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Solving Excess Oil Problems

By Jack Sine
For *The News*

Everyone knows that excess oil in a chiller's refrigerant can create serious performance problems. But what many don't know is the frequency with which oil migrates to the refrigerant side and what percentage of chillers and refrigeration systems suffer from oil logging.

In recent years, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has been emphasizing that not only does oil entrained in the refrigerant of a chiller significantly degrade performance, but it is also a far more common problem than previously thought.

In ASHRAE research project 601-TRP, samples of refrigerant from 10 randomly selected operating chillers were analyzed for oil content. All of the chillers were found to contain varying amounts of excess oil. The three with the lowest amounts had been serviced and had their refrigerant recycled in the last six years, but the oil content in these three ranged from 3 percent to 7 percent. The oil content in the refrigerant of the remaining chillers was from 9 percent to more than 20 percent.

As can be seen in the chart shown in Figure 1, even a small amount of excess oil can have serious consequences.

How Oil Affects The Refrigerant Side

Oil circulating in refrigerant is first subjected to heat at the compressor, then cold in the evaporator. While circulating, it can come in contact with other contaminants, such as moisture, and form an acidic sludge that can do serious damage. The most common effect of oil, however, is to degrade chiller efficiency.

In the condenser it will coat the wall and parts, reducing the rate of heat exchange. It also reduces the capacity of the condenser by the amount of its own volume.

In the evaporator, the inner surfaces become coated with oil, which acts as an insulator, greatly reducing heat transfer. This results in high temperatures on the low side of the system. The reduction in capacity is also felt here.

Until recently, however, little has been done to identify and remove excess oil from chillers until it becomes a major problem. The reasons? First, aside from decreasing efficiency, oil by itself on the refrigerant side does no physical damage to the system and gives no immediate indication of its presence. Compared to moisture, which creates acids and leads to machine wear and catastrophic shutdowns, oil is a benevolent contaminant.

Second, it costs more to learn of its presence. Most mechanical contractors routinely perform oil analysis to detect moisture, acids, and metal fragments. But refrigerant analysis, which reveals the presence of oil, costs five times as much, so it is usually not performed. And, since oil usually accumulates gradually in refrigerant through migration, the attendant loss in efficiency is usually diagnosed to be some other cause. It isn't until performance has significantly degraded that oil is suspected.

So, the typical method of dealing with oil has been to wait until it becomes a serious problem, belatedly identify oil as the cause, and then decontaminate the refrigerant charge or pull it out and install a fresh one. Either way, this is a costly solution in both the ramped-up power demands for the chiller and the time and money spent in decontaminating or replacing the entire charge.

Identifying The Problem

Usually, the first thing that indicates oil in the refrigerant side is reduced efficiency — systems' running at longer cycles to produce the same result. By that time, there is usually a significant amount of oil in the refrigerant because the system degrades very gradually.

There are several items to look for to catch oil contamination early on:

- A noisy compressor indicates that oil is low because it has migrated to the refrigerant side. This causes wear and, hence, noise. Oil is also a sound deadener.
- Low oil level in the sight glass is key because the tendency is to simply add more oil. Low oil level is an early hint of oil migration.
- The thermostatic expansion valve (TXV) will have trouble controlling superheat. Because of reduced heat transfer, the TXV's remote transfer bulb will have difficulty sensing a true evaporator outlet temperature.
- Low compressor superheat is a direct result of the TXV running a low superheat.

A Permanent Solution To Oil Contamination

There have always been ways of dealing with oil contamination. Replacing the charge and reclaiming the old refrigerant used to be the standard. Then came portable decontamination services that could remove the oil and other contaminants on site. Some could even perform on line. The problem with these was twofold — first, they were expensive and, second, they were temporary fixes.

Fortunately, a new technology has recently been introduced that seems to address all facets of the oil. That's what Ron Summerhays, service foreman for Johnson Controls in Anchorage, Alaska, discovered.

"I had three chillers that I suspected of being contaminated with

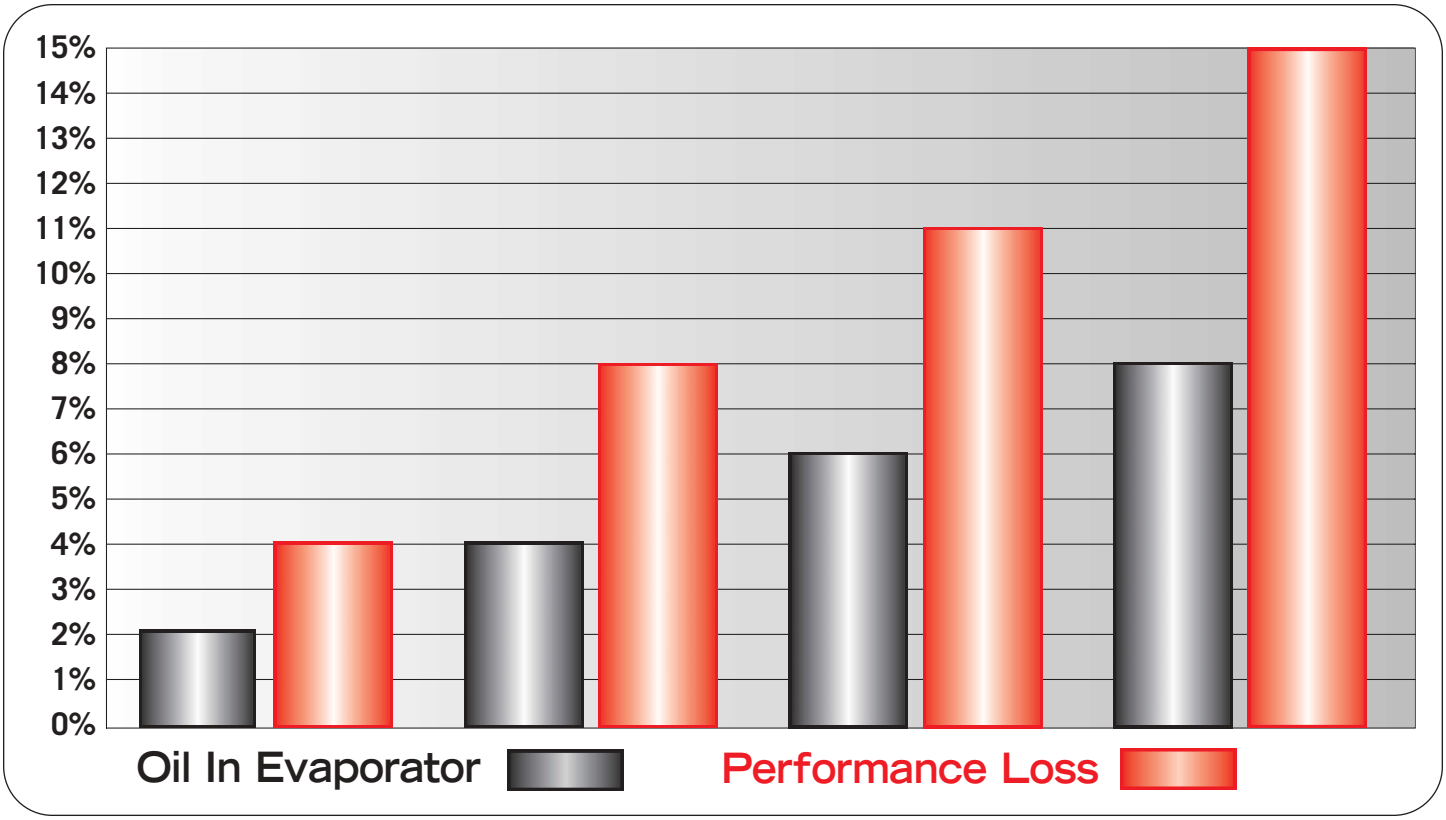

Figure 1. The relationship between oil in the evaporator and chiller performance loss.

The OAM Purger is installed on chillers and removes oil, acids, and moisture even when the chiller is idle.

oil," he said. "Two were in a BP office building and the other in the Frontier office tower. They all had been losing capacity over time. The No. 1 chiller in the BP building, a 275-ton unit, was running at 100 percent load on a 65-degree day, and we had to bring the second on line to maintain temperature."

Once Summerhays had verified that the trouble with all three was oil logging, he examined his options. He knew about on-site decontamination, but wanted a long-term solution.

"I'm on the newsletter list for Redi Controls and have done business with them in the past," he said. "About a year ago, they started talking about something they called the OAM Purger. It was a retrofit for removing oil, acid, and moisture from refrigerant and sounded like what I was looking for. I gave them a call. They explained how it worked and it sounded like good technology to me, so I ordered one."

The key to the OAM Purger is that it works around the clock, even when the chiller isn't operating.

"We designed it to remove excess oil from the refrigerant and then to maintain equilibrium so no oil logging occurs," said Mark Key, vice president of marketing at Redi Control.

"We also designed it to remove acid and moisture as well. That's a pretty good bonus. Most chillers lose oil into the refrigerant side, especially when operating at low load and/or low lift. With the OAM Purger operating 24/7, it is able to maintain equilibrium even during the worst conditions."

"I installed the Purger myself," said Summerhays. "It was an easy job and the folks at Redi Controls gave me all the help I needed. In no time at all, I had removed 30 gallons of oil from the chiller. That brought it to equilibrium, so I just directed any future oil back to the sump."

"Right now the system is running about 95 percent capacity. Then I installed another unit on the backup and recovered 10 gallons of oil from that one and brought it to equilibrium as well. It was pretty much the same at the Frontier building. That one has a 400-ton chiller, and we recovered a bunch of oil and it's running great. We regained almost full capacity on all three."

For more information on the Redi Controls OAM Purger, call 800-626-8640 and ask for Mark Key, or visit www.redicontrols.com. Author Jack Sine is a freelance writer specializing in the HVACR marketplace. He can be reached at 845-838-1466 or jack.sine@verizon.net. Ⓝ