

Test report

ThermoCare box for 2.0 °C ... 8.0 °C shipments

Print date: 2018-10-31

Pages: 29

Author: Konstantin Hoff

Version: 1.2

Date: 2018-10-31



ThermoCare box for 2.0 °C ... 8.0 °C shipments

Approved by: Philipp Amendt

Version: 1.2

Abstract

The ThermoCare box container is tested within the ambient temperature scenarios V05.05 provided by Post Logistics CH for 2.0 °C ... 8.0 °C shipments. va-Q-tec's +05G va-Q-accus are used as a phase change material to stabilize the temperature inside the ThermoCare box.

According to the defined delivery process the ThermoCare box is tested to:

Table 1: Test results

Temperature scenario	Tested $t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ [hrs]	Tested (temp x time) [K*hrs] ¹	Average ambient temperature [°C]
Summer A	28	1197	26.0
Summer B	44	1117	20.3
Winter B	49	n.a. ²	5.1

A fourth test with the winter scenario V05.05 winter A hasn't been carried out because Winter B already represents a tougher scenario than A. Further information can be found in chapter 3.2.

In this test report, the equipment and the test procedures are described step by step.

¹ The calculated (temp x time)-values refer to an internal average container temperature of 5 °C

² Temp x time is not applicable in the winter scenario, because the average ambient temperature is in the targeted temperature range.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

List of contents

1	Test target.....	4
2	Equipment used	5
2.1	Shipment containers	5
2.2	Phase-change-material (PCM)	5
2.3	Climate chambers.....	6
2.4	Temperature measuring equipment.....	6
2.5	Simulated goods.....	7
3	Test procedure	8
3.1	Sensor positions	8
3.2	Ambient temperature scenarios.....	9
3.2.1	Summer A.....	9
3.2.2	Winter A	11
3.2.3	Summer B.....	13
3.2.4	Winter B	15
3.3	Table of actions	17
3.4	PCM and container pre-conditioning.....	18
3.5	va-Q-accu loading.....	18
3.6	Evaluation of data	19
4	Test results.....	20
4.1	Summer A scenario	20
4.2	Summer B scenario.....	22
4.3	Winter B scenario	24
5	Conclusion	26
6	Personnel Involved.....	27
7	Change History	28
8	Appendix	29

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

1 Test target

The ThermoCare box container, in combination with several va-Q-accus, filled with a +05G phase change material (PCM), allows the transportation of goods that must be kept between 2.0 °C and 8.0 °C. The target of this test is the evaluation of the duration $t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ of temperature stability of the inner temperature between these limits. The time span $t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ defines when the average value of the four sensors undercuts the 2.0 °C limit or exceeds the 8.0 °C limit.

$$t_{2.0\text{ °C} \dots 8.0\text{ °C}} \geq 25 \text{ hrs}$$

The simulated ambient temperature scenario V05.05 represents the logistic process of the ThermoCare box and is explained more detailed in chapter 3.2. The targeted temperature stability of the ThermoCare box between 2.0 °C and 8.0 °C is given in Table 2.

For simulating a worst-case scenario, the ThermoCare box is tested without product load. All tests are carried out with the pack out and the pre-conditioning as described in chapter 3.4 and 3.5.

Table 2: Targeted $t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ value for the test scenario

Test scenario	Average ambient temperature [°C]	Targeted timespan ($t_{2.0\text{ °C} \dots 8.0\text{ °C}}$) [hrs]	Targeted (temp x time) ($\Delta T \times t_{2.0\text{ °C} \dots 8.0\text{ °C}}$) [K*hrs]
Summer A	26.8	≥ 25	≥ 470
Winter A	13.9	≥ 25	≥ 148
Summer B	24.7	≥ 25	≥ 418
Winter B	7.3	≥ 25	n.a. ³

³ Temp x time is not applicable in the winter scenario, because the average ambient temperature is in the targeted temperature range.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

2 Equipment used

2.1 Shipment containers

To simulate the transport the ThermoCare box is used. Table 3 lists the dimensions and the weight of the ThermoCare box.

The thermal insulation performance of the ThermoCare box is given by its Q-value. From statistical measurements the Q-value of the ThermoCare box can be determined to (0.24 ± 0.02) W/K.

Table 3: Detailed information about the ThermoCare box

ThermoCare box	
Outer dimensions [mm ³] (length x width x height)	597 x 397 x 335
Outer dimensions [inch ³] (length x width x height)	23.6 x 15.7 x 13.2
Inner dimensions [mm ³] (length x width x height)	380 x 250 x 160
Inner dimensions [inch ³] (length x width x height)	14.9 x 9.8 x 6.2
Tolerance [mm]	± 5
Tolerance [inch]	± 0.2
Weight (empty container) [kg]	6.1
Weight (empty container) [lbs]	13.4
Weight (with va-Q-accus) [kg]	12.5
Weight (with va-Q-accus) [lbs]	27.6
Tolerance [kg]	± 1.0
Tolerance [lbs]	± 2.2
Q-value [W/K]	0.24
Tolerance [W/K]	± 0.02

2.2 Phase-change-material (PCM)

va-Q-tec's PCM flasks, named va-Q-accu, are the cooling or heating material stabilizing the temperature inside the ThermoCare box. In this test 2 pcs of va-Q-accu 44253 +05G and 2 pcs. of va-Q-accu 24163 +05G with a phase transition temperature of 2.0 °C ... 8.0 °C are used (see also Table 4).

Table 4: Used PCM configuration for the test criterion

Test criterion	Size of va-Q-accu	PCM type	Weight per va-Q-accu [kg]	Amount of va-Q-accu per container
2.0 °C ... 8.0 °C	44253	+05G	2.3	2 pcs
2.0 °C ... 8.0 °C	24163	+05G	0.9	2 pcs.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

2.3 Climate chambers

Two climate chamber are used in order to simulate different ambient temperature scenarios as well as to pre-condition the PCM flasks.

The climate chambers and the corresponding specifications are summarized in Table 5 and Table 6.

Table 5: Internal labeling and corresponding serial number of climate chambers

Internal Climate chamber number	Climate Chamber number	Serial no.	Site
W4	CTS T-70/600	174018	Wuerzburg
W5	CTS T-70/600	174019	Wuerzburg
W7	CTS T-70/600	174056	Wuerzburg

Table 6: Physical data of climate chambers

Internal Climate Chamber Number	Internal dimensions	Temperature range	Spatial accuracy	Temperature dependent accuracy
W4	(850 x 850 x 830) mm ³	-70 °C to +180 °C	± 1.0 K to ± 2.0 K	± 0.3 K
W5	(850 x 850 x 830) mm ³	-70 °C to +180 °C	± 1.0 K to ± 2.0 K	± 0.3 K
W7	(850 x 850 x 830) mm ³	-70 °C to +180 °C	± 1.0 K to ± 2.0 K	± 0.3 K

2.4 Temperature measuring equipment

To monitor the temperatures during the test process, calibrated temperature data loggers and the corresponding sensor sets are used.

Table 7: Temperature range of measurement equipment

Description	Number of probes	Accuracy for a temperature range of	
Data logger ELPRO Ecolog TN4 with NTC temperature sensor set	4	-50 °C ... -25 °C	± 0.4 °C
		-25 °C ... 0 °C	± 0.3 °C
		0 °C ... 30 °C	± 0.2 °C
		30 °C ... 70 °C	± 0.3 °C
		70 °C ... 100 °C	± 0.4 °C
		100 °C ... 140 °C	± 0.7 °C

The temperature data loggers are programmed to save one temperature value for each sensor every minute. They are factory calibrated and checked annually according to recommended standards of the supplier. The corresponding temperature sensor sets are also checked annually.

Calibration certificates and raw data can be found in the appendix of this report. The ISO documentation is available on request.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

2.5 Simulated goods

During the tests, no transport good is placed inside ThermoCare box to simulate a worst-case scenario.⁴

⁴ A rationale explaining why empty testing represents a worst-case scenario can be provided on request.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3 Test procedure

3.1 Sensor positions

The packed ThermoCare box is placed in the relevant climate chamber for the simulation of the shipment. To control the temperature inside the inner compartment of the ThermoCare box the temperature sensors of an ELPRO Ecolog TN4 are placed diagonally inside the box (see Figure 1).

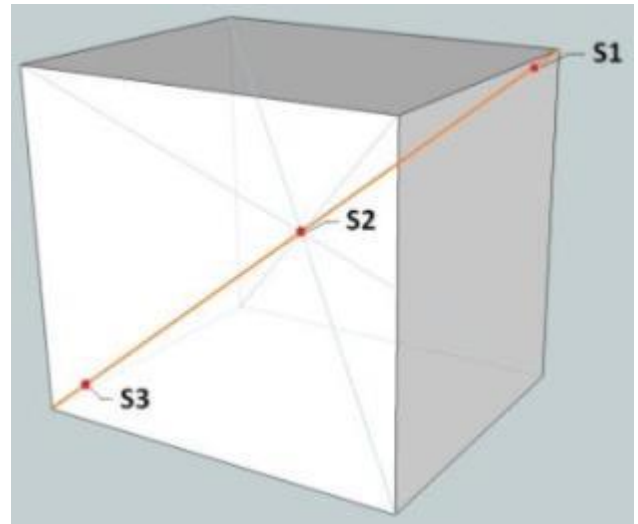


Figure 1: Empty test box with sensor positions in the body diagonal.

These three sensors are connected with temperature data loggers and sensor probes, which are stored inside the test box. Sensor S4 is neglected in the evaluation but records data due to the construction of the logger.

The ambient temperature is measured with another logger. The measurement points are illustrated in Figure 2.

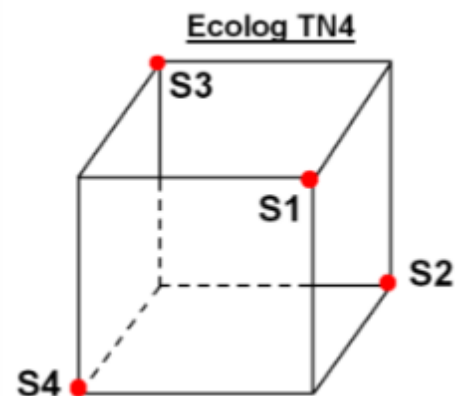


Figure 2: Sensor positions inside the relevant climate chamber for ambient temperature measurement.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.2 Ambient temperature scenarios

The shipment is simulated in four different temperature scenarios according to the ambient temperature profiles provided by the Post Logistics CH. The profiles simulate the shipment conditions starting from the commissioned box in the fulfillment center until the delivery of the box to the customer.

3.2.1 Summer A

During the summer scenario A the testing time is made up of transport of the ThermoCare box for five hours at 30 °C, storing the box for one day at 22 °C and 49 hours of the provided summer profile V05.05. Detailed information on the profile is given in Table 8 and Figure 3.

Table 8: Ambient temperature scenario V05.05 summer A

Transport from fulfillment center		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
30	5	5
Box storage		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
22	24	29
Summer profile V05.05		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
30	1	30
25	1	31
30	2	33
25	1	34
30	3	37
25	9	46
30	2	48
35	6	54
25	2	56
30	1	57
25	1	58
30	3	61
25	9	70
30	2	72
35	6	78
Average temperature: 26.8 °C ± 2.0 °C		

targeted performance →

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

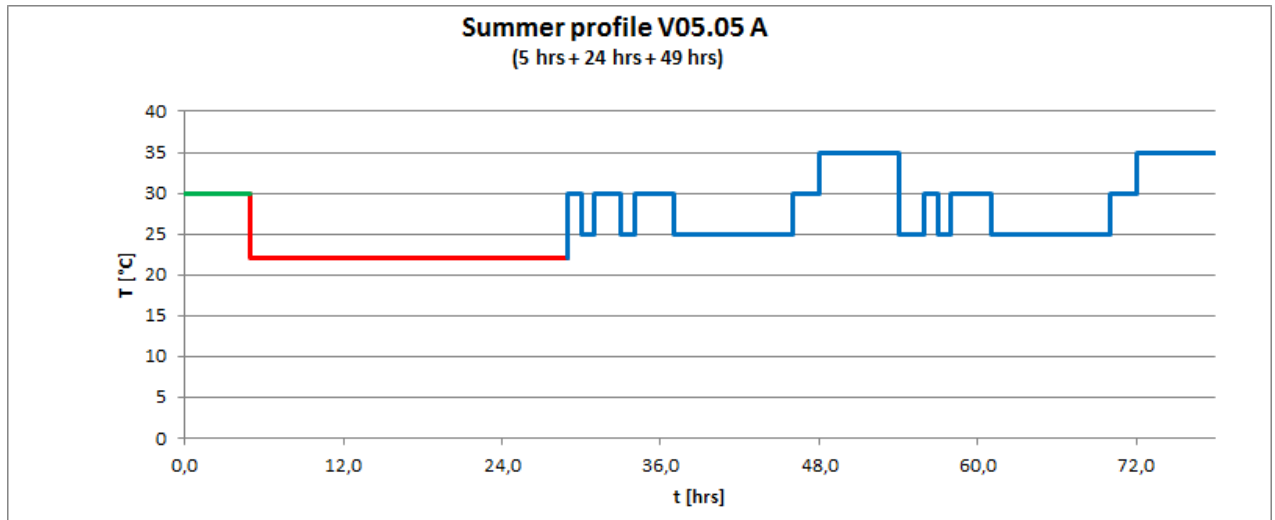


Figure 3: Testing profile including transport (green), storage (red) and summer profile V05.05 (blue).

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.2.2 Winter A

During the winter scenario A the testing time is made up of transport of the ThermoCare box for five hours at 8 °C, storing the box for one day at 21 °C and 49 hours of the provided winter profile V05.05. Detailed information on the profile is given in Table 9 and Figure 4.

Table 9: Ambient temperature scenario V05.05 winter

Transport from fulfillment center		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
8	5	5
Box storage		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
21	24	29
Winter profile V05.05		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
8	1	30
18	1	31
5	2	33
18	1	34
5	5	39
0	3	42
18	2	44
-5	3	47
0	7	54
18	2	56
5	1	57
18	1	58
5	5	63
0	3	66
18	2	68
-5	3	71
0	7	78
Average temperature: 13.9 °C ± 2.0 °C		

targeted performance →

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.2.3 Summer B

During the summer scenario B the testing time is made up of transport of the ThermoCare box for five hours at 30 °C, storing the box for 12 hours at 4 °C and 49 hours of the provided summer profile V05.05. Detailed information on the profile is given in Table 10 and Figure 5.

Table 10: Ambient temperature scenario V05.05 summer A

Transport from fulfillment center		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
30	5	5
Box storage		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
4	12	17
Summer profile V05.05		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
30	1	18
25	1	19
30	2	21
25	1	22
30	3	25
25	9	34
30	2	36
35	6	42
25	2	44
30	1	45
25	1	46
30	3	49
25	9	58
30	2	60
35	6	66
Average temperature: 24.7 °C ± 2.0 °C		

targeted performance →

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

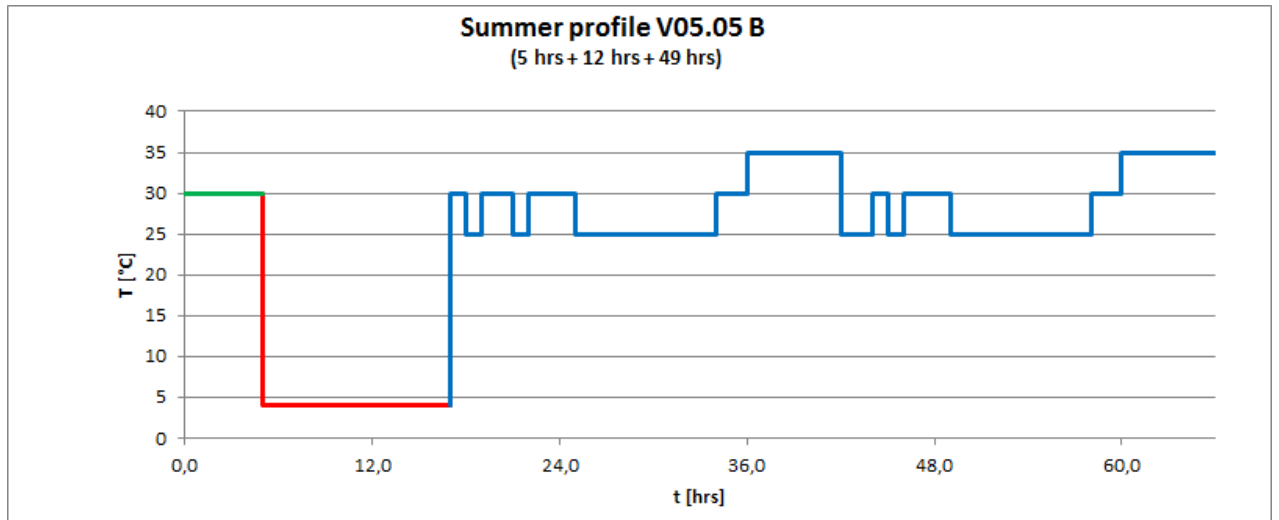


Figure 5: Testing profile including transport (green), storage (red) and summer profile V05.05 (blue).

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.2.4 Winter B

During the winter scenario B the testing time is made up of transport of the ThermoCare box for five hours at 8 °C, storing the box for 12 hours at 3.5 °C and 49 hours of the provided winter profile V05.05. Detailed information on the profile is given in Table 11 and Figure 6.

Table 11: Ambient temperature scenario V05.05 winter

Transport from fulfillment center		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
8	5	5
Box storage		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
3.5	12	17
Winter profile V05.05		
Temperature [°C]	Cycle Period [hrs]	Total Time [hrs]
8	1	18
18	1	19
5	2	21
18	1	22
5	5	27
0	3	30
18	2	32
-5	3	35
0	7	42
18	2	44
5	1	45
18	1	46
5	5	51
0	3	54
18	2	56
-5	3	59
0	7	66
Average temperature: 7.3 °C ± 2.0 °C		

targeted performance →

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

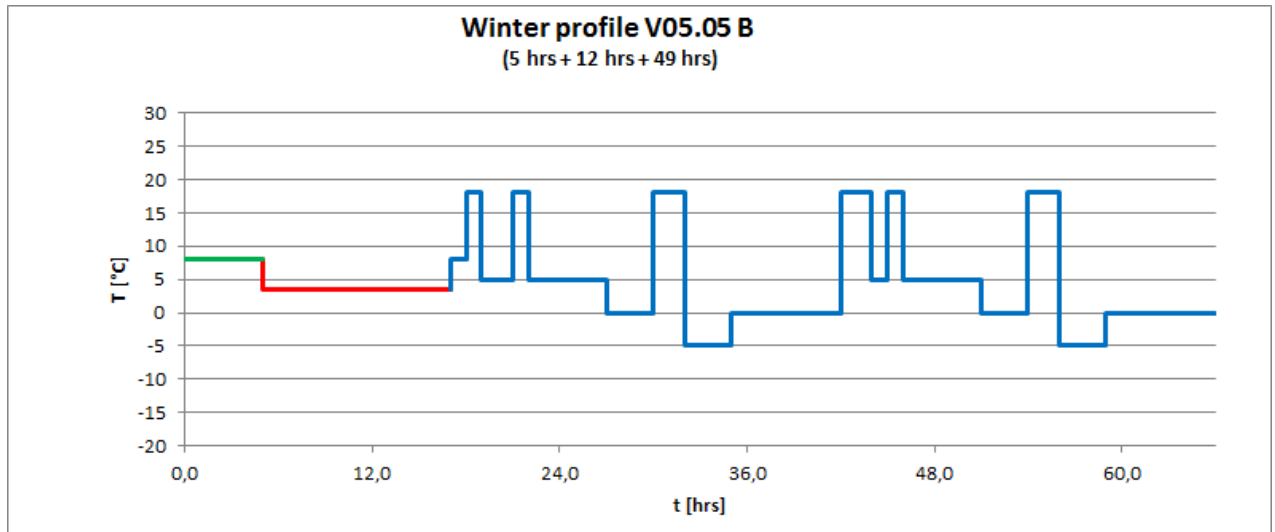


Figure 6: Testing profile including transport (green), storage (red) and winter profile V05.05 (blue).

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.3 Table of actions

Table 12: Table of actions for the test process

Step	Action	Duration
1	Pre-conditioning of all va-Q-accus +05G at -25.0 °C ± 1.0 °C	24 hrs
2	Pre-conditioning of all va-Q-accus +05G at 2.0 °C ± 1.0 °C	20 hrs
3	Preparation of the climate chamber and the data logger for the ambient temperature	≤ 10 minutes
4	Loading one va-Q-accu 44253 +05G onto the bottom of the ThermoCare box	≤ 15 min
5	Loading the lateral 2 va-Q-accus 24163 +05G into the ThermoCare box	
6	Starting the internal data logger	
7	Placing the top va-Q-accu 44253 +05G on top of the accu holder	
8	Closing of the ThermoCare box	
9	Placing the ThermoCare box inside the climate chamber	
10	Starting the external data logger	
11	Start the climate chamber with the desired temperature scenario and simulate the shipment	≥ 66 hours
12	Collecting and saving pre-conditioning data	NA
13	Remove the ThermoCare box from the climate chamber and collect the data.	NA

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.4 PCM and container pre-conditioning

Table 13: Pre-conditioning data

PCM pre-conditioning	va-Q-accu	Temperature	Duration
		+05G	(-25.0 ± 1.0) °C
		(2.0 ± 0.5) °C	20 hrs

The ThermoCare box itself is stored at room temperature.

3.5 va-Q-accu loading

After pre-conditioning, the PCM flasks are packed into the ThermoCare box as shown in Figure 7. The container is packed in the following order: bottom, top. Before positioning the top va-Q-accu, the temperature data logger is placed inside the ThermoCare box.

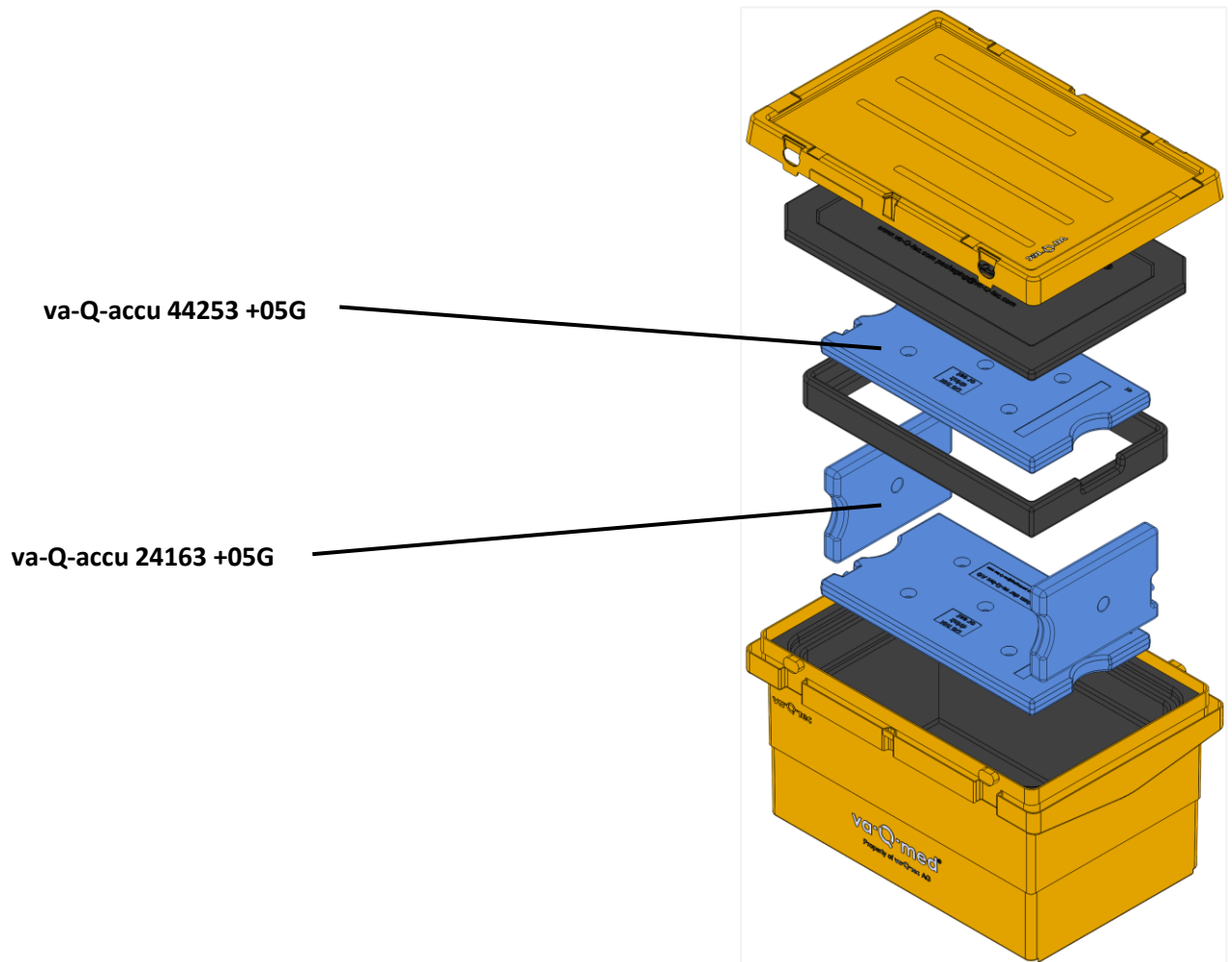


Figure 7: Arrangement of the PCM flasks in the ThermoCare box.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

3.6 Evaluation of data

The targeted time $t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ is measured from the start of the profile V05.05 until the time when the average value of the inner temperature sensors exceeds the 8.0 °C limit or undercuts the 2.0 °C limit. The exact start date and time is defined by the start of the data logger recordings.

Data logger recordings also document the average pre-conditioning temperature of the va-Q-accu during the 44 hours pre-conditioning process.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

4 Test results

4.1 Summer A scenario

The detailed device characteristics during the summer scenario can be found in Table 14, Table 15, Table 16 and Table 17 as well as in Figure 8. Hence, the ThermoCare box in combination with the specified load of pre-conditioned PCMs (2 pcs of va-Q-accu +05G 44253 and 2 pcs of va-Q-accu +05G 24163) is able to fulfill the requested quality criterion of

$$t_{2.0\text{ °C} \dots 8.0\text{ °C}} \geq 25 \text{ hrs.}$$

The calculated (temp x time)-values refer to an internal average container temperature of 5 °C.

Table 14: Detailed information on the summer test results

$t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ [hrs]	(temp x time) [K*hrs]	Average ambient temperature [°C]	Test passed
28	1197	26.0	✓

Table 15: Detailed information on the used temperature measurement equipment

ThermoCare box	Used data logger	Calibration valid until	Used sensor set	Calibration valid until
Inner temperature	403804	Jul. 18	S4N059	Sep. 18
Ambient temperature	404691	Aug. 18	S4N161	Sep. 18

Table 16: Used climate chambers for va-Q-accu pre-conditioning (summer scenario)

Used climate Chamber (Internal Number)	Calibration valid until	temperature	Purpose
W5	Apr. 18	-25.4 °C	Pre-conditioning of va-Q-accus
W5	Apr. 18	1.5 °C	

Table 17: Used climate chambers for summer scenario

Used Climate chamber (Internal Number)	Calibration valid until	temperature	Purpose
W5	Apr. 18	25.2 °C	Average ambient temperature during the complete test time

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

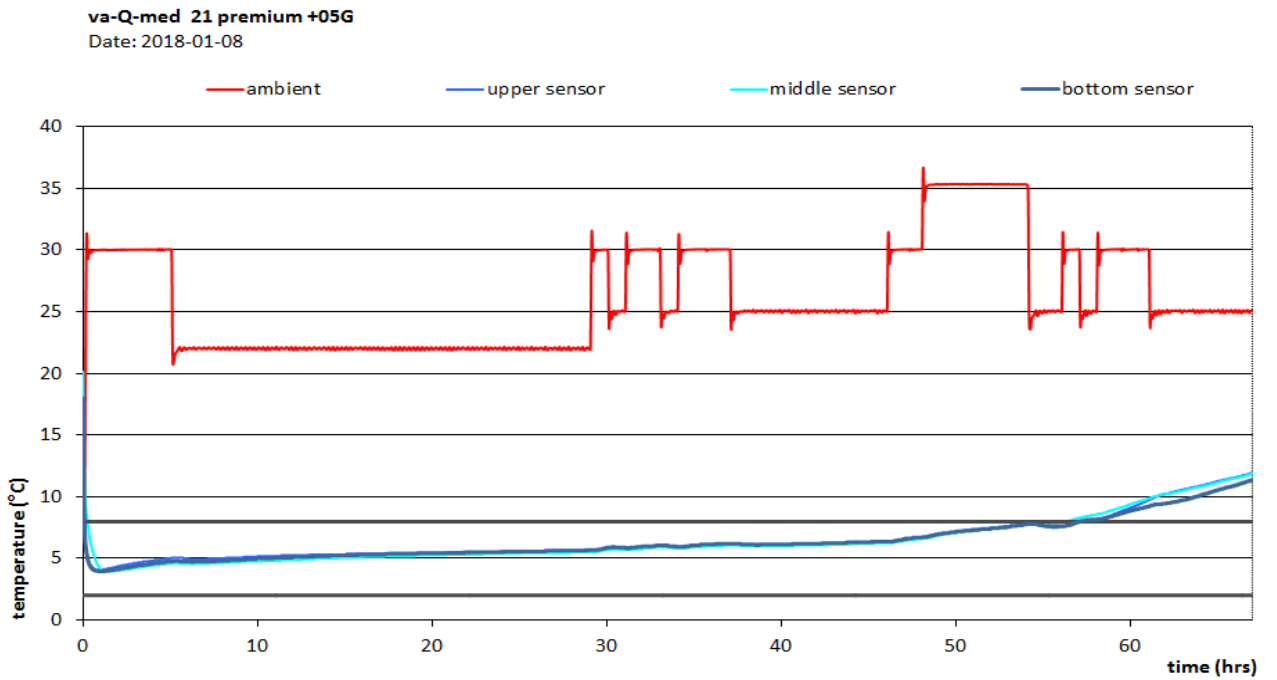


Figure 8: Test result ThermoCare box (summer scenario).

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

4.2 Summer B scenario

The detailed device characteristics during the summer scenario can be found in Table 18, Table 19, Table 20 and Table 21 as well as in Figure 9. Hence, the ThermoCare box in combination with the specified load of pre-conditioned PCMs (2 pcs of va-Q-accu +05G 44253 and 2 pcs of va-Q-accu +05G 24163) is able to fulfill the requested quality criterion of

$$t_{2.0\text{ }^{\circ}\text{C} \dots 8.0\text{ }^{\circ}\text{C}} \geq 25 \text{ hrs.}$$

The calculated (temp x time)-values refer to an internal average container temperature of 5 °C.

Table 18: Detailed information on the summer test results

$t_{2.0\text{ }^{\circ}\text{C} \dots 8.0\text{ }^{\circ}\text{C}}$ [hrs]	(temp x time) [K*hrs]	Average ambient temperature [°C]	Test passed
44	1117	20.3	✓

Table 19: Detailed information on the used temperature measurement equipment

ThermoCare box	Used data logger	Calibration valid until	Used sensor set	Calibration valid until
Inner temperature	95103	Oct. 18	S4N159	Sep. 18
Ambient temperature	403814	Jul. 18	S4N059	Sep. 18

Table 20: Used climate chambers for va-Q-accu pre-conditioning (summer scenario)

Used climate Chamber (Internal Number)	Calibration valid until	temperature	Purpose
W7	Jul. 18	-25.2 °C	Pre-conditioning of va-Q-accus
W7	Jul. 18	2.2 °C	

Table 21: Used climate chambers for summer scenario

Used Climate chamber (Internal Number)	Calibration valid until	temperature	Purpose
W4	May 18	25.2 °C	Average ambient temperature during the complete test time

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

va-Q-med 21 premium +05G
Date: 2018-02-12

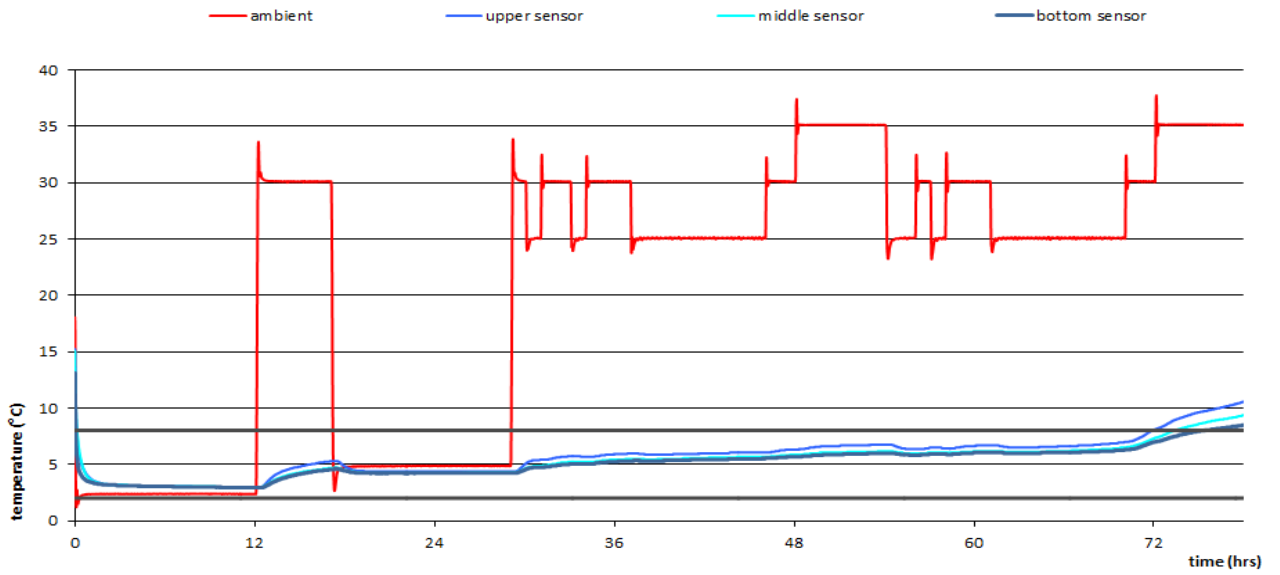


Figure 9: Test result ThermoCare box (summer scenario).

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

4.3 Winter B scenario

The detailed device characteristics during the winter scenario can be found in Table 22, Table 23, Table 24 and Table 25 as well as in Figure 10. Hence, the ThermoCare box in combination with the specified load of pre-conditioned PCMs (2 pcs of va-Q-accu +05G 44253 and 2 pcs of va-Q-accu +05G 24163) is able to fulfill the requested quality criterion of

$$t_{2.0\text{ }^{\circ}\text{C} \dots 8.0\text{ }^{\circ}\text{C}} \geq 25 \text{ hrs.}$$

The calculated (temp x time)-values refer to an internal average container temperature of 5 °C.

Table 22: Detailed information on the summer test results

$t_{2.0\text{ }^{\circ}\text{C} \dots 8.0\text{ }^{\circ}\text{C}}$ [hrs]	(temp x time) [K*hrs]	Average ambient temperature [°C]	Test passed
49	n.a. ⁵	5.1	✓

Table 23: Detailed information on the used temperature measurement equipment

ThermoCare box	Used data logger	Calibration valid until	Used sensor set	Calibration valid until
Inner temperature	403814	Jul. 18	S4N020	Jun. 18
Ambient temperature	403806	Aug. 18	S4N163	Sep. 18

Table 24: Used climate chambers for va-Q-accu pre-conditioning (summer scenario)

Used climate Chamber (Internal Number)	Calibration valid until	temperature	Purpose
W4	May 18	-25.0 °C	Pre-conditioning of va-Q-accus
W4	May 18	1.9 °C	

Table 25: Used climate chambers for summer scenario

Used Climate chamber (Internal Number)	Calibration valid until	temperature	Purpose
W4	May 18	5.4 °C	Average ambient temperature during the complete test time

⁵ Temp x time is not applicable in the winter scenario, because the average ambient temperature is in the targeted temperature range.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

va-Q-med 21 premium +05G
Date: 2018-01-15

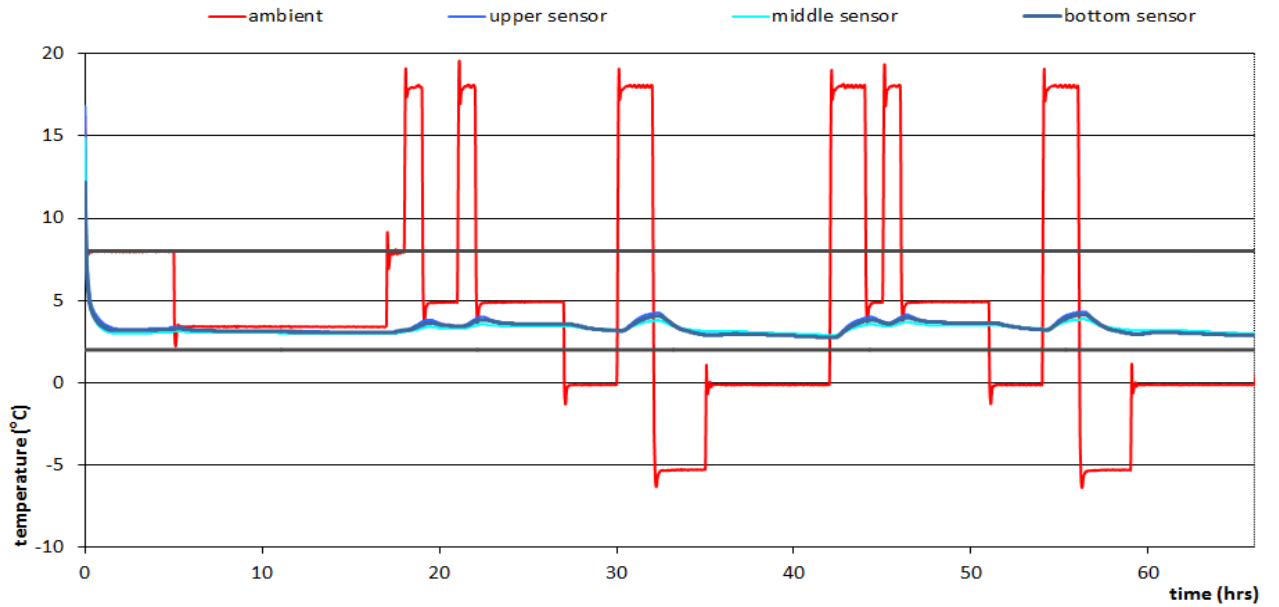


Figure 10: Test result ThermoCare box (winter scenario)

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

5 Conclusion

The ThermoCare box container is tested within the ambient temperature scenarios V05.05 provided by Post Logistics CH for 2.0 °C ... 8.0 °C shipments. va-Q-tec's +05G va-Q-accus are used as a phase change material to stabilize the temperature inside the ThermoCare box.

According to the defined delivery process the ThermoCare box is tested to:

Table 26: Test results

Temperature scenario	Tested $t_{2.0\text{ °C} \dots 8.0\text{ °C}}$ [hrs]	Tested (temp x time) [K*hrs] ⁶	Average ambient temperature [°C]
Summer A	28	1197	26.0
Summer B	44	1117	20.3
Winter B	49	n.a. ⁷	5.1

A fourth test with the winter scenario V05.05 winter A hasn't been carried out because Winter B already represents a tougher scenario than A. Further information can be found in chapter 3.2.

⁶ The calculated (temp x time)-values refer to an internal average container temperature of 5 °C

⁷ Temp x time is not applicable in the winter scenario, because the average ambient temperature is in the targeted temperature range.

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

6 Personnel Involved

Table 27: Personnel Involved

Name	Function
Philipp Amendt	<ul style="list-style-type: none"> <input type="radio"/> Consulting <input type="radio"/> Provision of resources
Kristina Kletzel	<ul style="list-style-type: none"> <input type="radio"/> Coordination <input type="radio"/> Revision
Christine Schmeier Marina Nahm Konstantin Hoff	<ul style="list-style-type: none"> <input type="radio"/> Preparation <input type="radio"/> Performance of Measurement <input type="radio"/> Evaluation of Data <input type="radio"/> Compilation of test report

Table 28: Approval

Date and Signature	
Approved by Philipp Amendt (Team leader laboratory, va-Q-tec AG):	Revised by Kristina Kletzel (Team leader product development, va-Q-tec AG):

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

7 Change History

Table 29: Change history

Version	Date	Approval by	Comments about changelog
1.0	2018-03-29	Martin Heinemann	New Document
1.1	2018-10-10	Philipp Amendt	Minor corrections
1.2	2018-10-31	Philipp Amendt	Minor corrections

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2

8 Appendix

- Calibration check certificates of used data loggers
- Calibration check certificates of used temperature sensor sets
- Calibration check certificates of used climate chamber
- Raw data of used data loggers

ThermoCare box for 2.0 °C ... 8.0 °C shipments	
Approved by:	Philipp Amendt
Version:	1.2