

## Hot Potato

I was a project engineer for a worldwide medical device company. The task I had was fairly simple and I had done similar tasks dozens of times; I was to get a new medical device through CSA certification. To make matters even easier, the only line voltage parts were the power switch, the input connector with fuse, a simple 12V DC world-wide-input medical grade power supply and the associated wiring—all of which came pre-approved.

Since the device had been pre-tested in our Swiss facility, I knew that everything was in pretty good order. So I gathered up some required samples and a pile of documentation. I marked up a translation of the Swiss/German instruction and service manuals, filled out the applications and took the whole thing to shipping.

Then I waited. Finally, my contact at CSA called me to say that the device had failed thermal testing quite seriously and would be returned. This had me puzzled since the Swiss engineers were certain that all the thermals were in perfect order. Furthermore they told me that they had used their super-special (and super-expensive) environmental test chamber. They assured me that the CSA test engineer had made some error.

Now, I had come to understand by that time that our Swiss engineers had great confidence in their abilities. These guys were good, but not perfect. CSA was good but not perfect, too. I awaited my box. My boss began to grumble about blown schedules on the new device. I had, after all used that term, “Piece of cake...”

The device arrived and I opened the cover. The CSA technician had nicely pointed out the over-temp problem with a sticky note. The 12V power supply had a load resistor right next to a filter capacitor. The load resistor got hot and overheated the electrolytic cap. Piece of cake...!

I told the Swiss engineers and they promised to get back to me. They had an identical device in their lab to test. They told me they had contacted the power supply manufacturer. The part carried CSA, TUV, ETL, UL and most other worldwide approvals, so I knew it would get their attention. Several weeks later I got a large stack of data on the component parts of the supply. There was a sticky tab pointing to a sheet labeled “Capacitor Temperature vs. Lifetime”. The graph showed that at the disallowed temperature the capacitor would still meet 50% of its design life. This, they said, made the temperature okay.

Even though I thought this was nutty, I dutifully sent the data to CSA. By this time everything was moving by FedEx overnight. My boss was poking his head in and mumbling something about “Piece of cake?” CSA laughed. “No way...” they said. I was having trouble sleeping.

Now, I knew a piece of silvered tape between the resistor and capacitor would have fixed the problem, but even this tiny redesign of the approved power supply was not in the

cards. To make matters worse, my suggestion to change the supply to some other were rebuffed. The Swiss engineers had retested the device and claimed the temps were fine.

How could the temperature be fine with that load resistor just 6 mm from the capacitor? Was the CSA thermocouple accidentally in contact with the resistor? CSA denied it. Would reorienting the supply fix the problem? I tested this hypothesis but found it was best as it was, the load resistor right near the air vents. How could the usually precise Swiss engineers have erred? This seemed to be the simplest of problems and yet I had no ready solution. The clock was ticking. I was getting calls from sales and marketing inquiring as to the health of the baby.

I remembered that in Physics, the measurement of temperature is the easiest thing to get wrong. It had cost Pons and Fleischmann their careers and me five-large in Palladium futures. I had to find some benchmark on which everyone could agree.

I decide to FedEx overnight my test mule device to Switzerland, inside of which I exceedingly-carefully taped the necessary thermocouple leading to my Omega digital thermometer, which showed quite clearly the over-temp failure, in agreement with CSA test results, too.

Next day, I called the Swiss engineer and discussed at length the thermal testing they had just completed. They agreed that my test mule clearly showed the over-temperature, but when they put the same unit into their fancy environmental test chamber, it passed just fine.

He told me that in order to make sure everything inside the chamber was at the same temperature the chamber had powerful internal mixing fans. The silence that followed could be heard clear across the Atlantic.

Piece of cake....

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