

DIY Zoning: Hot Summer of 2003

by Vadim Tkachenko

1. Introduction

Note:

The following article was written in mid-July 2003 and is now published without changes.

The summer of 2003 is so far the hottest summer of my life. Temperature in the shadow was reaching $+48\text{C}^{\circ}$ ($+118.4\text{F}^{\circ}$), in the sun it was up to $+64\text{C}^{\circ}$ ($+147.2\text{F}^{\circ}$). This gave me a possibility to watch the behavior of the whole complex in the extreme conditions, keeping in mind the fact that the air conditioner that I have is reaching the end of its useful life.

2. Upcoming Changes

I'm now selling the house, and if all goes well, the system will be shut down on or about August 18th. Good thing I've managed to collect almost two years worth of raw data - every single temperature reading since September 2001 is available for analysis.

Unfortunately, it'll take a while to set up the system in the new house - the HVAC setup is much more complicated. There are two HVAC units in the house itself, and the third in the workshop. Since the system was never tested with multi-unit setup, it'll take some thinking to figure out how the adjacent units will interact with each other.

There's another complicating factor - I think my significant other will strangle me in my sleep if I dare to staple the cables to the wall, like I did in this house ;) This means that I will have to get acquainted with the wireless technology (to get the sensors into the tough places like the middle of the two-story high vaulted ceiling), *and* learn how to properly do the wiring (because the servos will have to have the power source anyway).

On the other hand, the workshop is a perfect playground for the DZ: it has two natural zones already, and since I plan to be working at home anyway, the second wall will be built, thus making the third zone. The HVAC setup is relatively simple: unknown age Payne heat pump (I've seen some people spelling that brand name as Pain, guess there must be some truth to that, so I won't be hugely disappointed if I have to replace it someday soon). The unit is completely accessible, therefore the first thing to do will be to install all the necessary

sensors right away, and augment DZ with the HVAC return/supply temperature and pressure sensors logic.

3. Lessons Learned

While selling the house, I'd had a unique possibility to see how does the house behave when the system is inactive - according to the "common sense when selling the house", all the rooms had to be conditioned all the time. I didn't actually do it before, because at the time the sensors were installed, we were just manually shuffling the registers to get the temperature balanced.

Well, tell you what, I didn't like it at all.

3.1. Keeping Your Cool

Well, of course the A/C was struggling for its life (not even cycling), and it turned out that the only way to keep the house cool was to *set the thermostat to a lower temperature early in the morning* and allow the constantly working A/C to fight with the sun, keeping the precarious balance somewhere around the comfortable temperature.

3.2. Winter vs. Summer

This January my compressor was replaced (the old one just passed away silently after spending almost 30 years in service). I never liked the new one (it is extremely noisy), but the replacement had taught me another lesson: if you don't have a [TXV](#) enabled unit, make sure you check the charge when the ambient temperature changes.

The story goes like this: I noticed that the A/C is not cooling as good as it used to do before. Especially when I started to have the A/C running all day. Then, out of the blue, the compressor stopped one day, while the air handler was happily blowing increasingly hot air through the house. The most reasonable explanation I could come up with, with the help from my friends (you know who you are, thanks a lot), was that when the registers were completely open, the superheat was too high, and the compressor was starving, therefore overheating, and eventually the internal overload protection kicked in and shut it off.

Well, I did call my home warranty company, and the guy showed up, said "outside blower motor no good - too many amps", replaced the motor, and was gone. His explanation of the compressor shutting down was that the fan motor wasn't working properly, therefore the compressor wasn't being cooled enough, and therefore was overheating and shutting down.

Well, who am I to challenge the professional, and the compressor stopped overheating, but it's still not cooling enough. I'm through explaining to the HVAC guys how to do their job,

but I still think the charge that was put into the system without TXV when the ambient temperature was somewhere between 8 and 20C° (46F° and 68F°) is not right for the ambient temperature changing between 32C° and 48C° (90F° and 118F°).

In other words, *check the charge often.*

3.3. Ceiling Fans

Another lesson: ceiling fans don't always help to keep the house cool. One of the rooms in my house has a fan that, when switched on, makes the room uncoolable - temperature rises even with the register fully open. My guess is that the heat produced by the fan motor is overcoming the [illusionary] gain that may have been achieved by mixing the air within the room. So my guess would be that *the only reasonable time to use the ceiling fans is the winter*, when additional heat is welcome. Especially with high ceilings, when the warmer air floats up (and this may not be where you want it).

3.4. Bathroom Registers

Another thing you should pay a close attention to is your bathroom registers. The catch is that not only there are air supply registers in the bathrooms, but also "fart-fan" exhausts. As the static pressure in the supply duct rises, the exhausts leak the conditioned air outside - I don't really think you can control them in any reasonable manner.

The difference between the HVAC unit behavior may be as severe as normally cycling when the registers are closed, and never cycling after noon until the late night when the registers are open.

In other words, *keep your bathroom supply registers closed unless you're using the bathroom.*

3.5. Double Pane Windows? You Bet!

While the house was being completely conditioned, the temperature in the only room with double pane, low-E, tinted window was a good couple of centigrade lower than in other rooms. This room (master bedroom) is quite a bit bigger than others, and it was on the southern side of the house, moreover, it was upstairs, so it is not possible that the temperature was different because of other factors. Originally, all the windows (all single pane) were planned to be replaced, but it just so happened that we did one, and never got time or money to do the rest. Now, having the statistics, I would say that indeed, double pane windows are worth their weight in gold. In particular, the heat load calculation for the house that was done with [HVAC-Calc](#) indicated 3.5 ton, but when I did the calculation with the double pane

windows specified instead of single pane, it resulted in surprisingly low 2.5 ton. I was skeptical back then, but not now.

3.6. Losing Money or Saving Money?

I never really knew if I'm saving money or wasting money by using the DZ, but now I know (having taken a look at the last two months' electric bill) that *I was saving at least \$50 every month* (PS: 2300 ft2 tri-level, 4 zone controlled rooms out of 14, including the bathrooms).

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