

Qualification report

2020-03-DHL FROZEN SOLUTION-MEDIUM BELGIUM-01 (Pellets)

date

March 26, 2020

Client:	DHL Express
Unit/s under test (UUT):	DHL Frozen Solution Medium Belgium box 11507 – passive temperature maintenance systems
Test specification:	Temperature test according to DIN 55545-1:2018-11 and the ASTM standards D 3103-14 (2014) and D 4332 (2006).
Test scope:	Testing of the temperature stability of the above mentioned boxes for a defined temperature range at defined temperature profiles Tested temperature range: < -20°C

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1 Unit/s under test (UUT)

The tested unit is an insulating transport box made of EPS grey / Neopor®, which was inserted into a corrugated carton and equipped with a fixed mass of cooling elements.

Description:	DHL Frozen Solution Medium Belgium box 11507
External dimensions:	approx. 425 x 355 x 300 mm (incl. outer carton)
Internal dimensions:	approx. 315 x 245 x 185 mm
Payload capacity:	approx. 14.3 l
Weight:	approx. 660 g (without cooling elements)



Figure 1: DHL Frozen Solution Medium Belgium box 11507

Cooling element

Description:	Dry ice pellets
Weight:	approx. 11.0 kg

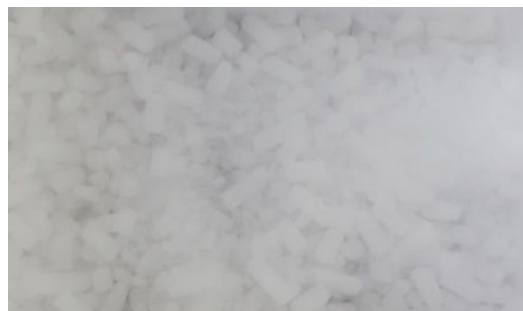


Figure 2: Dry ice pellets

Test product

Description: 36x 10 ml salt water filled vials

Dimensions: approx. 195 x 150 x 90 mm

Weight: approx. 700 g



Figure 3: Test product

2 Client

The company DHL-Express commissioned Schaumaplast Sachsen GmbH to test the above mentioned test specimen.

3 Objective of the test

The test specimen is tested in the temperature test chamber according to defined temperature profiles. Two different profiles with different average temperatures are tested. The product temperature inside the EPS/Neopor® box must not drop below the temperature limit of - 20°C. This temperature range of < - 20°C must be maintained for at least 96 hours without deviation for customer profile. There is no acceptance criteria for the static +30°C profile test.

4 Test object preparation

4.1 Temperature preconditioning before the test

The components required for the test, such as cooling elements and test products, were preconditioned for at least 24 h. The following table lists the condition temperatures of the individual components for the test profiles (see 4.4):

Description	Temperature profile	Condition temperature
Transport boxes	Customer profile & constant temperature profile	+21°C ± 3°C
Dry ice		- 79.0°C
Test products		-20°C ± 3°C

4.2 Positioning of the temperature sensors

The positions of the temperature sensors are always placed the same, so that a representative and comparable test result can be expected. The tables below show the positions as well as the names of the sensors for the different temperature profiles.

Customer profile:

Description	Position	Sensor name
Box 11507	bottom	S 1
	middle	S 2
	top	S 3
	Environmental temperature	S 4

Constant temperature profile:

Description	Position	Sensor name
Box 11507	bottom	S 1
	middle	S 2
	top	S 3
	Environmental temperature	S 4

4.3 Equipping the boxes



Temperature profile	cooling element
Customer profile	11 kg dry ice -78.9°C
	1x test product -21.8°C



Temperature profile	cooling element
Constant temperature profile	11 kg dry ice -78.8°C
	1x test product -20.7°C

4.4 Temperature profiles

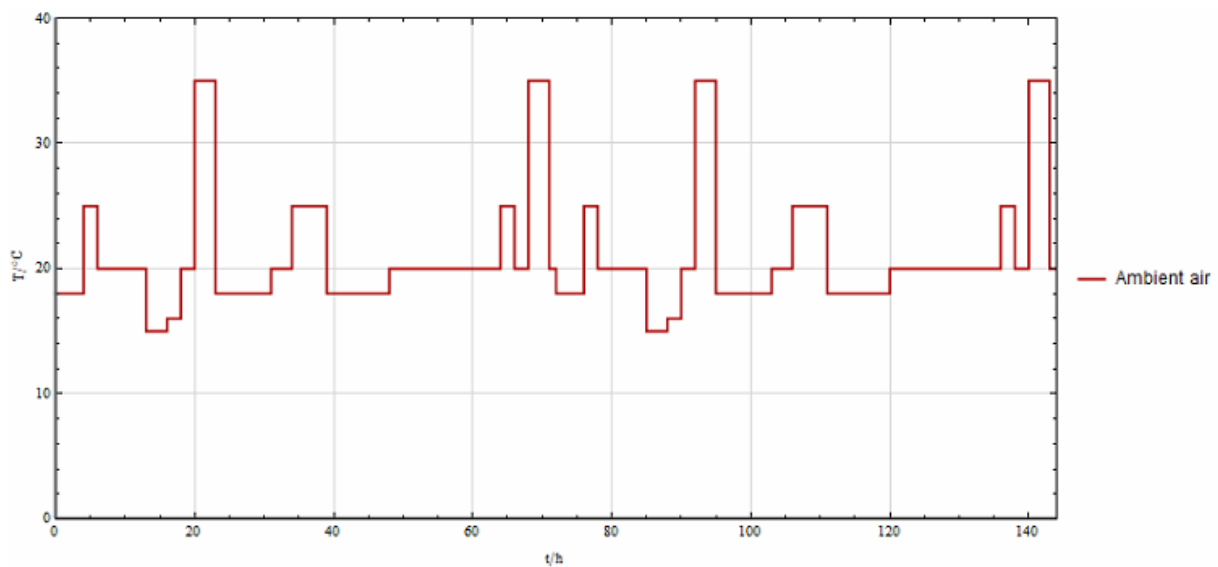
Customer profile:

Segment	1	2	3	4	5	6	7	8
Duration [h]	4	2	7	3	2	2	3	8
Temperature [°C]	18	25	20	15	16	20	35	18

Segment	9	10	11	12	13	14	15	16
Duration [h]	3	5	9	16	2	2	3	1
Temperature [°C]	20	25	18	20	25	20	35	20

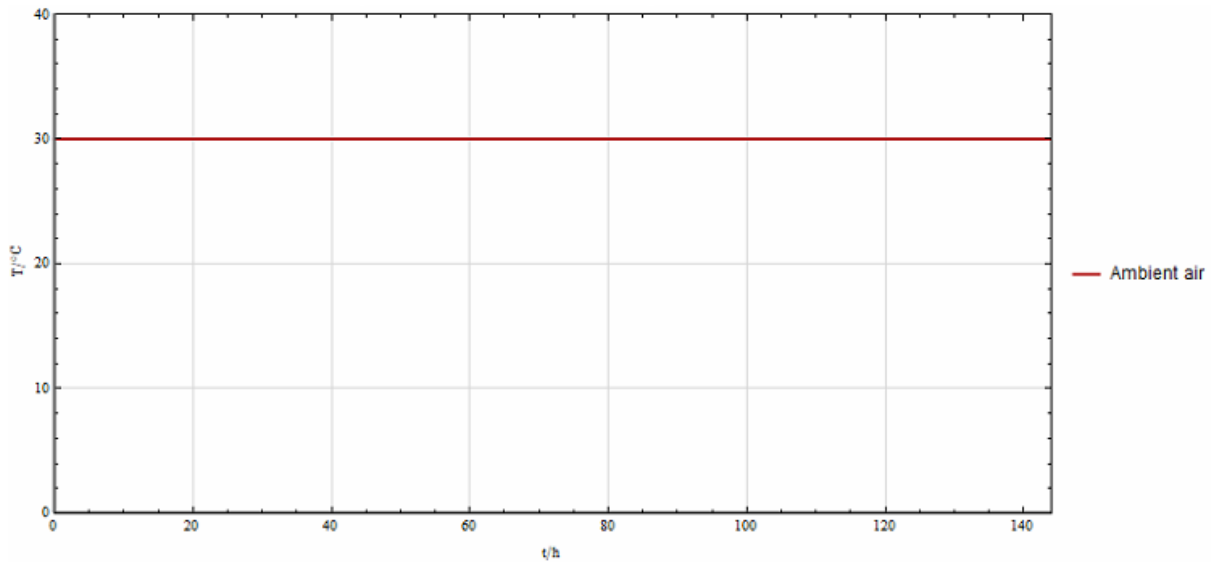
Segment	17	18	19	20	21	22	23	24
Duration [h]	4	2	7	3	2	2	3	8
Temperature [°C]	18	25	20	15	16	20	35	18

Segment	25	26	27	28	29	30	31	32
Duration [h]	3	5	9	16	2	2	3	1
Temperature [°C]	20	25	18	20	25	20	35	20



Constant temperature profile:

Segment	1
Duration [h]	144
Temperature [°C]	30



5 Test equipment

Calibration certificates (see appendix)

Device	Type	S/N	Manufacturer	Calibration date	Calibration mark
temperature test chamber	T-20_6300	BN20171350	L&R Kälte-technik	11.03.2020	1158-2020
Ecolog data logger	TP4-L	406317	Elpro-Buchs	27.02.2020	1130-2020

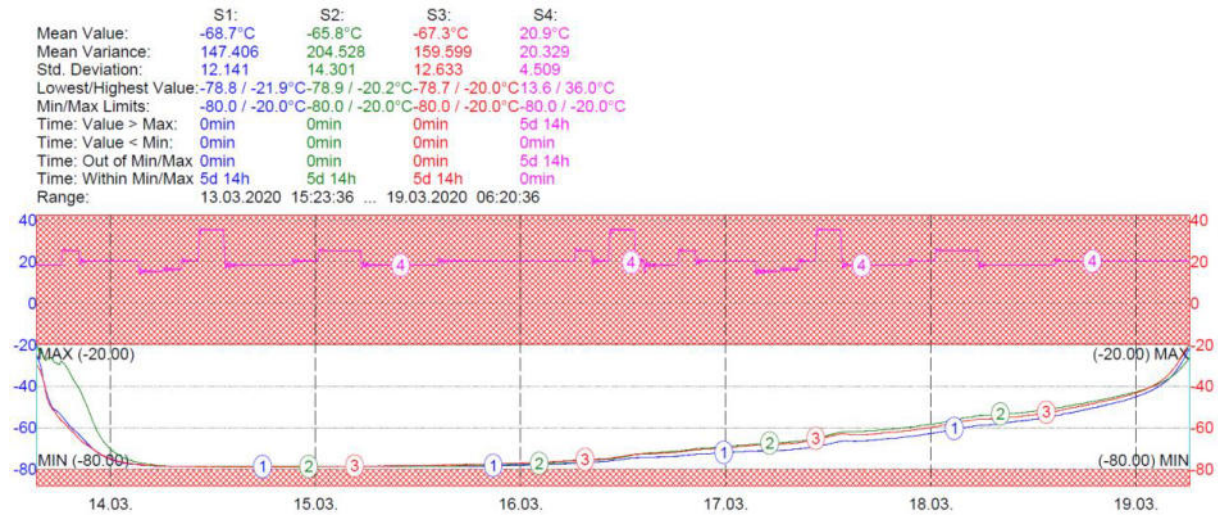
6 Test procedure

Test date: from March 13, 2020 until March 26, 2020

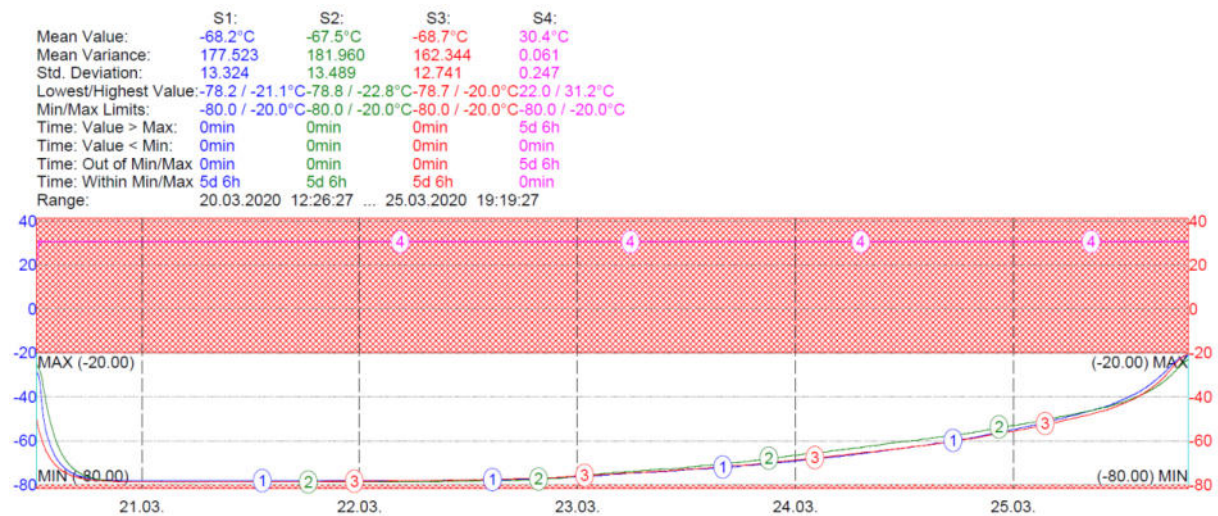
No.	Test	Period	Data logger (S/N)
1	Customer profile	03-13-2020 until 03-19-2020	406317
2	Constant temperature profile	03-20-2020 until 03-26-2020	406317

7 Test documentation

7.1 Measurement diagram of the customer profile



7.2 Measurement diagram of the constant temperature profile



8 Photo documentation

Customer profile:

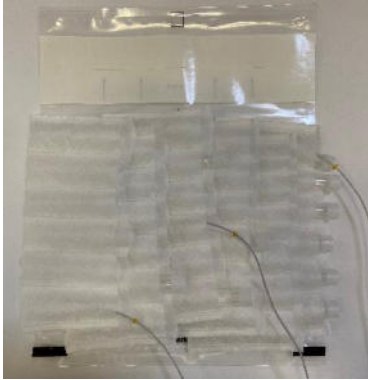


Figure 4: Product preparation (1)



Figure 5: Product preparation (2)



Figure 6: Setup (1)



Figure 7: Setup (2)



Figure 8: Setup (3)

Constant temperature profile:

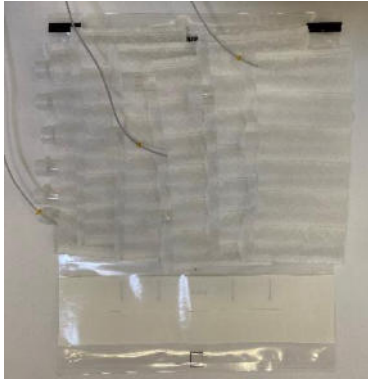


Figure 9: Product preparation (1)



Figure 10: Product preparation (2)



Figure 11: Setup (1)



Figure 12: Setup (2)



Figure 13: Setup (3)



Figure 14: Setup (4)

9 Summary

Test No.	Test profile	Assembly	Running time [h]
1	Customer profile	11 kg dry ice 1x test product -21.8°C	134
2	Constant temperature profile	11 kg dry ice 1x test product -20.7°C	126

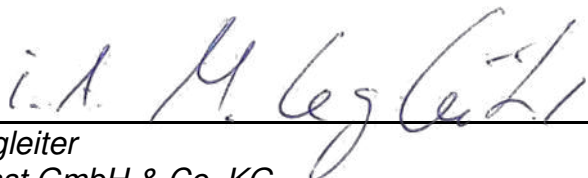
10 Appendix

- Calibration certificate temperature test chamber
- Calibration Certificates Ecolog data logger


Final note


In the climate chamber tests carried out by Schaumaplast, actual or specified conditions are simulated as accurately as possible. For the tests, true-to-original components are used, as they are also used in series production. Tolerances, measurement inaccuracies and parameters that cannot be influenced can nevertheless lead to deviating results in reality.

Created by

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Kalibrierschein

Calibration Certificate

Kalibrierzeichen / Calibrationmark
1158-2020



WKM

Telefon: (0 51 45) 28 666 -10
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Gegenstand Object	Temperaturprüfkammer
Hersteller Manufacturer	L&R Kältetechnik GmbH & Co. KG Hachener Straße 90c, 59846 Sundern
Typ Type	Temperaturprüfkammer
Fabrikat/Serien-Nr. Serial number	17-2907
Auftraggeber Customer	Schaumaplast GmbH & Co. KG Haydnallee 40, 68799 Reilingen
Auftragsnummer Order number	per Mail
Anzahl der Seiten Number of Pages	4
Datum der Kalibrierung Date of the calibration	11.03.2020

Die für die Kalibrierung verwendeten Messeinrichtungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch Technische Bundesanstalt (PTB) Deutschlands.

The measuring installations used for calibration are regularly calibrated and are based on the national standards of the German Federal Physical and Technical Institute (PTB).



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16. MRZ. 2020

Stempel

Datum

Prüfer: Michael Weber

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Messeinrichtung

Measuring installations

Datenlogger:
Datalogger:

Ahlborn, Almemo

Seriennummer Fühler:
Serial number:

13/02/20-4

Kalibrierzeichen:
Calibrationmark:

08-0240 D-K-15186-01-00 2020-02

Fühler Temperatur:
Sensor temperature:

Messunsicherheit: 0,07 K

Umgebungsbedingungen:

Ambient conditions

Temperatur:
temperature:

22,81 °C bei Messung +50°C

21,49 °C bei Messung -20°C

Messverfahren:

Measuring procedure:

Vergleichsmessungen zwischen o.a. Anzeigegerät / Fühler als Referenz und den Anzeigen des Schrankes während des laufenden Prozesses. Position des Messfühlers ist die Prüfraummitte.

Comparison between datalogger and sensor for reference and the value in the control panel of the chamber during a running process. Position of the temperature sensor is middle of the testspace.

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Fühler (Referenz-Fühler: 13/02/20-4)

Regelvorgabe	Anzeige Schrank	Anzeige Referenzfühler	Abweichung
--------------	-----------------	------------------------	------------

T °C	T °C	T °C	K
------	------	------	---

50	50,0	49,71	-0,29
50	50,1	49,91	-0,19
50	50,0	49,77	-0,23
50	49,9	49,61	-0,29
50	50,1	49,71	-0,39
50	50,0	49,85	-0,15

50,0	49,76	-0,24
------	-------	-------

Abweichung Temperatur: -0,24 K
Deviation temperature:

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Fühler (Referenz-Fühler: 13/02/20-4)

Regelvorgabe	Anzeige Schrank	Anzeige Referenzfühler	Abweichung
--------------	-----------------	------------------------	------------

T °C	T °C	T °C	K
------	------	------	---

-20	-20,1	-20,01	0,09
-20	-20,3	-20,35	-0,05
-20	-20,6	-20,46	0,14
-20	-20,5	-20,20	0,30
-20	-18,9	-18,77	0,13
-20	-20,0	-19,89	0,11

-20,1	-19,95	0,15
-------	--------	------

Abweichung Temperatur: 0,15 K
Deviation temperature:

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Kalibrierzeichen / Calibrationmark
1130-2020

Gegenstand Object	Ecolog Datenlogger	
Hersteller Manufacturer	Elpro-Buchs AG, Langäulistraße 62, CH - 9470 Buchs SG	
Typ Type	TP4-L	
Fabrikat/Serien-Nr. Serial number	406317	intern: Logger 3
Auftraggeber Customer	Schaumaplast GmbH & Co. KG Haydnallee 40, 68799 Reilingen	
Auftragsnummer Order number	per Mail	
Anzahl der Seiten Number of Pages	6	
Datum der Kalibrierung Date of the calibration	27.02.2020	
Empfohlene Re-Kalibrierung Recommended recalibration	nach 12 Monaten	27.02.2021

Die für die Kalibrierung verwendeten Messeinrichtungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch Technische Bundesanstalt (PTB) Deutschlands.

The measuring installations used for calibration are regularly calibrated and are based on the national standards of the German Federal Physical and Technical Institute (PTB).



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28. FEB. 2020

Stempel

Datum Seite 1 von 6

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Messeinrichtung

Measuring installations

Datenlogger:
Datalogger:

Ahlborn, Almemo

Seriennummer Fühler:
Serial number:

16/05/18-4

Kalibrierzeichen:
Calibrationmark:

08-0940 D-K-15186-01-00 2019-06

Fühler Temperatur:
Sensor temperature:

Messunsicherheit: 0,06 K

Umgebungsbedingungen:

Ambient conditions

Temperatur:
temperature:

21,17 °C bei Messung +50°C
22,28 °C bei Messung -20°C

Messverfahren:

Measuring procedure:

Vergleichsmessungen zwischen o.a. Anzeigegerät / Fühler als Referenz und den Anzeigen des Datenloggers während des laufenden Prozesses. Der Messfühler des Datenloggers ist direkt neben dem Referenzfühler positioniert.

Comparison measurements between designated datalogger/ sensor as a reference as well as the values in the control panel of the datalogger during the running process. The measuring sensor is directly positioned beside the reference sensor.

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Fühler S1 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
----------------	---------------------	------------------------	------------

T °C	T °C	K
------	------	---

30 min.	49,9	49,96	0,06
05 min.	50,0	50,01	0,01
10 min.	50,1	50,03	-0,07
15 min.	50,0	50,02	0,02
20 min.	50,0	50,03	0,03
25 min.	50,0	50,00	0,00

50,0	50,01	0,01
------	-------	------

Abweichung Temperatur: 0,01 K (Messunsicherheit 0,06 K gemäß DAkkS-Zertifikat)
Deviation temperature:

Fühler S2 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
----------------	---------------------	------------------------	------------

T °C	T °C	K
------	------	---

30 min.	49,9	49,96	0,06
05 min.	50,1	50,01	-0,09
10 min.	50,0	50,03	0,03
15 min.	50,0	50,02	0,02
20 min.	50,0	50,03	0,03
25 min.	50,0	50,00	0,00

50,0	50,01	0,01
------	-------	------

Abweichung Temperatur: 0,01 K (Messunsicherheit 0,06 K gemäß DAkkS-Zertifikat)
Deviation temperature:

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Fühler S3 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
----------------	---------------------	------------------------	------------

T °C	T °C	K
------	------	---

30 min.	50,1	49,96	-0,14
05 min.	50,2	50,01	-0,19
10 min.	50,2	50,03	-0,17
15 min.	50,1	50,02	-0,08
20 min.	50,1	50,03	-0,07
25 min.	50,2	50,00	-0,20

50,2	50,01	-0,19
------	-------	-------

Abweichung Temperatur: -0,19 K

Deviation temperature:

Fühler S4 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
----------------	---------------------	------------------------	------------

T °C	T °C	K
------	------	---

30 min.	49,9	49,96	0,06
05 min.	49,9	50,01	0,11
10 min.	50,0	50,03	0,03
15 min.	49,9	50,02	0,12
20 min.	50,0	50,03	0,03
25 min.	49,9	50,00	0,10

49,9	50,01	0,11
------	-------	------

Abweichung Temperatur: 0,11 K

Deviation temperature:

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Fühler S1 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
----------------	---------------------	------------------------	------------

T °C	T °C	K
------	------	---

30 min.	-19,9	-19,98	-0,08
05 min.	-20,1	-19,99	0,11
10 min.	-19,9	-19,97	-0,07
15 min.	-19,9	-20,02	-0,12
20 min.	-19,8	-19,91	-0,11
25 min.	-19,9	-20,13	-0,23

-19,9	-20,00	-0,10
-------	--------	-------

Abweichung Temperatur: -0,10 K

Deviation temperature:

Fühler S2 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
----------------	---------------------	------------------------	------------

T °C	T °C	K
------	------	---

30 min.	-19,9	-19,98	-0,08
05 min.	-20,2	-19,99	0,21
10 min.	-19,9	-19,97	-0,07
15 min.	-20,0	-20,02	-0,02
20 min.	-19,8	-19,91	-0,11
25 min.	-19,9	-20,13	-0,23

-20,0	-20,00	0,00
-------	--------	------

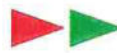
Abweichung Temperatur: 0,00 K (Messunsicherheit 0,06 K gemäß DAkkS-Zertifikat)

Deviation temperature:

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Calibration Certificate

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Fühler S3 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
	T °C	T °C	K
30 min.	-19,8	-19,98	-0,18
05 min.	-20,1	-19,99	0,11
10 min.	-19,8	-19,97	-0,17
15 min.	-19,9	-20,02	-0,12
20 min.	-19,7	-19,91	-0,21
25 min.	-19,8	-20,13	-0,33
	-19,9	-20,00	0,10

Abweichung Temperatur: 0,10 K

Deviation temperature:

Fühler S4 Referenz-Fühler: 16/05/18-4

Beharrungszeit	Anzeige Datenlogger	Anzeige Referenzfühler	Abweichung
	T °C	T °C	K
30 min.	-19,9	-19,98	-0,08
05 min.	-20,1	-19,99	0,11
10 min.	-19,9	-19,97	-0,07
15 min.	-19,9	-20,02	-0,12
20 min.	-19,8	-19,91	-0,11
25 min.	-19,9	-20,13	-0,23
	-19,9	-20,00	-0,10

Abweichung Temperatur: -0,10 K

Deviation temperature: