Contracting Business

How to Eliminate the Worst Refrigerant Contaminants

BY MARK KEY & JACK SINE

Many chillers suffer from reduced efficiency caused by refrigerant contaminated with excess oil, water and/or acid, and air. In sufficient quantities, or simply over time, any of these contaminants can lead to catastrophic failure.

Oil: The Most Common Contaminant

A recent research project by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) sampled refrigerant from 10 randomly selected chillers. All contained excess oil even though three of them had recently had their refrigerant recycled. The oil content in the refrigerant of these three was 3% to 7%. The others had oil contamination ranging from 9% to more than 20%.

Figure 1 shows approximately how energy efficiency declines as excess oil builds.

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 on the refrigerant side does no damage to the system and gives little indication of its presence. Compared to moisture, which creates acids and leads to machine wear and catastrophic shut downs, oil is a "benevolent contaminant."

Second, it can be expensive to identify the presence of oil. Most service technicians routinely perform oil analysis to detect moisture, acids, and metal fragments. However, refrigerant analysis, which reveals the presence of oil, costs significantly more — so it's often not performed.

Finally, 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.

The typical way of dealing with oil has been to wait until it becomes a serious performance problem, belatedly identify oil as the cause, and then decontaminate the refrigerant charge, or install fresh refrigerant. Unfortunately, this is an expensive solution both in the ramped up power demands for the chiller and the cost of decontaminating or replacing the entire refrigerant charge.

FIGURE 1

Percent Oil in Evaporator	Efficiency Loss
1 to 2%	2 to 4%
3 to 4%	5.5 to 8%
5 to 6%	9.5 to 11%
7 to 8%	13.5 to 15%

Water: The Most Dangerous Contaminant

Moisture in the refrigerant side presents one of the most common and costly problems to a chiller. Moisture in refrigerant not only reduces chiller efficiency, it also creates serious damage in several different ways. If undetected, moisture can lead to significant downtime and repair expense.

When moisture gets into the refrigerant side of a chiller or refrigeration system it can do more damage than any other contaminant. It can:

- Form as ice in expansion valves, capillary tubes, and evaporators
- 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.

Any amount of water more than 50 ppm is potentially dangerous and should be removed.

Air: The Non-condensable Contaminant

Air is one of the most difficult contaminants to remove from a chiller or refrigeration system. If left in the refrigerant side, this non-condensable can cause excessive head pressure and increased operating temperatures. The result is higher utility costs, degradation of lubricant effectiveness, and premature compressor problems.

When a chiller operates with contaminated refrigerant, power use ramps up, chiller performance declines, and operating costs skyrocket. If not detected, catastrophic damage can result

Service Solutions

Fortunately, there are readily available solutions for the most problematical refrigerant contaminants. These solutions exist on two levels.

The first is high speed, emergency decontamination services. Several companies offer such services, and count OEMs and major independent service contractors among their clients.

These services feature a portable decontamination system that can be wheeled up to a chiller and decontaminate it onsite.

While the portable systems are excellent for emergency situations, they don't address the problem of ongoing contamination.

As a cost-effective permanent solution, consider equipping the chiller with a new, high-efficiency oil purger as well as a non-condensible purger.

The oil purger removes oil and acid; the non-condensible purger removes air.

Most chillers come with either an old-style low- or new-style high-efficiency non-condensable purger. Older, low-efficiency purgers can remove a significant amount of refrigerant along with the air (3 to 8 lbs. of refrigerant per pound of air emission). High efficiency purgers sacrifice speed for efficiency, but can run during chiller down time (unlike older units). New units also duty cycle and are more energy efficient than older ones, remove only an insignificant amount of refrigerant, and retrofit easily. Oil purgers are designed to return any excess oil that migrates to the refrigerant side to the chiller's oil sump.

New purgers may be just the ticket to consider on your next chiller service call, to protect customers' valuable chillers from the dangers of contaminants.

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For More Information

Several companies offer services for decontaminating refrigerant, including Hudson Technologies, Pearl River, NY, which has a patented decontamination system named the Zugibeast™. Visit *www.hudsontech.com*.

CFC Refimax of Marietta, GA offers a portable decontamination system they call the RPS that also removes air from the refrigerant side of chillers and refrigeration systems. Visit *www.refimax.com*.

For an example of a condensable or non-condensable purger, check out the OAM Purger from Redi Controls. Visit *www.redicontrols.com*.

Improved OAM-Purger is Easier to Install, Saves More Energy

The OAM-Purger from Redi-Controls, Greenwood, IN, is now easier to install, and provides improved energy savings over the previous model.

The unit is no longer liquid level sensitive, and three sight glasses have been added to observe operation and assist in determining liquid level in a chiller, while continuing to regain chiller capacity.

Redi Controls says the improvements will save users thousands of dollars per year in energy savings, by removing oil from refrigerant and returning it to the oil sump.

Redi Controls manufactures equipment for use with:

- industrial process cooling chillers
- commercial and industrial HVACR chillers
- cascade systems

New Non-Condensable Purgers from Redi Controls

The Redi-Purge line of non-condensable purgers for low-pressure refrigerant (R-11 and R-123) centrifugal chillers (ARI Certified and UL & UL Canada Listed) from Redi Controls is also available in an R-113 model, as well as models for high-pressure refrigerant (R-12, R-22, R-134A) applications (Model HPP-2 & HPP-3 series for commercial and heavy industrial installations). For more information, visit

www.RediControls.com or call 317/865-4130 — *Redi Controls*