

Calibration Verification Certificate

Device Description
Dual Laser Infrared Thermometer

Date of Test
1/1/2018

Brand and Model Number
ennoLogic eT650D

Ambient Temperature
66.3°F ±1°F

Serial Number
123456789012

Ambient Relative Humidity
49.2% ±4%

Certificate Number
CI12345678901201

As-Found: N/A
As-Left: In Tolerance

Device Specifications

Temperature Range: -50°C to 650°C (-58°F to 1202°F)
Accuracy: ± (1% of reading + 1°C/2°F) or ± 2°C/3.5°F (whichever is greater)

Reference Standards

Device	Model Number	Manufacturer	Serial Number	Calibration
Infrared Calibrator	IR-500	Thermoworks	140322792	Last: 8/16/17 Due: 8/16/18
Reference Thermometer	DTU6005-002-N	QTI Sensing Solutions	33651452	Last: 6/5/17 Due: 6/5/18
Calibration Ice Bath	D03	MobiCool	11013333	N/A (intrinsic)

Test Measurement Results

Reference Temperature [°F]	Test Unit Measurement [°F]	Test Error [°F]	Specification Tolerance [°F]	Acceptance Tolerance [°F]	Uncertainty (k=2) [°F]	Test Uncertainty Ratio TUR
32.0	32.3	0.3	+/- 3.5	+/- 3.4	+/- 1.0	3.5:1
66.3	65.6	-0.7	+/- 3.5	+/- 3.5	+/- 0.2	≥4:1
212.0	211.8	-0.2	+/- 4.1	+/- 2.2	+/- 2.8	1.5:1

SAMPLE

Measurement Uncertainty and Test Uncertainty Ratio

The measurement uncertainties provided in this report represents the uncertainties present at the time of testing and consider all relevant sources of uncertainty involved in the measurement process including test standards and process uncertainties. The uncertainties are estimated and calculated in accordance with the methods described in BIPM publication JCGM 100:2008 "Evaluation of measurement data — Guide to the expression of uncertainty in measurement".

The stated expanded uncertainty is the combined uncertainty of the entire calibration verification process multiplied by a coverage factor of $k=2$ and provides a coverage probability of approximately 95%.

The comparison between the accuracy of the device under test and the uncertainty of the calibration or measurement process is called the Test Uncertainty Ratio (TUR). Due to the relatively large uncertainty inherent in the IR measurement process the generally recommended TUR of $\geq 4:1$ cannot be achieved for all tests. The TUR for the test at 212.0°F was determined to be 1.5:1 and the TUR for the test at 32°F was determined to be 3.5:1. For both of these tests, the acceptance tolerance was reduced accordingly by applying guard bands based on Method 6 of Z540.3.

Section 5.3 of ANSI/NCSL Z540.3 states that the probability of false acceptance (PFA) must be constrained to less than 2% when claims of compliance are made. To comply with the 2% PFA requirement, the guidance Handbook for Z540.3 outlines 6 methods. Of these, Method 6 provides compliance with the standard with the least impact to false rejects and has been used to determine guard bands (reduced acceptance tolerance) to reduce the PFA to the required 2%. A Dobbert guard band factor of 0.76 has been applied to the acceptance tolerance at 212°F based on the TUR of 1.5:1, and a Dobbert guard band factor of 0.97 has been applied to the acceptance tolerance at 32°F based on the TUR of 3.5:1.

Calibration Interval

Instruments of this type typically do not undergo changes in accuracy between the time of calibration and the time they are placed into service. Therefore, the calibration interval begins on the date the unit is placed into service rather than the date of calibration stated on page 1 of this certificate. Please note: although the measurement results in this certificate can be considered to be traceable to NIST reference standards at the time the measurements were performed, Cascadia Innovations cannot certify that those measurement results are valid after the instrument has been returned to the customer and placed into service. The customer must have an appropriate internal measurement assurance program in place to assure the continued validity of these measurement results. This program should also specify a calibration interval appropriate for the customer's application. The recommended calibration interval for this instrument for general industrial and laboratory use is one year.

Calibration Verification Summary

This instrument has been checked for accuracy and found to be within the model's specified tolerance of " $\pm (1\% \text{ of reading} + 1^\circ\text{C}/2^\circ\text{F})$ or $\pm 2^\circ\text{C}/3.5^\circ\text{F}$ (whichever is greater)". Its manufacturer's calibration has been tested using standards traceable to the National Institute of Standards and Technology, or accepted intrinsic standards of measurement.