

mysugarcase / MedAngel Test

OBJECTIVES

1. Do medications stored in the inlay of a mysugarcase combi risk freezing, when an ice pad is inserted in the ice pad pocket?

1.1 What is the minimum temperature reached in the inside the case?

2. How long does the ice pad keep temperatures inside of the case lower than ambient temperature?

METHOD

Materials: mysugarcase COMBI bag with inlay, ice pad '*icing*' (delivered by mysugarcase), 4x MedAngel temperature sensor (MedAngel BV), FLIR ONE thermal imaging camera (FLIR Systems, Inc.)

1. Thermal Imaging

Thermal images were taken of the mysugarcase combi with inlay and 3 insulin pens both without and with an inserted ice pad.

2. Test A (conducted 3 times)

- the ice pad was stored in a freezer for 12+ hours, temperature monitored by a MedAngel sensor [max -16.9°C, min -28.8°C, data not shown]
- an inlay was put into a mysugarcase combi bag with 3 insulin pens
- ice pad was inserted into the ice pad pocket of the mysugarcase combi
- 3 MedAngel sensors were used for temperature measuring (see Figure 1 for Test Arrangement):
 - 1 sensor next to the ice pad in the ice pad pocket ("Ice Pad 1")
 - 1 sensor in the mesh pocket of the inlay, with the inlay facing the ice pad pocket ("mysugarcase")
 - 1 sensor outside of the bag ("Ambient Air Temperature")
- the case was stored closed at room temperature until temperature inside the case ("mysugarcase") and outside temperature ("Ambient Air Temperature") had reached the same values

3. Test B (conducted once)

- see Test A / additionally, the case was opened every 30 minutes

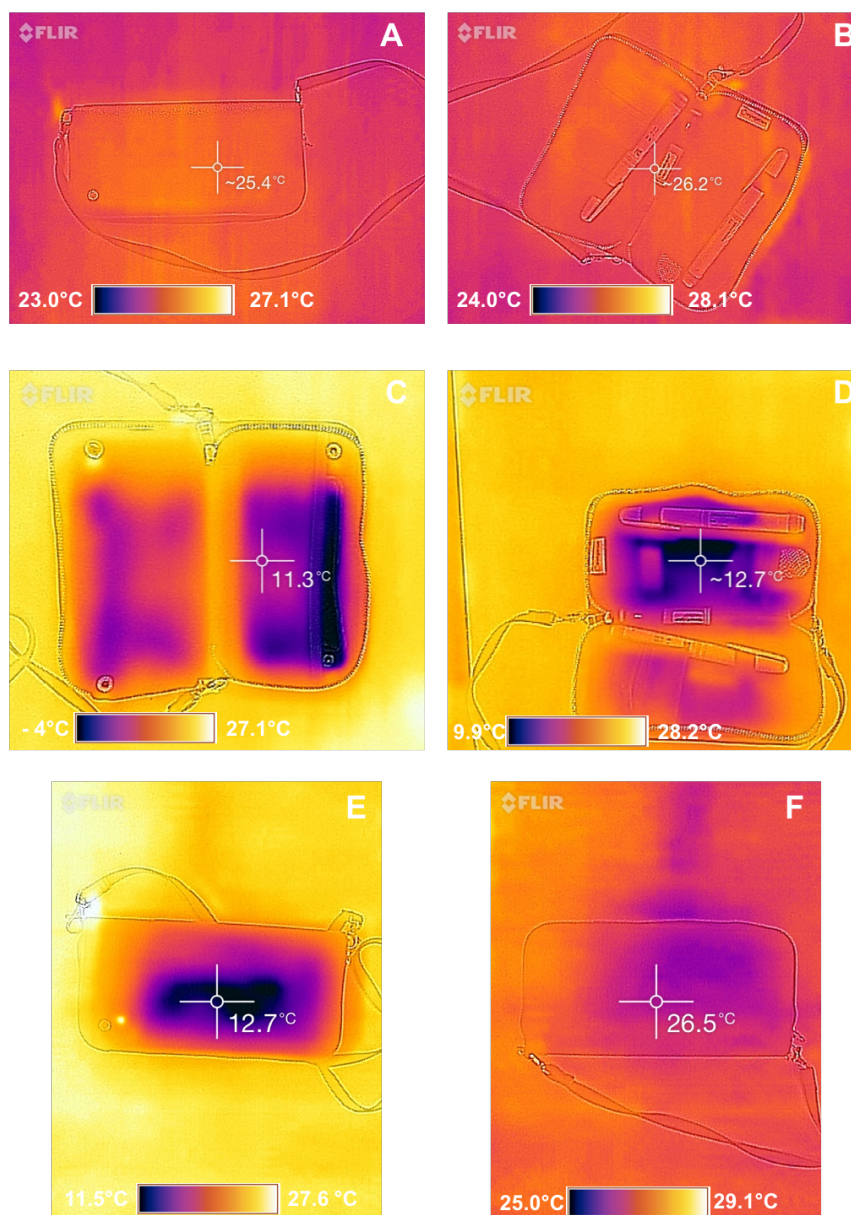
Figure 1: Test Arrangement. **A)** Sensor 1 ("Ice Pad 1") was put into the pocket with an ice pad, which had previously been stored in a freezer (-17 to -29°C) **B+C)** Sensor 2 ("mysugarcase") was placed in the mesh pocket of the inlay, next to the ice pad pocket (see B), also 3 insulin pens were put into the case **D)** Sensor 3 ("Ambient Air Temperature") was placed 10 cm next to the closed case



RESULTS

THERMAL IMAGING

Figure 2: **Thermal Images of mysugarcase**, with inserted ice pad. A) closed mysugarcase B) opened mysugarcase C) opened case, open inlay with inserted ice pad, which had previously been stored in a freezer at -17°C to -29°C for 12 hours D) opened case with closed inlay E) closed case, side with ice pad pocket facing upwards F) closed case, side with ice pad pocket facing downwards. Images were taken with FLIR ONE thermal imaging camera, using the 'iron' color palette. Displayed are one local temperature, as well as minimum and maximum temperature.



TEMPERATURE MONITORING

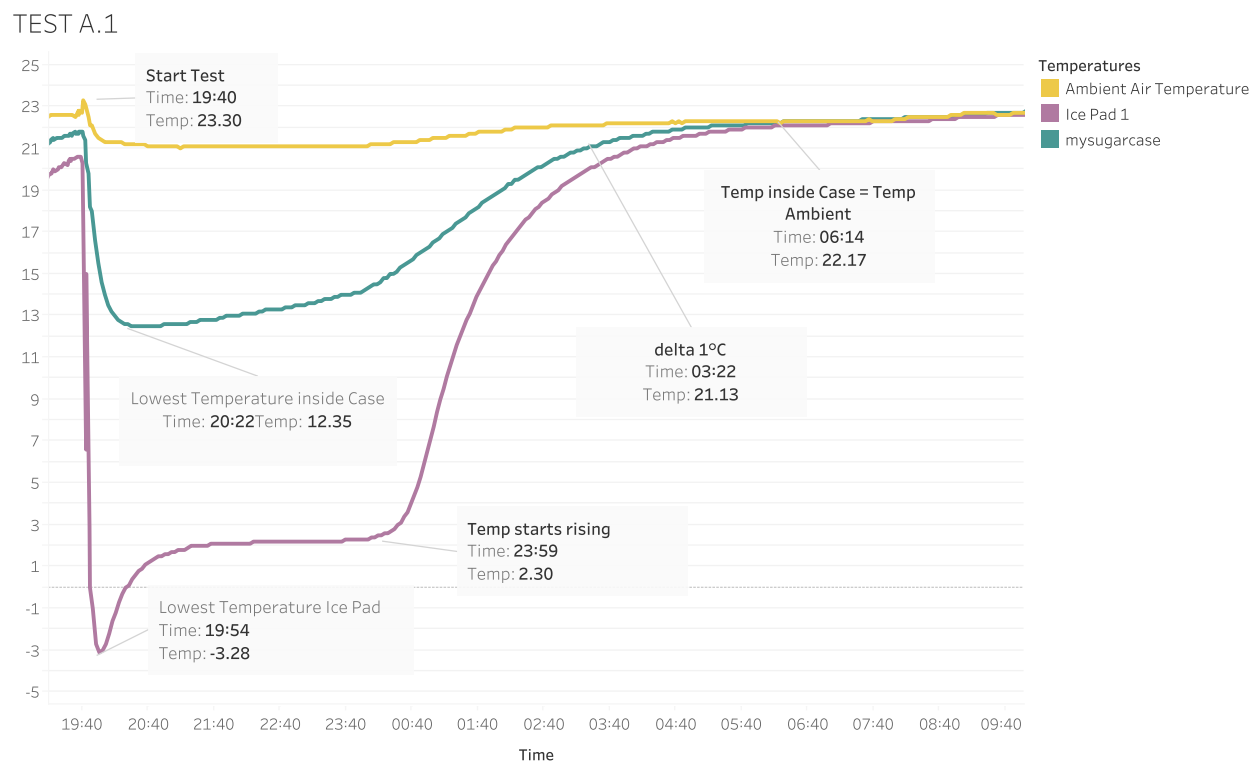
Table 1: Summary of Temperature Monitoring Test Results.

	ambient temp start/finish [°C]	Ice Pad minimum temp [°C]	mysugarcase minimum temp [°C]	time to: temp ice pad starts rising	time to: mysugarcase temp=ambient temp -1°C	time to: mysugarcase temp=ambient temp
TEST A.1	23.3/22.17	-3.28	12.35	4:19 hours	7:42 hours	10:40 hours
TEST A.2	22.9/22.66	+6.5*	16.89	*	8:58 hours	12:02 hours
TEST A.3	23.09/22.19	-2.27	15.15	4:30 hours	7:20 hours	09:51 hours
TEST B	23.5/22.8	-0.55	9.39	4:50 hours	7:20 hours	**

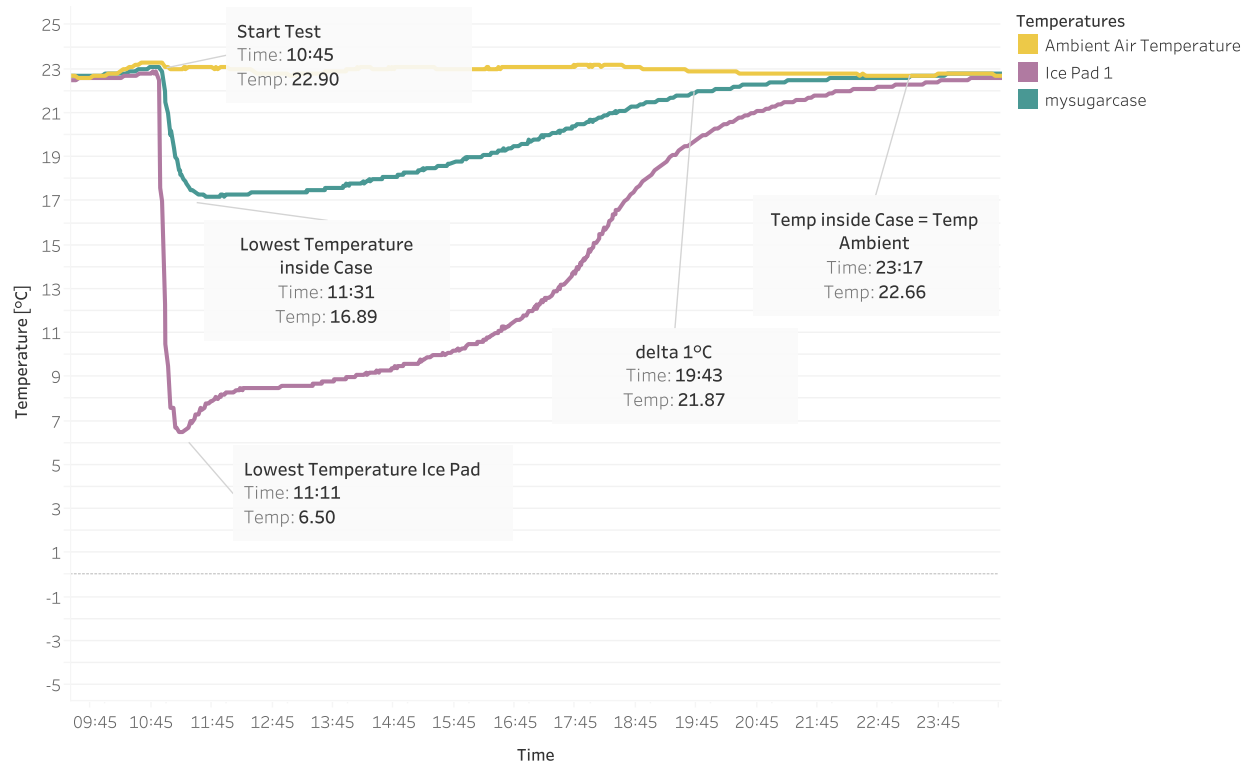
* temperature sensor might not have been located properly, high minimum temperatures and gradual, not rapid rise in temperature

** test was stopped before, when mysugarcase temp=ambient temp -1°C

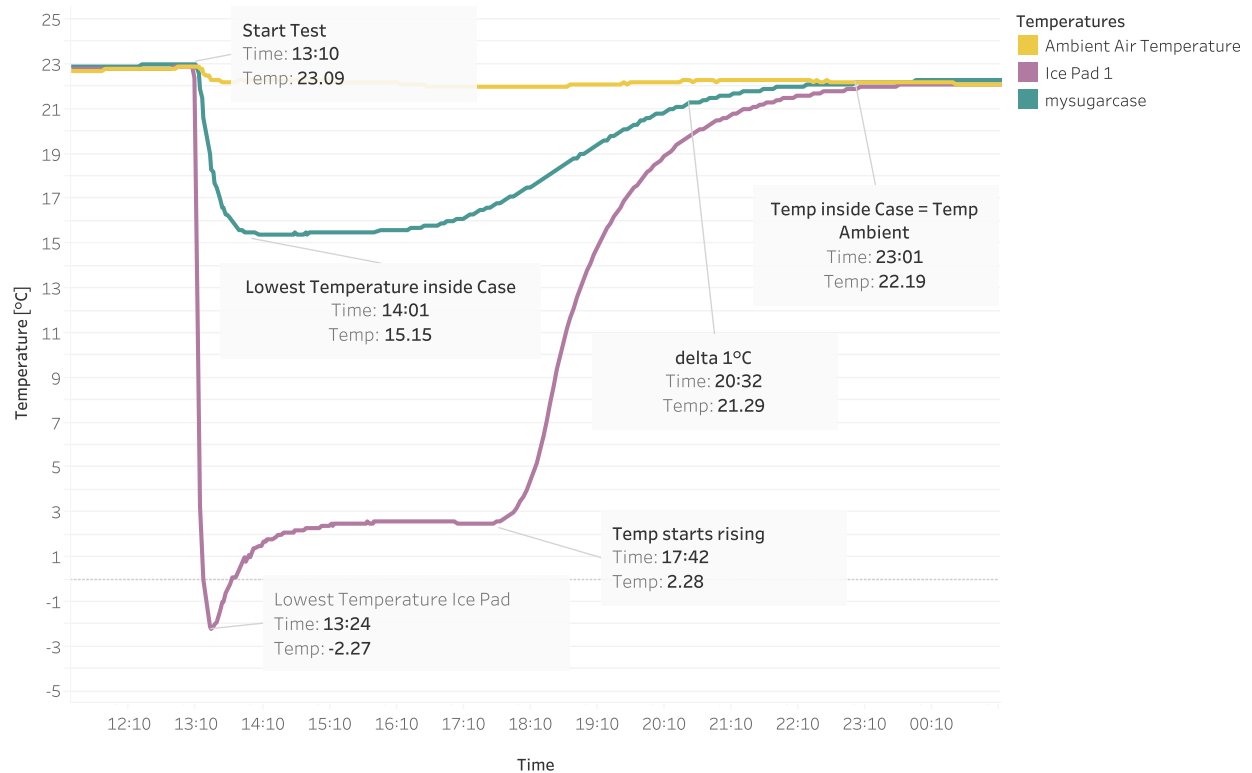
Figure 3: **Temperature Monitoring Test.** Shown are the test results of Test A.1, A.2, A.3 and B as temperature over time graphs, with temperature data from the 3 different MedAngel sensors 'Ambient Air Temperature', 'Ice Pad 1' and 'mysugarcase' (see Figure 1 for Test Arrangement). delta 1°C marks the point where mysugarcase temp=ambient temp -1°C



TEST A.2

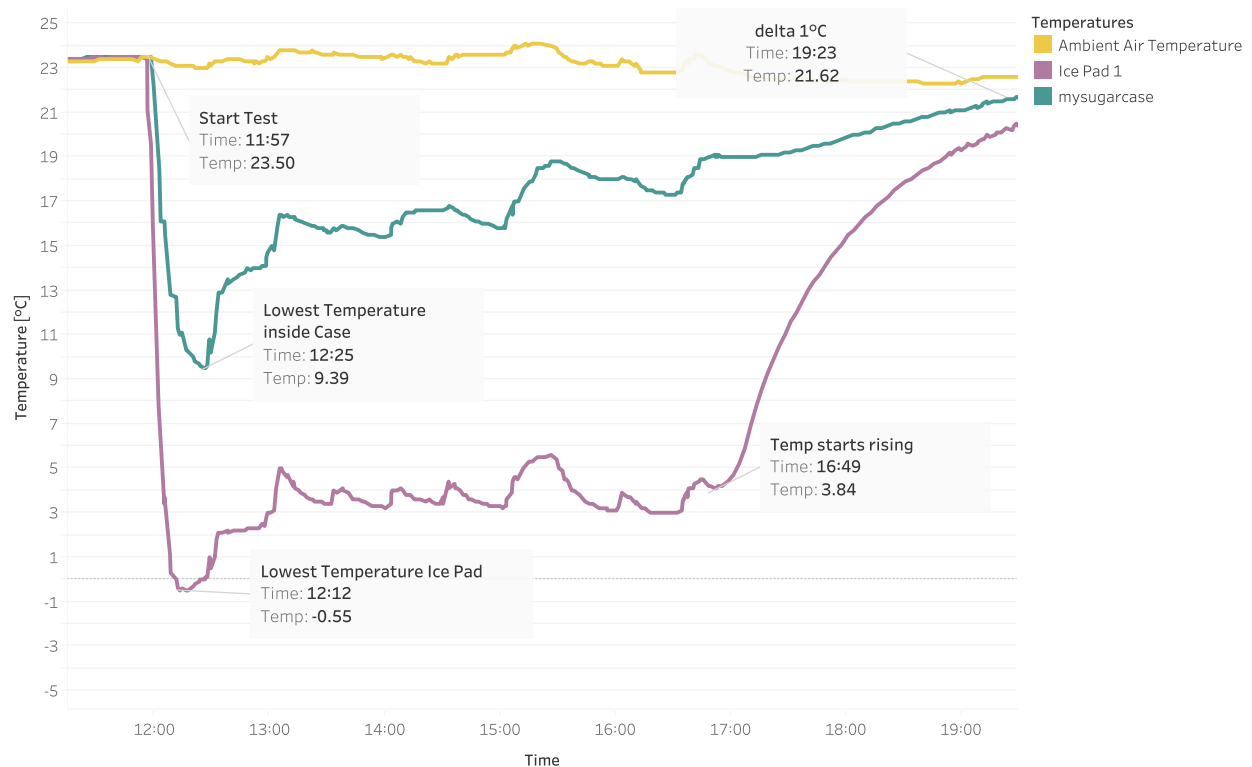


TEST A.3



TEST B

Opening the case every 30 mins



CONCLUSIONS

OBJECTIVES

1. Do medications stored in the inlay of a mysugarcase combi risk freezing, when an ice pad is inserted in the ice pad pocket?

--> **No, as temperatures in the mysugarcase combi inlay do not fall below 0 °C.**

1.1 What is the minimum temperature reached in the inside the case?

--> The minimum temperatures measured inside the case ranged from 9 °C to 17 °C, at ambient temperature of 22 to 23.5 °C.

2. How long does the ice pad keep temperatures inside of the case lower than ambient temperature?

--> The temperature of the ice pad started rising rapidly in 3/4 tests after 4:19 to 4:50 hours at ambient temperature of 22 to 23.5 °C.

It took between 7:20 and 8:58 hours for the inside temperature to reach values of 1°C lower than ambient temperature. Both observations were independent of opening the case every 30 minutes.

3. Insulation

The ice pad pocket is well insulated towards the inside of the case, as can be seen in all Temperature

monitoring tests (Figure 3) and in thermal images of Figure 2 (C+D). Even when the ice pad is freshly inserted, the inside temperature does barely fall below 10°C.

If users are also storing their medications in the case without the inlay, further tests could be done without the inlay to investigate, whether the temperature right next to the ice pad pocket are still high, which the thermal images (Figure 2C) suggest. Material in future mysugarcases could be optimized to be less insulating towards the inside of the case.

At the same time, cold is lost towards the outside of the case, as can be seen in thermal images in Figure 2 (E+F). Insulating this layer better would increase cooling times.

LIMITATIONS

The temperature monitoring tests were conducted at steady room temperature of 22 to 23.5°C. Active use (proximity to body heat), higher ambient temperatures and especially exposure to sunlight will significantly shorten cooling times.