. Test thermometer temperature determination	A	2.0	2.0	2.0	2.0	2.0
6. 1990 NIST Radiance Temperature Scale relative to the Thermodynamic Temperature Scale	B	0.1	0.2	0.4	0.6	0.9
Overall uncertainty of test lamp calibration with respect to SI units						
		2.0	2.1	2.1	2.3	2.5