



# Certificate of Calibration

## THERMOMETERS

20472E, 20400E, 20473E, E1184

*This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.*

**FOR:** Facility for Airborne Atmospheric Measurements  
Building 146  
Cranfield University  
Cranfield  
Bedfordshire  
MK43 0AL

For the attention of Dr Hannah Price

**DESCRIPTION:** Four 50  $\Omega$  platinum resistance thermometers (PRTs)

**IDENTIFICATION:** Type: E102BL (Plate), E102AL (Plate), E102BL (Plate), E102BL (Plate)  
Serial No: 20472E, 20400E, 20473E, E1184

**PREVIOUS CERTIFICATES:** 20472E: Not previously calibrated at NPL  
20400E: Not previously calibrated at NPL  
20473E: 2015110037-1 dated 10 December 2015  
E1184: 2013060136-2 dated 30 August 2013

**DATES OF CALIBRATION:** 11 January to 14 January 2018

**Reference:** 2017120149-2

**Date of issue:** 17 January 2017

**Checked by:**

**Signed:**

**Name:** Dr S A Bell

**Page 1 of 3**  
**(Authorised Signatory)**

**on behalf of NPLML**



*This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognise the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).*

# NATIONAL PHYSICAL LABORATORY

Continuation Sheet

## MEASUREMENTS

As requested the platinum resistance thermometers (PRTs) were monitored using a precision resistance bridge with traceability to national standards, using an excitation current of 2.8 mA, and the resistance values obtained appear in the table below. At each generated condition a time of not less than 60 minutes was allowed for temperature to equilibrate. A set of 10 readings recorded at 1 minute intervals was then taken from the instruments under test.

The calibration was carried out in a test chamber, in air, against NPL reference thermometers. Traceability of measurement was provided by calibration of these thermometers to ITS-90 through NPL Temperature Standards.

The values of the applied conditions are shown in the first column of the table below. The values measured from the instruments under test are then quoted with their equivalent expanded uncertainties, shown in degrees Celsius. This quoted uncertainty relates to the period of the calibration and is not an indication of the long-term stability of the instruments.

The ambient conditions in the NPL humidity laboratory were  $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$  and less than 80 % relative humidity.

Applied Condition Measured Temperature	Test Thermometers				
	Measured Resistance of PRT Serial Number 20472E	Measured Resistance of PRT Serial Number 20400E	Measured Resistance of PRT Serial Number 20473E	Measured Resistance of PRT Serial Number E1184	Expanded Uncertainty of the Temperature Measurement
$^{\circ}\text{C}$	$\Omega$	$\Omega$	$\Omega$	$\Omega$	$^{\circ}\text{C}$
-60.08 #	38.152	38.188	38.193	38.174	$\pm 0.10$
-50.09 #	40.153	40.191	40.193	40.173	$\pm 0.10$
-40.04	42.157	42.198	42.197	42.174	$\pm 0.08$
-30.06	44.150	44.183	44.180	44.153	$\pm 0.08$
-20.06	46.129	46.164	46.158	46.132	$\pm 0.08$
-10.03	48.104	48.140	48.133	48.108	$\pm 0.08$
-0.06	50.067	50.105	50.094	50.065	$\pm 0.08$
+9.93	52.033	52.065	52.050	52.022	$\pm 0.05$
+20.01	54.002	54.034	54.017	53.989	$\pm 0.05$
+29.92	55.930	55.964	55.945	55.916	$\pm 0.05$
+39.94	57.868	57.907	57.885	57.856	$\pm 0.05$
+50.10	59.831	59.872	59.847	59.817	$\pm 0.05$

NOTE: # All points below  $-40\text{ }^{\circ}\text{C}$  are outside the range of UKAS accreditation of NPL for air temperature

Reference: 2017120149-2  
Checked by:



Page 2 of 3

# NATIONAL PHYSICAL LABORATORY

Continuation Sheet

## UNCERTAINTIES

The standard uncertainty of the applied condition represents a combination of the uncertainties arising from calibration and estimated stability of the reference standards, and from the method of transfer to the instrument under test.

The standard uncertainty of measurement is calculated by combining the uncertainty of the applied condition, the resolution of the instrument and its standard deviation for the period of the test. An uncertainty contribution has been included for rounding to give results an equivalent resolution of 0.01 °C.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a coverage probability of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Reference: 2017120149-2

Checked by:



Page 3 of 3