FROM THE FIELD

The case of the missing voltage

BY DAN FOLEY CONTRIBUTING WRITER

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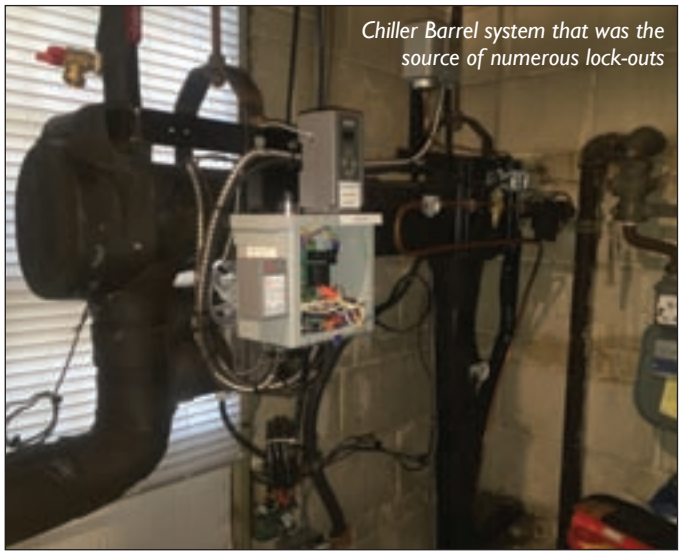
We do over one hundred installation jobs annually. These range from simple change-outs to 30,000-square foot Taj Mahals, and everything in between. The vast majority of these go in without a hitch. Sure, most require adjustments and balancing, but almost all our projects start and operate smoothly. Almost all.

Every once in a while, we run into a buzzsaw that we cannot figure out. These jobs test our limits and the patience of our clients.These are the jobs you remember years after they are done, and the problem is solved. I refer to the time and money spent on these jobs as "tuition." I consider myself a PhD, as I have run into many memorable problem jobs.

One of these was a replacement chiller system we did this past spring. It was in a large residential home in the Kalorama neighborhood of Washington, D.C. The 1930s vintage brick home was heated by a gas boiler and cooled by a chilled water system. The two-pipe convector system required seasonal manual change-over.The existing Carrier condenser was approaching 30 years of age, and the chiller barrel inside was installed in the 1950s.

The existing chilled water cooling system was still operational, but the owner wanted to be proactive and replace the system before the summer heat. He did not want to get stuck over the summer with a failed cooling system. We installed the new chiller system in early May using a 16 SEER Trane condenser tied to a new Standard Refrigeration chiller barrel kit (see photo #1). We have used this system at least a ½ dozen times, including one in the same neighborhood. I outlined this system in a previous column (Chiller Dilemma, PHC News August 2014). This set up has proven to be reliable and bulletproof, until this project.



Chiller Barrel system that was the source of numerous lock-outs

All was well during a mild May with no issues. The very first heatwave in June, the client called with no cooling. I dispatched a technician who arrived at 7am the next morning. The chiller controls had locked out sometime the previous afternoon or evening (see photo #2). My tech reset the control, and the system started right up and was cooling the house down quickly. He searched for the usual suspects: loose connections, low voltage wiring error, bad sensors, bad thermostats or aqua-stats, blown or shorted capacitors. After two hours, he could not find any issues and was on his way. Maybe it was a voltage spike or power blink that caused the control to lock out? Who knew? I did not want to tie up my technician, chasing a ghost on a very hot day, with calls stacking.

Chiller system control board

All was fine for another week or so until the next stretch of hot weather. The next time the mercury hit 90 F, the system locked out again. Again, I sent a tech

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immediately. The control was reset, and all was well again. This went on through June and July. At the end of July and into August, we hit a two-week stretch of 90+ degree weather with three days over 100 F. Altogether, the system had locked out eight times since it was installed. Three different techs were sent, and yet the problem remained. At one point I instructed my tech to reset the control and stay until it locked out again. Of course, it would not lock out while he was there. Six hours were wasted watching the chiller system work to perfection. I was frustrated, as was my client. Remember, he replaced a system that was functional and had served him well for many years.

Mark stuck with this chiller problem until it was solved. The key is to never quit or walk away from a problem job. It is easy to get frustrated and quit. The sign of a professional is how the problem jobs are resolved.

After a hot weekend during which the owner himself reset the control several times, my presence was requested at the job site. I knew my techs were much better than me at troubleshooting, so I went along for moral support and maybe to take the heat off of my lead tech, Mark Wilson, while he was trying to figure out the problem.

As I was driving to the site, I tried to clear my head and think this through. We have installed many of these chiller barrel systems, so I did not think it was a manufacturer problem. None of the previous installations gave us any problems. On previous visits, the control wiring was checked out, the refrigerant charge checked out, all components were checked and double checked. The thermostat was replaced. The problem remained unresolved.

One thing that stuck in my head was the timing of the failures. They always occurred on the hottest days or during stretches of very hot weather. I always responded quickly, usually early the next morning, after receiving a call the night before. The system was reset early morning when the weather was cool and there was little load, either cooling load in the home or electrical load on the grid.

This time, Mark and I were there in the midday heat with temperatures around 95 F. Mark questioned the use of a relay control to power the system. This was slightly different than previous installations. We used a Taco SR-501 relay control to provide 24 volts for the control circuit and to electrically isolate the chiller control circuit, the condensing unit contactor and the thermostat.

Mark asked if the 10VA transformer in the relay control was big enough to handle the electrical draw.

"But it is working?" I responded.

"No it is not!" the owner chimed in as he was watching over our shoulders.

I could not argue with that. He was right. It was not working.

Mark traced out the control circuit. The transformer had to power the electronic thermostat, aquastat, AC contactor, pump relay, chiller relay, solenoid valve and chiller control board. He then took out his multimeter and measured voltage at the transformer. With the system off, he measured 27VAC at the transformer. As soon as the chiller kicked on, voltage dropped to 22VAC. Now he was on to something.

During mild weather, the system ran fine. During hot weather, it would lock out. This neighborhood has very old electrical infrastructure. During peak demand, the electrical utility cannot maintain steady voltage. The voltage drop from the utility combined with an undersized transformer was the cause of the nuisance lock-outs. The main control board will lock out when the control voltage drops below a specified threshold. This would only happen on the hottest days of the cooling season.

Mark rewired the control circuit, replaced the existing 10VA transformer with a 50 VA transformer (see photo #3). Now the readings were 28 volts with the system off, 27.5 volts with the system on. Problem solved.

50VA transformer wired into the control circuit resolved the nuisance lock-outs.

The transformer was replaced over a week ago with no lock-outs since then. Mark stuck with this chiller problem until it was solved. The key is to never quit or walk away from a problem job. It is easy to get frustrated and quit. The sign of a professional is how the problem jobs are resolved. Mark was able to look at the entire job, isolate the problem area, identify the culprit and then come up with a solution. ●

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