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Purge System, Creativity Result in Cost Fix

By Jack Sine
For *The NEWS*

INDIANAPOLIS — Ever wonder how some of the case studies published in trade journals turn out a few years later? This article concerns one that appeared in the Jan. 19, 2004, issue of *The NEWS*. It covered chiller decontamination in the MSD Perry Township School District in Indiana.

The initial problem the contractor worked with back in 2003 was oil contamination. These days Choice Mechanical has been dealing with something much more severe: moisture contamination.

Of all the contaminants possible in the refrigerant side of a chiller, oil is the most common. Moisture is the most damaging. Over time, oil migrates from the compressor to the refrigerant side, especially during transitional times between seasons when chillers are operating at low loads.

Over the last several years, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has been emphasizing the importance of monitoring and removing oil that has become entrained in refrigerant. The society stressed that it is more common than many maintenance engineers and service contractors may believe. It does no catastrophic damage by itself; the problems accumulate gradually. The result is a costly loss of heat transfer over time, and a significant degradation of performance.

ASHRAE research project 601-TRP sampled refrigerant from 10 randomly selected chillers. All contained excess oil; three had recently had their refrigerant recycled. The oil content in the refrigerant of these three was 3-7 percent. The others had oil contamination ranging from 9-20-plus percent. Table 1 shows approximately how much chiller efficiency declines as excess oil builds.

Traditionally, little has been done to identify and remove excess oil from chillers until it becomes a major problem. Why?

1. Aside from decreasing efficiency, oil on the refrigerant side does no damage to the system and gives little indication of its presence. Compared to moisture (which creates acids and rust and leads to machine wear and catastrophic shutdowns), oil is a relatively benevolent contaminant.

2. It can cost more to learn of oil's 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. It usually isn't done unless performance has significantly degraded.

3. Since oil usually accumulates gradually in refrigerant through migration, the attendant loss in efficiency is usually di-



MSD Perry Township School District in Indianapolis had problems with oil and water in two separate instances. Contractor Choice Mechanical installed this Redi Controls purger to clean up a chiller after it experienced water-related damage.

agnosed to be some other cause.

HARMFUL CONTAMINANT

When moisture gets into a chiller's refrigerant, serious problems develop. Even in systems using a secondary cooling agent, moisture can infiltrate the refrigerant side in a variety of ways.

Moisture is considered the most dangerous contaminant because it can:

- Combine with lubricating oil in the compressor to form acids that attack the motor windings, leading to burnout.
- Remove copper ions from tubing and deposit them on hot surfaces, causing bearings to seize.
- Join with oil to form a sludge that blocks oil flow passages, pits polished surfaces, and restricts metering devices.
- Significantly reduce chiller efficiency.
- Form ice in expansion valves, capillary tubes, and evaporators.

DISTRICT FOLLOW-UP

The MSD Perry Township School District in Indianapolis had problems with both oil and water — in separate instances.

The first was in Mary Bryan Elementary School, where a 100-ton centrifugal chiller was performing so badly the school had to run the backup to supplement it. After the backup was online the school's service contractor, Choice Mechanical, decided to run a refrigerant analysis to try and identify the problem.

"We had tried oil analysis, which didn't show any problem," said Mike Hilterbrand, Choice's service manager. "The problem seemed to be reduced heat transference, so we cleaned the evaporator tubes during a routine maintenance, but that only provided a small improvement.

"We don't usually do refrigerant analysis because it's expensive for the customer and we get information on destructive contaminants like moisture, acid, and metal fragments through oil analysis," he said. "What it didn't give us was information on excess oil in the refrigerant, and that's what showed up."

Norm Chastain, assistant director of Facilities Engineering for the school district, asked Hilterbrand if there was a more economical method of decontaminating the charge, other than pulling it and reclaiming it.

"We had been doing business with a company named Redi Controls for a long time," Hilterbrand said. The company manufactures chiller purge systems and relief valves. "We thought they might have something for oil purging. Turns out they had recently unveiled the system that removes not only oil, but acid and moisture as well. We decided to give it a try."

Choice Mechanical technicians installed the OAM Purger™ system. "In two to three weeks we removed about 125 pounds of excess oil and restored the system to equilibrium," said Hilterbrand.

WHAT'S YOUR EFFICIENCY LOSS?

OIL IN EVAPORATOR

1-2%

3-4%

5-6%

7-8%

EFFICIENCY LOSS

2-4%

5-8%

9-11%

13-15%

Table 1. For every percent of excess oil in a chiller, some efficiency is lost in the chiller due to loss of heat transfer.

Independent test company Intertek ETL Semko (ITS) confirmed that between May 7 and June 20, the measured tonnage on the evaporator side of the chiller increased from 75.2 tons to 92.8 tons — a 19 percent increase in capacity. "It constantly removes the oil and returns it to the sump," Hilterbrand said.

MOISTURE DAMAGE

Excess oil was a minor problem compared to what happened recently in the same school district at Southport High School.

"The difference between this school and Mary Bryan Elementary is that we don't run the chiller through summer at the elementary school," said Hilterbrand. "At the high school we do. When we had a surprise oil pump failure on the No. 1 chiller during the summer, we went to put the backup into service and found we had a very serious water problem and couldn't use it. It had a 1,200-pound charge of R-11, and that meant a lot of rust.

"We got the main unit back online in a few days and turned our attention to the No. 2 unit. While we run it periodically to make sure it's sound and ready, a major leak must have occurred just after the last test run. The interior was a rusty mess. There was nothing for it but a complete rebuild.

"We pulled the charge and had it reclaimed and set to work replacing bearings, gears, seals — everything the moisture had damaged," Hilterbrand said. "But the chiller was still full of rust and moisture."

Choice Mechanical called two national companies that perform system flushes for moisture and rust, and received two almost identical quotes: approximately \$28,000 to clean out the interior of the chiller.

SAVINGS SOLUTION

"We were a little stunned," said Hilterbrand. "The work we had already done was going to cost our client \$50,000. This was just too much to hit them with.

"We tried to think if we could do it ourselves using desiccant core driers, but that would involve cutting into the evaporator. Since it's a low-pressure system, it would take a long time. Then I thought of the purgers we already had working on three other chillers in the district. They remove moisture and acid as well as oil.

"I got the idea to hook up four driers in series with the purger and circulate refrigerant first through the driers and then through the purger and back into the chiller."

The technicians from Choice Mechanical put their heads together with the engineers at Redi Controls and agreed that it seemed like a plausible solution. For the savings involved it was certainly worth a try.

"I offered my client the option, told him we were confident it would work, and laid the numbers in front of him. He decided to go for it. We installed the OAM Purger first, then attached the desiccant driers to the evaporator with the purger being the final filter. Any contaminants that got past the driers would be removed by the purger.

"We ran the chiller for several hours after everything was installed to verify that our rebuild work was effective, then shut it down and let the purger do its work," Hilterbrand said. "We figured that it could pull all 1,200 pounds of R-11 through in two days. The moisture and oil were collected in containers and disposed of.

"Six months later we performed a refrigerant analysis and found the R-11 had returned to ARI standards. Plus, we had saved our clients more than \$20,000. That purger will continue to remove contaminants for the life of the chiller."

SIMILAR RESULTS

Claude Baker, Ph.D., is a professor at Indiana University Southeast in New Albany, Ind. Among other duties, Dr. Baker is an energy consultant to the Floyd School District in New Albany. "I'm always looking for ways to save them money on energy



usage,” said Baker. “A colleague came to me and said I should look at a new oil purge unit for chillers. I went to the Redi Control Web page and was intrigued by the OAM Purger. I was also pleased to see they were a local company.

“I called and spoke with Dan Albertson, the president and co-inventor of the purger, and arranged a meeting. He showed me how the technology works and the concept im-

pressed me. This concept looked like it should work.”

Baker contacted administrators at the Floyd School District and set up a meeting with Facilities Director Bill Wisenhert and other key personnel.

“It definitely looked like solid technology,” said Wisenhert. “We decided to try it out. We had two fairly new chillers installed next to each other. They were identical 220-ton systems. We saw this as a great opportunity to do a real-life comparison. They run about an equal amount of time, so we decided to put the purger on only one of them and see how their performances compared.”

“The real test will come when school is back in session,” said Baker who, along with a team of students from Indiana State Southeast, are monitoring performance. “But we’ve been watching the numbers since May and the unit with the purger is clearly

outperforming the other system.”

“If the numbers continue to prove out,” Wisenhert concluded, “we’re going to be retrofitting a lot of these units.” ■

ABOUT THE AUTHOR...

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