Calibration Certificate

On site Calibration

Certificate nr. 10102136-00003

Applicant

Institute / client	CYCLERtest
Department	Calibration
Address	Rotscherweg 61
Zip/ City	6374 XW Landgraaf
Country	Netherlands

On site location

Contact	Roger Dupuits
Address	Rotscherweg 61
Room	Demo
Zip / City	6374 XW Landgraaf
Country	Netherlands
Phone	+31(0) 45-5338733
E-mail	dupuitsr@cyclertest.com

Calibrated instrument

Manufacturer	Qiagen
Instrument	Rotor-Gene Q ®
Instrument serial number	R1109122
Block type	Rotor
Block position	Single
Block serial number	
Internal reference	Test

Calibration method

12 temperature sensors measure the temperature at different prescribed points in the sample block of the instrument and are monitored through an ITS-90 traceable measurement system. Measurements are made on all temperature sensors simultaneously at ½ second intervals at several temperature levels.

Pre-heat protocol

Step 1 : 45.0 °C for 60 seconds
Step 2 : 95.0 °C for 60 seconds
Step 3 : 45.0 °C for 60 seconds

Protocol

Step 1 : 45.0 °C for 60 seconds
Step 2 : 95.0 °C for 180 seconds
Step 3 : 45.0 °C for 120 seconds
Step 4 : 90.0 °C for 180 seconds
Step 5 : 50.0 °C for 180 seconds
Step 6 : 70.0 °C for 180 seconds
Step 7 : 60.0 °C for 180 seconds
Step 8 : 45.0 °C for 60 seconds

Instrument settings

Instrument in default mode and heated lid on. The reaction volume is set to 25 µl and the instrument is set to maximum ramp rate.

Non-conformities

No non-conformities reported.

Environmental conditions (average)

Ambient	22.3 °C
Relative humidity	45.5 %rh

Results

The calibration results are given on following pages of this certificate.

Calibration and measurement capability (CMC)

0.40 °C (*k* =2) based on an idealized thermocycler block at a given point in time

Uncertainty

0.60 °C (*k* =2)
The reported uncertainty of measurement is based on the standard uncertainty of measurement multiplied by a coverage factor *k* = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance to 'Guide to the expression of uncertainty in measurement' (GUM).

Traceability

The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the RvA.
The Raad voor Accreditatie is one of the signatories of the Multilateral Agreement of the European Cooperation for Accreditation (EA) for the mutual recognition of calibration certificates.

Calibration date

14-Aug-2013

Report date

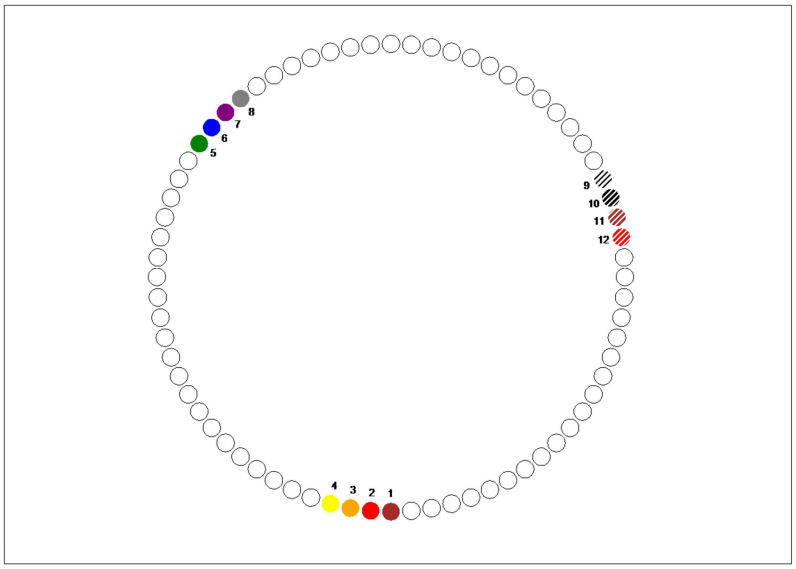
14-Aug-2013

Approved signatory

Ralph Mullenders
Operations coördinator

Legend & sensor positions

- Sensor 1 (1)
- Sensor 2 (2)
- Sensor 3 (3)
- Sensor 4 (4)
- Sensor 5 (5)
- Sensor 6 (6)
- Sensor 7 (7)
- Sensor 8 (8)
- Sensor 9 (9)
- Sensor 10 (10)
- Sensor 11 (11)
- Sensor 12 (12)



Room conditions

	Temperature (*t* /°C)	Specifications (*t* /°C)	Humidity (*RH* /%rh)	Specifications (*RH* /%rh)
Minimum	22.1	14.0	45.4	10.0
Maximum	22.4	28.0	46.4	90.0

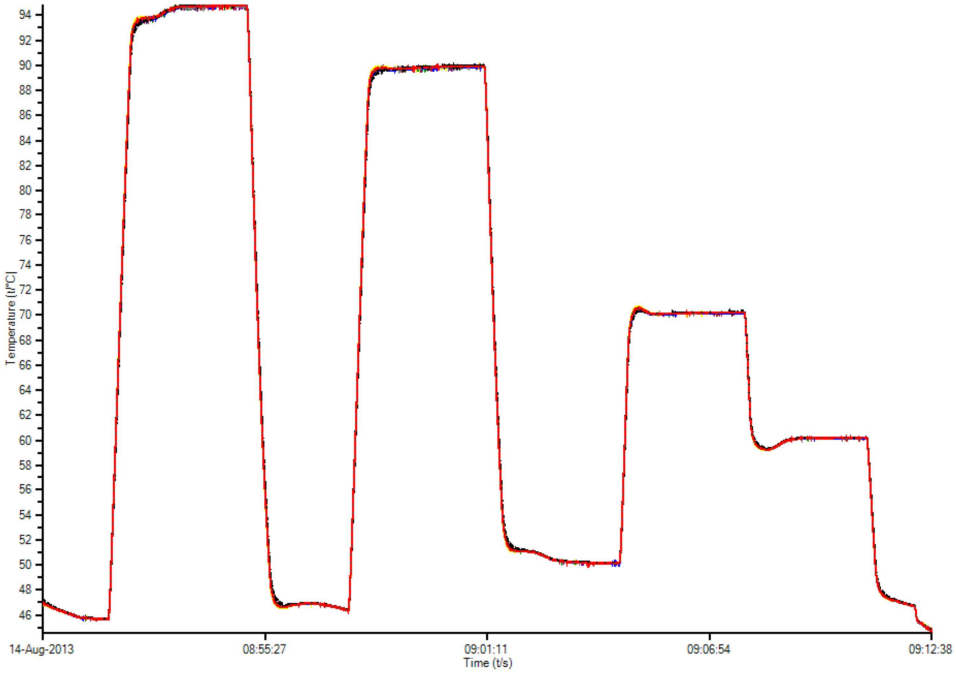
Recommended control positions

Positive	Sensor 4	Sensor 1
Negative	Sensor 9	Sensor 2

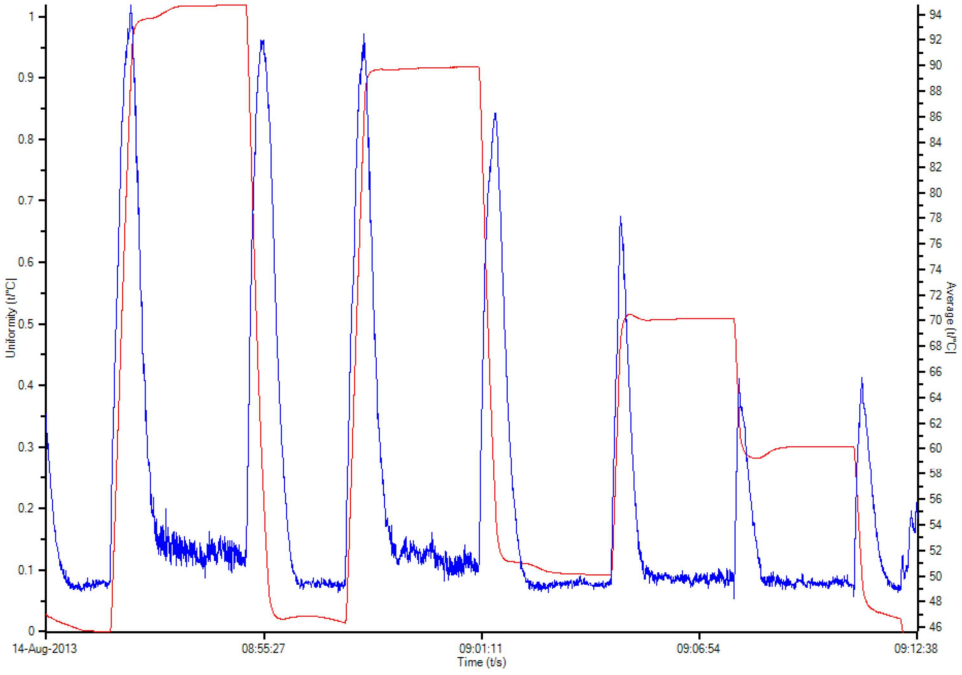
Protocol run time

22 m:54 s

Overview chart



Uniformity chart



Static data overview

All data items are calculated @ 30 seconds

t_{set} (*t* /°C)	Hold time (*t* /s)	Average (dev) (*t* /°C)	Specifications (*t* /°C)	Uniformity (*t* /°C)	Specifications (*t* /°C)
95	177	93.73 (-1.27)	94.96 ± 0.60	0.18	0.66 ± 0.38
45	114	46.78 (1.78)	44.91 ± 0.54	0.10	0.29 ± 0.49
90	181	89.67 (-0.33)	90.00 ± 0.49	0.21	0.57 ± 0.32
50	177	51.06 (1.06)	49.91 ± 0.54	0.13	0.29 ± 0.49
70	182	70.14 (0.14)	69.98 ± 0.47	0.13	0.32 ± 0.29
60	183	59.26 (-0.74)	59.93 ± 0.49	0.11	0.24 ± 0.35

Ramp and dynamic uniformity data overview

Transition (*t* /°C)	Ramp time (*t* /s)	Ramp rate (max) (°C/s)	Specifications (°C/s)	Uniformity (max) (*t* /°C)	Specifications (*t* /°C)
45.0 - 95.0	38	1.38 (1.48)	3.19 ± 3.78	0.75 (1.02)	3.46 ± 3.48
95.0 - 45.0	43	1.30 (1.70)	2.10 ± 1.07	0.76 (0.96)	2.96 ± 3.42
45.0 - 90.0	30	1.41 (1.49)	3.33 ± 4.22	0.68 (0.97)	3.36 ± 3.32
90.0 - 50.0	32	1.31 (1.58)	2.17 ± 0.84	0.66 (0.84)	2.97 ± 3.39
50.0 - 70.0	13	1.38 (1.46)	3.33 ± 5.22	0.41 (0.65)	2.46 ± 1.93
70.0 - 60.0	7	1.07 (1.12)	2.00 ± 1.11	0.30 (0.41)	1.63 ± 1.49

Overshoot data overview

Transition (*t* /°C)	Duration (*t* /s)	Overshoot (max) (*t* /°C)	Specifications (*t* /°C)	Uniformity (*t* /°C)	Specifications (*t* /°C)
45.0 - 95.0		94.71 (94.80)	97.40 ± 4.70	0.13	2.03 ± 2.64
95.0 - 45.0		46.42 (46.38)	42.99 ± 3.02	0.07	1.48 ± 2.00
45.0 - 90.0		89.87 (89.94)	92.43 ± 4.88	0.12	1.97 ± 2.32
90.0 - 50.0		50.10 (50.06)	47.99 ± 3.02	0.08	1.48 ± 2.00
50.0 - 70.0	24	70.45 (70.65)	72.51 ± 5.04	0.43	1.73 ± 1.97
70.0 - 60.0	20	59.24 (59.17)	57.96 ± 2.37	0.16	1.31 ± 1.56

Static data step 2: 95 °C

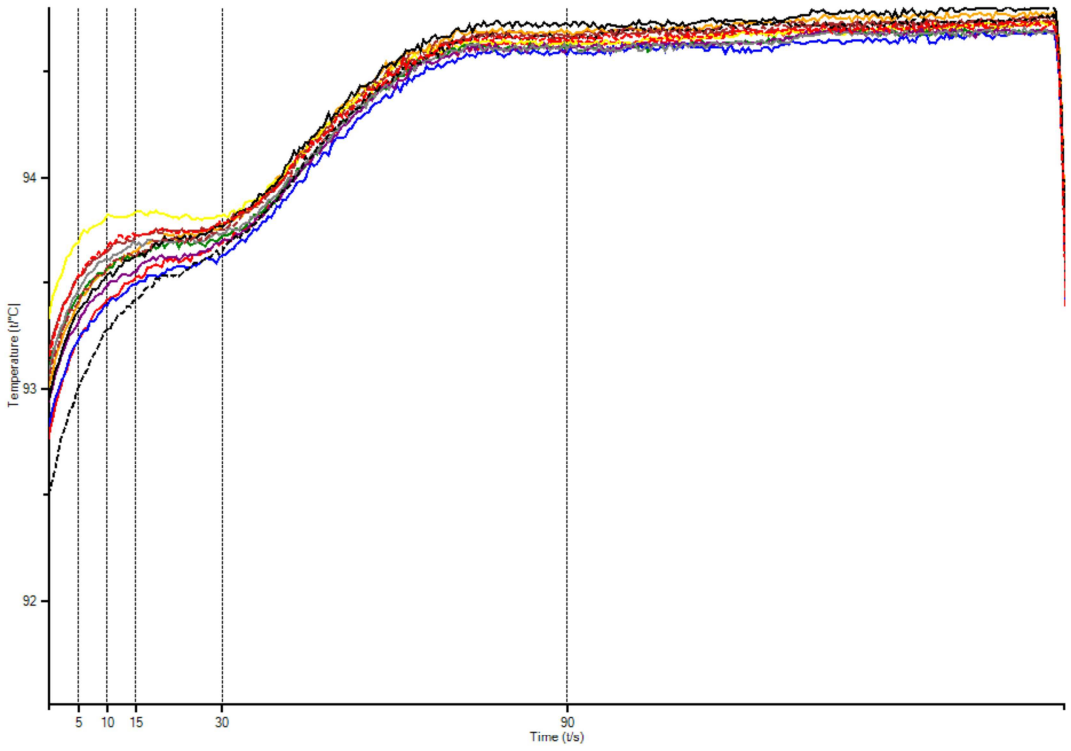
Plateau start (t_0) = 08:52:03 (sample 726), hold time = 177 s

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
1	93.53	93.64	93.72	93.78	94.66
2	93.23	93.42	93.53	93.69	94.62
3	93.40	93.56	93.65	93.77	94.69
4	93.69 (+)	93.81 (+)	93.83 (+)	93.81 (+)	94.62
5	93.43	93.57	93.62	93.72	94.62
6	93.23	93.39	93.49	93.63 (-)	94.58 (-)
7	93.31	93.48	93.55	93.70	94.61
8	93.46	93.61	93.68	93.73	94.60
9	93.01 (-)	93.28 (-)	93.42 (-)	93.65	94.65
10	93.36	93.54	93.63	93.76	94.72 (+)
11	93.41	93.58	93.62	93.75	94.65
12	93.54	93.67	93.72	93.78	94.64

Calculated data

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
Average	93.38	93.55	93.62	93.73	94.64
Uniformity	0.68	0.53	0.41	0.18	0.14
Deviation	-1.62	-1.45	-1.38	-1.27	-0.36

Plateau chart 95 °C



Static data step 3: 45 °C

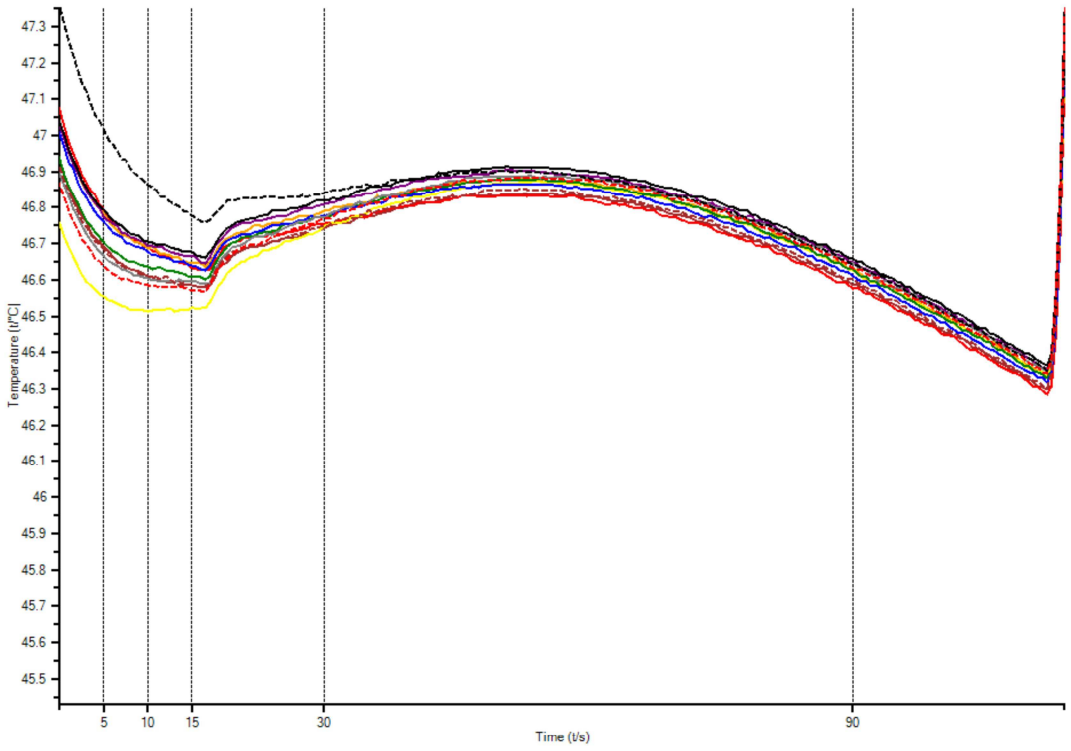
Plateau start (t_0) = 08:55:43 (sample 1165), hold time = 114 s

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
1	46.69	46.61	46.58	46.74 (-)	46.59
2	46.79	46.69	46.63	46.76	46.58 (-)
3	46.78	46.69	46.65	46.79	46.63
4	46.55 (-)	46.51 (-)	46.53 (-)	46.75	46.63
5	46.70	46.64	46.61	46.77	46.63
6	46.76	46.68	46.64	46.78	46.61
7	46.77	46.69	46.67	46.81	46.65
8	46.66	46.60	46.59	46.77	46.64
9	47.01 (+)	46.86 (+)	46.78 (+)	46.84 (+)	46.64
10	46.79	46.71	46.68	46.82	46.66 (+)
11	46.68	46.61	46.59	46.75	46.60
12	46.64	46.58	46.57	46.77	46.63

Calculated data

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
Average	46.74	46.66	46.63	46.78	46.62
Uniformity	0.46	0.35	0.25	0.10	0.08
Deviation	1.74	1.66	1.63	1.78	1.62

Plateau chart 45 °C



Static data step 4: 90 °C

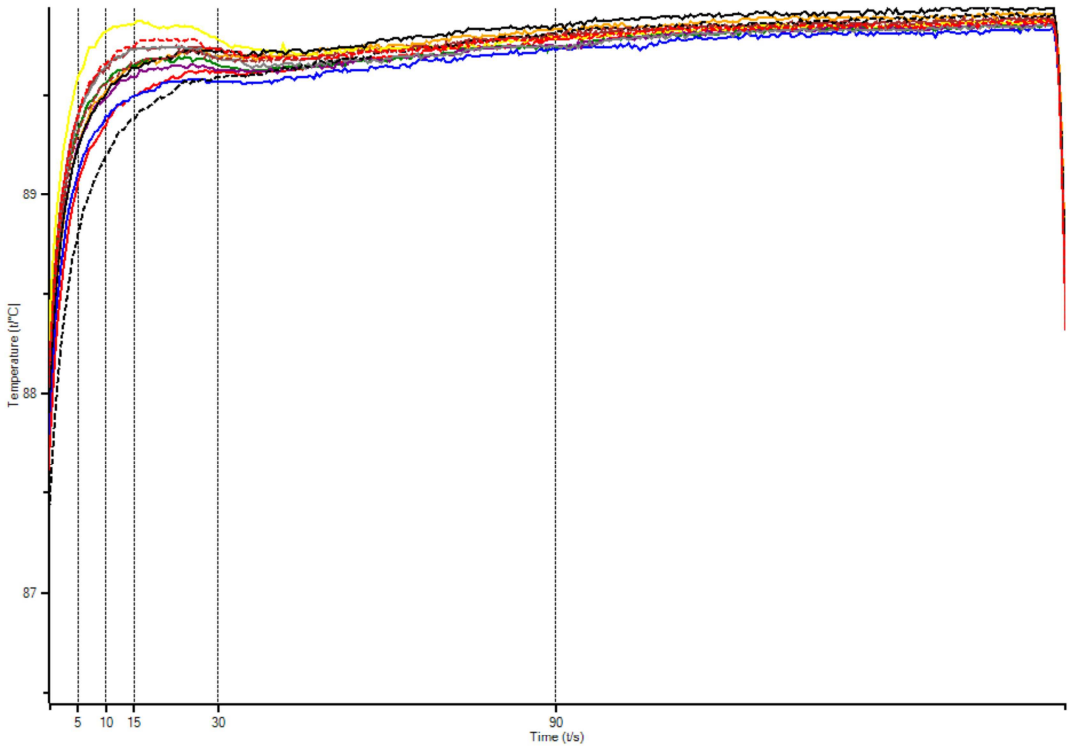
Plateau start (t_0) = 08:58:07 (sample 1453), hold time = 181 s

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
1	89.45	89.64	89.73	89.73	89.82
2	89.11	89.39	89.50	89.62	89.78
3	89.29	89.53	89.65	89.69	89.84
4	89.62 (+)	89.83 (+)	89.87 (+)	89.78 (+)	89.79
5	89.36	89.58	89.66	89.66	89.74
6	89.15	89.40	89.50	89.57 (-)	89.73 (-)
7	89.28	89.50	89.60	89.63	89.75
8	89.44	89.67	89.74	89.69	89.75
9	88.85 (-)	89.22 (-)	89.40 (-)	89.59	89.81
10	89.27	89.53	89.63	89.72	89.85 (+)
11	89.35	89.57	89.66	89.68	89.81
12	89.44	89.67	89.76	89.73	89.79

Calculated data

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
Average	89.30	89.54	89.64	89.67	89.79
Uniformity	0.77	0.61	0.47	0.21	0.12
Deviation	-0.70	-0.46	-0.36	-0.33	-0.21

Plateau chart 90 °C



Static data step 5: 50 °C

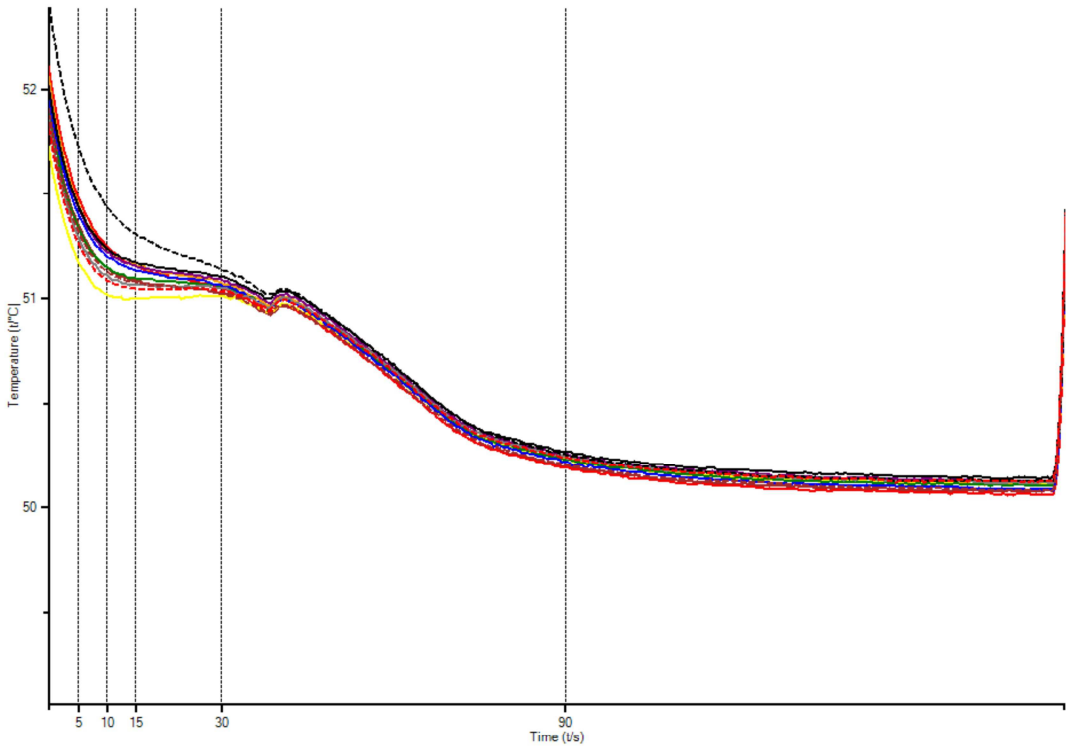
Plateau start (t_0) = 09:01:39 (sample 1878), hold time = 177 s

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
1	51.35	51.15	51.09	51.02	50.20
2	51.48	51.25	51.16	51.04	50.19 (-)
3	51.45	51.23	51.16	51.07	50.23
4	51.17 (-)	51.02 (-)	51.00 (-)	51.01 (-)	50.23
5	51.33	51.15	51.09	51.05	50.23
6	51.40	51.20	51.13	51.06	50.22
7	51.43	51.22	51.15	51.09	50.26
8	51.29	51.11	51.06	51.05	50.24
9	51.73 (+)	51.44 (+)	51.31 (+)	51.14 (+)	50.26
10	51.44	51.24	51.17	51.10	50.27 (+)
11	51.32	51.13	51.08	51.02	50.21
12	51.26	51.08	51.05	51.03	50.24

Calculated data

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
Average	51.39	51.18	51.12	51.06	50.23
Uniformity	0.56	0.42	0.31	0.13	0.08
Deviation	1.39	1.18	1.12	1.06	0.23

Plateau chart 50 °C



Static data step 6: 70 °C

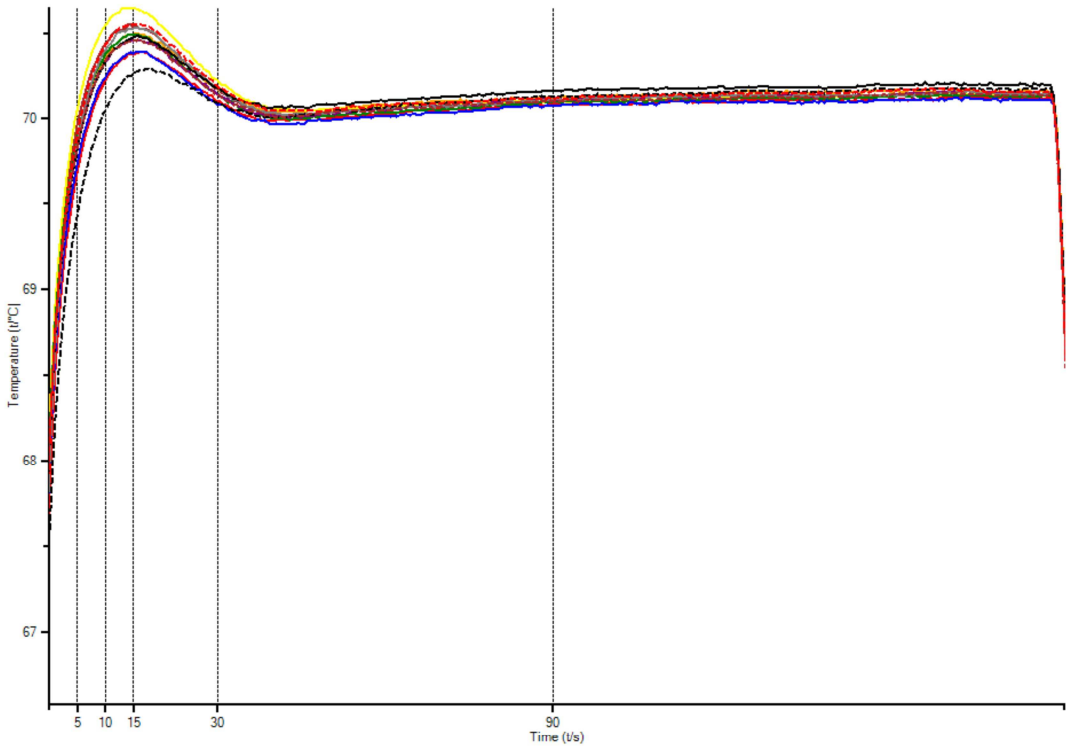
Plateau start (t_0) = 09:04:49 (sample 2257), hold time = 182 s

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
1	70.05	70.46	70.54	70.16	70.10
2	69.77	70.25	70.38	70.10	70.08
3	69.93	70.38	70.49	70.16	70.12
4	70.14 (+)	70.57 (+)	70.64 (+)	70.21 (+)	70.10
5	69.98	70.39	70.49	70.13	70.10
6	69.83	70.27	70.39	70.08 (-)	70.07 (-)
7	69.92	70.34	70.46	70.13	70.11
8	69.95	70.43	70.52	70.16	70.11
9	69.54 (-)	70.09 (-)	70.27 (-)	70.08 (-)	70.13
10	69.91	70.36	70.48	70.17	70.16 (+)
11	69.92	70.37	70.46	70.13	70.10
12	70.00	70.45	70.55	70.17	70.12

Calculated data

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
Average	69.91	70.36	70.47	70.14	70.11
Uniformity	0.60	0.48	0.37	0.13	0.09
Deviation	-0.09	0.36	0.47	0.14	0.11

Plateau chart 70 °C



Static data step 7: 60 °C

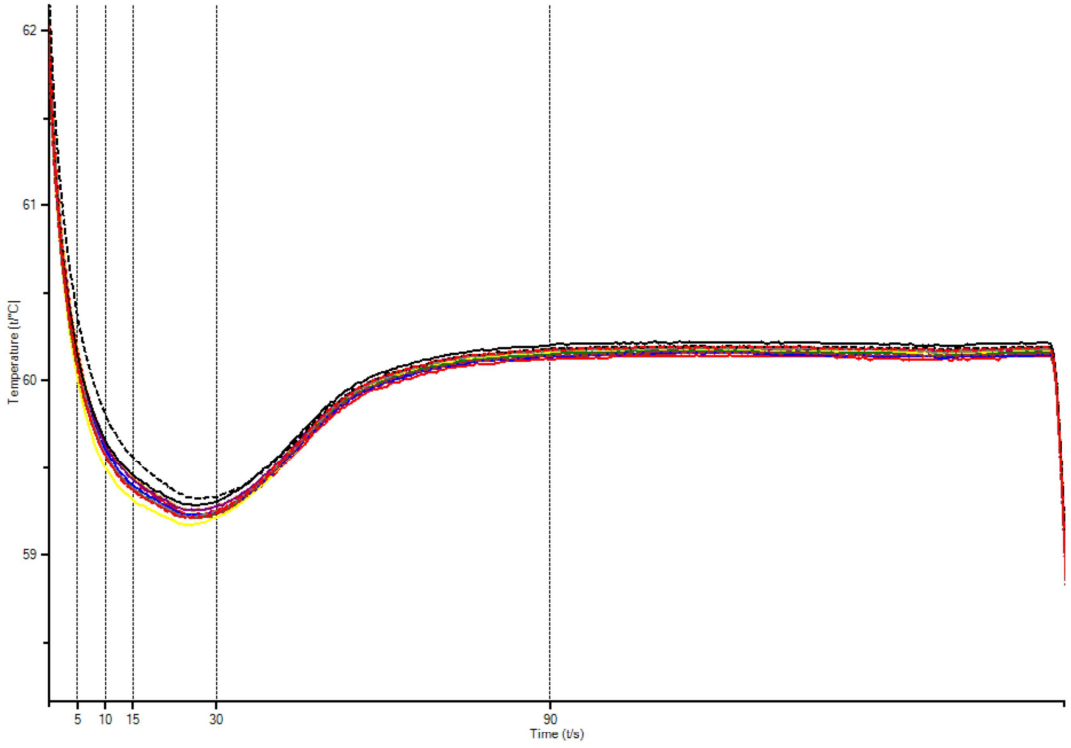
Plateau start (t_0) = 09:07:57 (sample 2633), hold time = 183 s

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
1	60.09	59.59	59.37	59.23	60.14
2	60.17	59.64	59.43	59.24	60.12 (-)
3	60.16	59.65	59.44	59.27	60.17
4	60.01 (-)	59.50 (-)	59.31 (-)	59.21 (-)	60.16
5	60.07	59.58	59.38	59.24	60.15
6	60.11	59.60	59.40	59.24	60.13
7	60.14	59.63	59.43	59.27	60.17
8	60.12	59.58	59.37	59.24	60.17
9	60.36 (+)	59.81 (+)	59.56 (+)	59.32 (+)	60.18
10	60.15	59.66	59.46	59.30	60.20 (+)
11	60.06	59.58	59.37	59.24	60.14
12	60.08	59.57	59.37	59.24	60.17

Calculated data

	5 s (*t* /°C)	10 s (*t* /°C)	15 s (*t* /°C)	30 s (*t* /°C)	90 s (*t* /°C)
Average	60.13	59.62	59.41	59.26	60.16
Uniformity	0.35	0.30	0.25	0.11	0.08
Deviation	0.13	-0.38	-0.59	-0.74	0.16

Plateau chart 60 °C



Terminology

average [°C]	t_{90} *(avg)* , average value of all active sensors at a specific sample position.
minimum [°C]	minimum value of all active sensors at a specific sample position.
maximum [°C]	maximum value of all active sensors at a specific sample position.
uniformity [°C]	maximum temperature - minimum temperature at a specific sample position. Other commonly used terms for uniformity are temperature spread or homogeneity.
deviation [°C]	average measured temperature (t_{90}) minus set temperature (t_{set}).
ramp rate [°C/s]	*dT/dt* , where *dT* = between 10% and 90% of the ramp. *dt* = interval *t* (T90%) - *t* (T10%).
average overshoot [°C]	average value of all active sensors at the sample position of the maximum overshoot.
maximum overshoot [°C]	maximum of all active sensors towards a static temperature hold.
overshoot duration [°C]	the time it takes for the plateau to reach the set temperature again.
set temperature [°C]	t_{set} , set or target temperature is the value which is programmed to be reached.
uncertainty [°C]	parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the quantity intended to be measured.
protocol run time [mm:ss]	the time it takes for the protocol to complete (pre-heat steps are not included).
hold time [s]	the measured time it takes for a plateau to complete.
ramp time [s]	the measured time it takes for an instrument to ramp from one temperature to another.

Calibration information

Calibration number	10102136-00003
Sofware version	MTAS 6.0.1.1
Engineer	Roger Dupuits (Calibration engineer)
Analysis engine version	05-Mar-2013
Measurement engine version	05-Mar-2013
Definitions	14-Aug-2013
Specifications	Market specifications (28-Jun-2013)
Population	10
Data filename	10102136-00003.ulf
Sample interval	500 ms
QMS document	DOC.SYS.063 revision 7

Equipment information

Probe serial	101021-36
Probe type	MTAS Rotorgene
Probe calibration date	14-Aug-2013
Hardware box serial	10102136
Hardware box version	070102
T-RH device serial	75935
T-RH device calibration date	15-Mar-2010

Disclaimer