Thermal test - summer conditions

SixCase SC1330
Aivia 210
Rotaid Solid plus heat
SmartCase SC1230

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1 Summary

Manufacturers of AED's specify a thermal range from 0°C to +50°C for the device and pads for storage. This report publishes the results of a test performed on 4 types of outdoor cabinets under summer conditions:

- SixCase SC1330
- Aivia 210
- Rotaid Solid plus heat
- SmartCase 1230

The test has been performed under identical conditions for all 4 cabinets:

- Same Date and timeframe: 15-07-2018, between 12:00 and 17:00
- Same location: Zoeterwoude Netherlands, South-West orientation
- Same AED inside the cabinet: Zoll AED plus (without bag)

The weather conditions on 15-07-2018 were:

- Maximum Outside air temperature around 27°C.
- Mostly sunny, sporadic clouds

The test and results comprises 2 aspects:

1. The increasing temperature at different locations on the AED/pads due to the energy of the sun radiation. This temperature must stay below 50°C according to the AED manufacturing specification.
2. Possibility to open the cabinet when it is heated up by the sun.

The temperature results are presented in graphic form. The opening test has been performed at the end of the test (around 17:00).

SixCase SC1330: The maximum temperature does not exceed the allowed 50°C. Opening under these conditions is not a problem. General performance under summer conditions is very good (++)

Aivia 210: On two locations, the AED temperature exceeds the allowed 50°C (max temperature = 67°C). Opening under these conditions is not a problem. General performance under summer conditions is mediocre (+/-)

Rotaid Solid plus heat: On two locations, the AED temperature exceeds the allowed 50°C (max temperature = 67°C). Normal opening under these conditions is not possible. General performance under summer conditions is very poor (--)

SmartCase SC1230: On one location, the AED temperature just exceeds the allowed 50°C by 1 degree (max temperature = 51°C). Opening under these conditions is not a problem. General performance under summer conditions is good (+)

A full video of the test, test set-up and results can be viewed on youtube:

https://youtu.be/oUg5zbe2Bqs

2 Test setup

For the test A ZOLL AED plus (without bag) is placed inside the cabinets, See Figure 2-1 for the ZOLL AED.

Figure 2-1: Zoll AED plus (without bag)

Temperature probes are placed on the following locations:

1. In the front compartment of the pads, in front of the pads (see Figure 2-2)
2. At the top of the AED (see Figure 2-3)
3. At the back of the AED (see Figure 2-4)
4. At the bottom of the AED (see figure 2-4)

The cabinet is facing South-West during the test (see figure 2-5)

Figure 2-2: Temperature probe 1: in front of the AED pads

Figure 2-3: Temperature probe 2: top of the AED

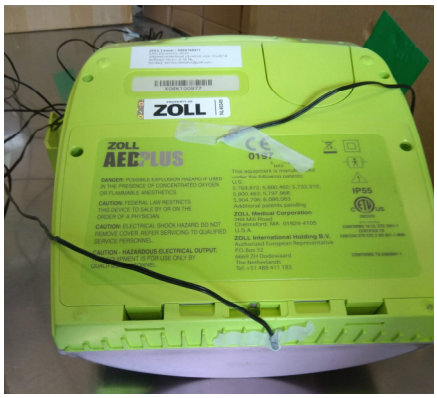

Figure 2-4: Temperature probe 3 and 4: At the back and bottom of the AED

Figure 2-5: Orientation of the test (South-West)

2.1 Thermal Test Instrumentation

During the test, the temperature is monitored using a Pace Scientific XR5-SE data logger and PT907 temperature probes. The data logged by the XR5-SE is transferred to a computer using LogXR software provided by Pace Scientific.

The XR5-SE data logger is presented in Figure 2- whereas a PT907 temperature probe is presented in Figure 2-.

Figure 2-6: Pace scientific XR5-SE data logger

Figure 2-7: Pace scientific PT907 temperature probe

3 Cabinet design for summer conditions

Aivia 210:

All outdoor cabinets of the Aivia brand are equipped with active cooling by a Fan. The fan is located at the right bottom part of the cabinet and sucks in the outside (cooler) air. The hot (inside) air leaves the cabinet through the differebnt openings in the cabinet.

SixCase SC1330:

All outdoor cabinets of the SixCase serie are equipped with active cooling by a Fan. The fan is located at the top rear part of the cabinet and blows out the inside (hot) air. The cooler (outside) air is entering the cabinet through the different openings at the bottom of the cabinet. In addition, the latest versions of the outdoor SixCase series is equipped with a polycarbonate window with Infrared blocking coating. This coating prevents the IR radiation of the sun to enter the cabinet. This feature further reduces temperatures inside the cabinet.

Rotaid Solid plus heat:

The Rotaid cabinets doesn't have any measure to cool the inside air. It is completely sealed of except for a small (lock) hole at the bottom. The hot inside air cannot leave the cabinet.

SmartCase SC1230:

All outdoor cabinets of the SmartCase serie are equipped with active cooling by a Fan. The fan is located at the top rear part of the cabinet and blows out the inside (hot) air. The cooler (outside) air is entering the cabinet through the different openings at the bottom of the cabinet. In addition, the SmartCase series is equipped with a polycarbonate window with Infrared blocking coating. This coating prevents the IR radiation of the sun to enter the cabinet. This feature further reduces temperatures inside the cabinet.

4 Test results

4.1 Temperature Graphs

Figure 4-1 shows the temperature test results for the Aivia 210 between 12:00 and 16:48 hrs on the 15th of July 2018, Zoeterwoude, Netherlands. Maximum temperature during the day is 27°C. Mostly sunny with some minor clouds between 14:30 and 15:30.

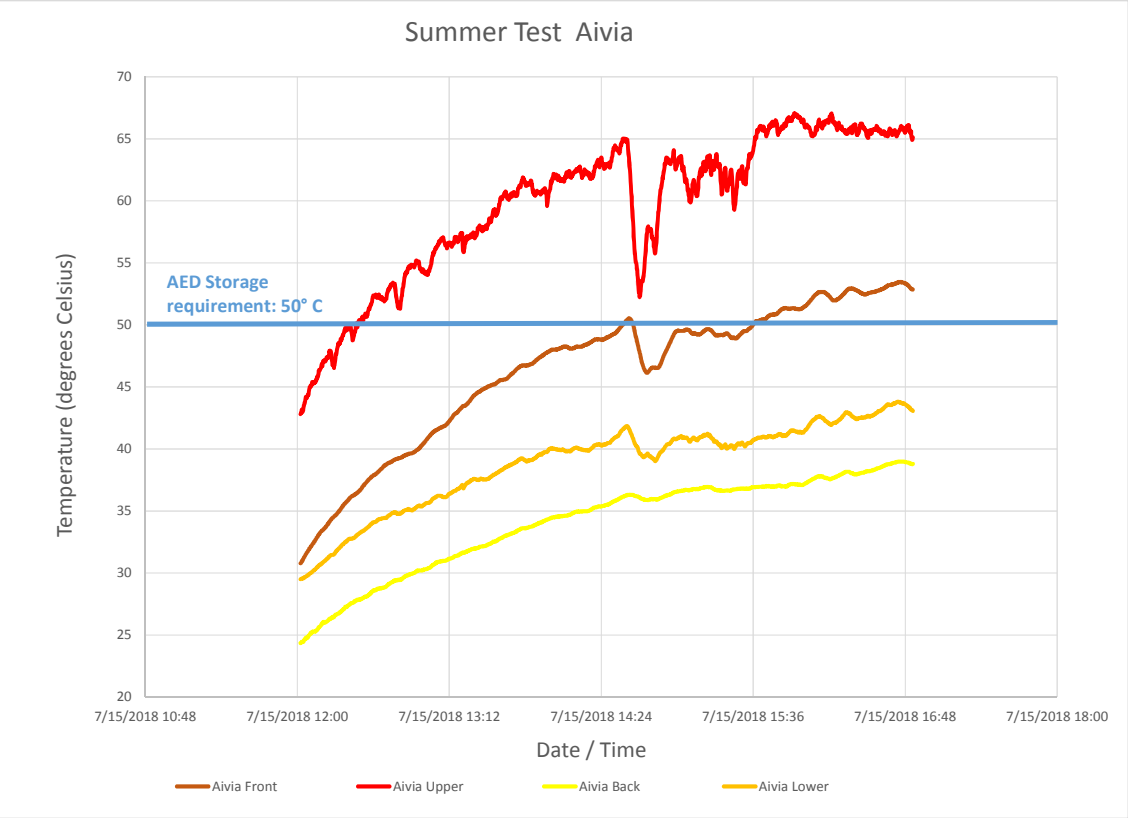

Figure 4-1: Temperature test results AIVIA.

Maximum temperature summary:

Probe nr	location	Max temperature (°C)	Time
1	In front of pads	53.5	16:46
2	Upper side of AED	67.1	16:13
3	Back of AED	39.0	16:44
4	Bottom of AED	43.8	16:44

Figure 4-1 shows the temperature test results for the SixCase SC1330 between 12:00 and 16:48 hrs on the 15th of July 2018, Zoeterwoude, Netherlands. Maximum temperature during the day is 27°C. Mostly sunny with some minor clouds between 14:30 and 15:30.

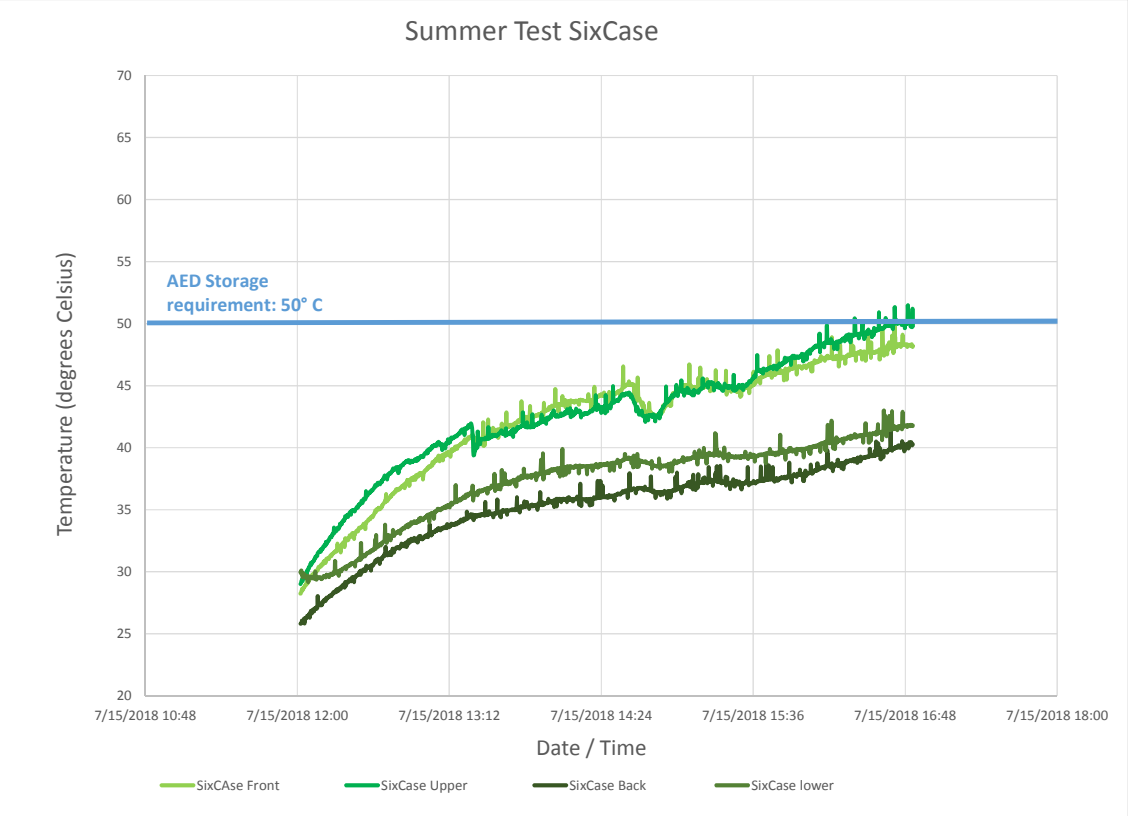

Figure 4-2: Temperature test results SixCase.

As can be seen from the graphs, there are local fluctuations in temperature (disturbances). This is most probably caused by the fact that the cabinet is made from metal (as opposed to the Aivia and the Rotaid cabinet). For the results below in the table, these disturbances are filtered out.

Maximum temperature summary:

Probe nr	location	Max temperature (°C)	Time
1	In front of pads	48.1	16:43
2	Upper side of AED	50.1	16:43
3	Back of AED	41.7	16:44
4	Bottom of AED	43.8	16:44

Figure 4-13 shows the temperature test results for the Rotaid Solid plus heat between 12:14 and 16:58 hrs on the 15th of July 2018, Zoeterwoude, Netherlands. Maximum temperature during the day is 27°C. Mostly sunny with some minor clouds between 14:30 and 15:30.

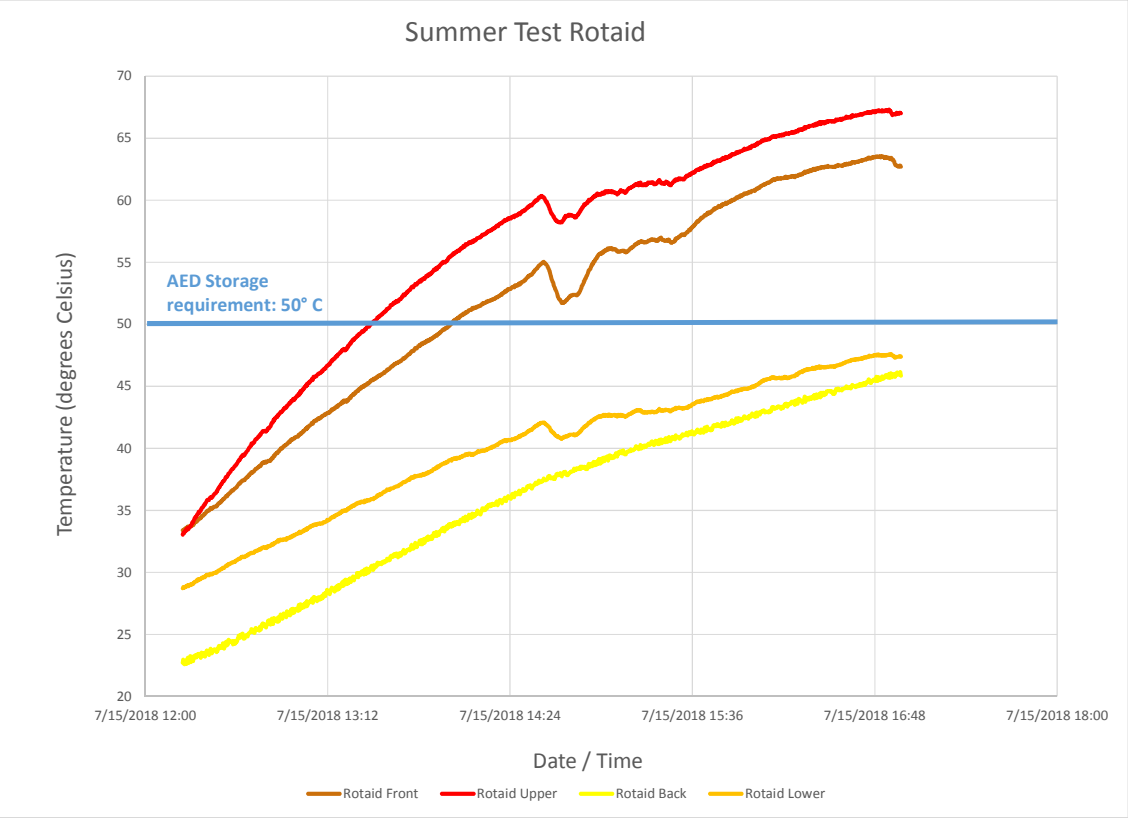

Figure 4-3: Temperature test results Rotaid.

Maximum temperature summary:

Probe nr	location	Max temperature (°C)	Time
1	In front of pads	63.5	16:49
2	Upper side of AED	67.3	16:49
3	Back of AED	46.2	16:57
4	Bottom of AED	47.6	16:48

Figure 4-1 shows the temperature test results for the SmartCase SC1230 between 12:14 and 16:58 hrs on the 15th of July 2018, Zoeterwoude, Netherlands. Maximum temperature during the day is 27°C. Mostly sunny with some minor clouds between 14:30 and 15:30.

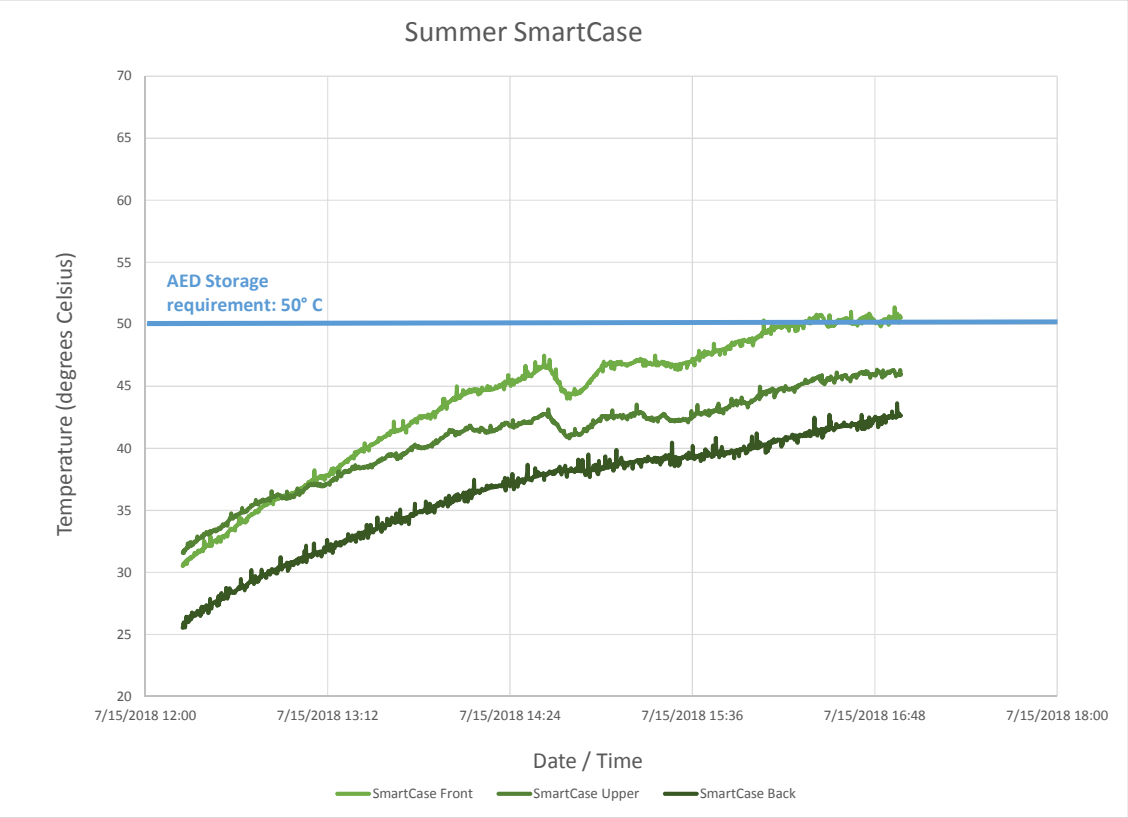

Figure 4-4: Temperature test results SmartCase.

As can be seen from the graphs, there are local fluctuations in temperature (disturbances). This is most probably caused by the fact that the cabinet is made from metal (as opposed to the Aivia and the Rotaid cabinet). For the results below in the table, these disturbances are filtered out.

Maximum temperature summary:

Probe nr	location	Max temperature (°C)	Time
1	In front of pads	50.6	16:54
2	Upper side of AED	46.2	16:54
3	Back of AED	42.6	16:58
4	Bottom of AED	Not measured	Not measured

4.2 Opening

All cabinets have been tested at the end of the test to see if there are any problems to open the cabinet.

All cabinets can be opened normally except the Rotaid Solid plus heat.

The Rotaid cannot be opened in a normal fashion under these summer conditions. Due to expansion of the different plastic components, the friction between the rotating parts is so high that with normal (hand) force the cabinet cannot be opened. It required 2 people to open the Rotaid cabinet after it was cooled down with water.

The other 3 cabinets do not rely on friction when opening or closing, so logically, this problem does not occur for the SixCase, Aivia and SmartCase cabinets.

See also the following videos on youtube from 3 different sources:

Test performed by Twente Hartsafe: https://www.youtube.com/watch?v=zJWA-PaDyTM

Test performed by BHVtotaal: https://www.youtube.com/watch?v=2oplROu5dvU

This test: https://youtu.be/oUg5zbe2Bqs

5 Conclusions Summer Test

Aivia 210:

- Temperature at 2 locations on the AED exceed the maximum allowed value of 50°C. On the top of the AED, the direct exposure of the AED to sunlight causes the temperature to rise to 67.1°C, exceeding the maximum with 17°C. The front of the AED just exceeds the limit (53.5°C.).
- There is no problem opening the cabinet under these summer conditions.

Conclusion: The Aivia cabinet should not be placed in direct sunlight to avoid overheating of the AED. Overall performance under summer conditions is mediocre (+/-)

SixCase SC1330:

- Temperatures at all locations on the AED stay within the maximum allowed value of 50°C.
- There is no problem opening the cabinet under these summer conditions.

Conclusion: The design measures (active cooling and IR blocking) to reduce temperatures inside the cabinet are effective. Overall performance under summer conditions is very good (++)

Rotaid Solid plus heat:

- Temperature at 2 locations on the AED exceed the maximum allowed value of 50°C. On the top of the AED, the temperature rises to 67.3°C, exceeding the maximum with 17°C. The front of the AED also exceeds the limit (63.5°C.).
- The cabinet cannot be opened in a normal way under these summer conditions.

Conclusion: The Rotaid cabinet should under no circumstance be placed in direct sunlight to avoid overheating of the AED and to avoid that the AED is no longer accessible because the cabinet can no longer be opened. Overall performance under summer conditions is very poor (--)

SmartCase 1230:

- Temperature at 1 location on the AED just exceeds the maximum allowed value of 50°C (by 1 degree). The other locations are well below the requirement.
- There is no problem opening the cabinet under these summer conditions.

Conclusion: The design measures (active cooling and IR blocking) to reduce temperatures inside the cabinet are effective. Overall performance under summer conditions is good (+)

A summary of the overall performance of the different cabinets is provided in the next table.

Tested AED Cabinet	Used AED (without bag)	Test circumstance	Max Temperature on AED	Overall Cabinet performance
AIVIA 210 	*ZOLL Plus* 	**Date: 15-07-2018 Outside Temperature: 27˚C Orientation: South-West**	**67˚C**	**+/-**
Rotaid SOLID PLUS HEAT 	*ZOLL Plus* 	**Date: 15-07-2018 Outside Temperature: 27˚C Orientation: South-West**	**67˚C**	**--**
SixCase 1330 	*ZOLL Plus* 	**Date: 15-07-2018 Outside Temperature: 27˚C Orientation: South-West**	**50˚C**	**++**
SmartCase 1230 	*ZOLL Plus* 	**Date: 15-07-2018 Outside Temperature: 27˚C Orientation: South-West**	**51˚C**	**+**