Too old to work, too mean to die

Repairing the heat pump from heck

by Craig J. Barnett

One of the most interesting aspects of hvacr service is the variety of equipment and the types of problems encountered in the course of a typical business day. Few service calls are ever exactly alike, and some jobs that seem simple at first become more complicated as the work progresses. Occasionally, a job becomes a service technician's nightmare. Here is the story of one such job.

In late July 1991, a student informed me that a friend had a problem with the air conditioner in his Vine St. (Hollywood, Calif.) condominium. He asked if I would be interested in getting the unit back into proper operation. I asked the student to list all of the particulars regarding the machine.

The "air conditioner" was a Singer split-system heat pump with a plastic identification sticker that had faded completely. The only available data was stamped into the compressor nameplate — it was a four-ton machine. He also determined that the indoor blower was working properly.

My observations were in agreement with my student's. The customer noted that his system had not worked for the last three years. It had stopped operating when some roofing work was done.

I replaced the compressor with a Tecumseh AH5540E (specified by both a local wholesaler and Tecumseh for heat pump use). The replacement operation was a success; however, the unit took in an incredible amount of R-22 refrigerant before any significant cooling was noted — nearly 25 lb!

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On an 80°F outdoor ambient day, the pressures were 40 psig suction and 256 psig high side. The suction pressure would not rise with the addition of more refrigerant. If refrigerant was added, the head pressure climbed to above 300 psig. The heat pump showed a temperature split of 15° across the indoor coil and produced some comfort control for a few days.

I also switched the heat pump to the heating mode to check the action of the reversing valve and found that the unit either didn't change over, or the reversing valve stuck in mid-position. After consulting with the customer, we agreed that I should replace the reversing valve at some later time.

Not too cool

The customer called less than one week after the compressor changeout and complained that the unit was not cooling consistently. I verified his complaint, and this time I changed the reversing valve with an exact Ranco replacement.

All brazing was done with the reversing valve body coated in heat sink paste, plus it was wrapped with a wet rag. Dry nitrogen was allowed to flow through the refrigerant piping and torch flames were directed away from the valve body. Heating time was kept to a minimum.

The unit was charged with refrigerant, again in the cooling mode, and again the low-side pressure was around 35 psig and the high-side pressure was over 260 psig on an 80° outdoor ambient day. A 15° temperature difference across the indoor coil was again noted. The heat pump did, however, change from cooling to heating and back again without any problems.

I concluded that a blockage in the refrigerant piping system, possibly the metering devices, might have occurred due to unknown reasons.

The situation was discussed with the customer and it was agreed that replacement of all "pluggables" — the capillary tube metering devices and check valves — might take care of the refrigerant flow problem.

The four capillary tubes and the check valve in the outdoor coil section were replaced, along with four of the six capillary tubes and the check valve in the indoor unit. Neither of the strainer-driers were replaced because local vendors didn't carry them.

During the entire brazing process, low-pressure dry nitrogen was bled through the copper refrigerant lines and the check valve bodies were wrapped in wet rags. Also, a heat pump filter-drier was brazed into the liquid line at the outlet of the condenser.

The heat pump was recharged in the cooling mode (outdoor ambient temperature was 65°). After adding approximately 25 lb of refrigerant, the low-side pressure was 35 psig and the high-side pressure was 150 psig. The excessive high-side pressure problem was apparently remedied, but the low-side problem remained.

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I made nearly a dozen telephone calls before I located a former Singer service manager. He informed me that company policy had recommended a suction accumulator replacement whenever the compressor failed.

In a final attempt to solve the refrigerant flow problems of this machine, the liquid and suction lines were disconnected at the indoor coil. Compressed dry nitrogen was blown into the suction connection of the coil.

I saw particulate debris — stucco and plaster — behind a metering orifice at the liquid line inlet to the coil. The debris was cleaned out and the metering orifice, which should never have been there in the first place, was removed from the system. The heat pump was then charged with refrigerant (13 lb), energized in the cooling mode, and system performance monitored.

On an 85° outside ambient day, head pressure was 200 psig and suction pressure was 60 psig. Return air temperature was 84° and the supply air temperature was 63°. Although it was much too hot to test the heating mode, the customer informed me in November that the heat pump worked flawlessly in the heating mode. The nightmare was over.

Conclusions

I should have sold the customer a brand new system. (With all the replaced components, that's what he ended up with anyway.) Unfortunately, few of us carry a crystal ball in our tool bags. A new system would have been the easy, although expensive, way to resolve the initial malfunctions and eliminate debris in the system.

Instead, I chose to proceed in the standard step-by-step manner of asking questions and obtaining answers *before* making repairs. Most service problems are remedied quickly and fairly inexpensively this way. I was lucky to have a customer who was patient and appreciated a logical approach to problem solving. In most cases, a problem that requires five or six service calls to solve results either in litigation or an invitation to be adopted into the customer's family.

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