Don’t get caught in a (condensate) trap of your own

by Jon Summers, The Trane Company

The past 10 years have seen a dramatic change in the design and function of air handlers, due in part to the challenges associated with indoor air quality. Moisture in HVAC systems is one area of concern, since if not properly managed, it can lead to the spread of mold organisms to the conditioned space.

Sloped drain pans and antibacterial surfaces and agents, coupled with regular preventive maintenance, can help prevent bacterial growth. But if the cooling coil condensate runs down the coil fins and drips into a condensate pan, while the water seal (the water level maintained in the trap) prevents the flow of ambient air into or out of the air handler.

Several problems result from improperly trapped systems, some of which can severely impact indoor air quality. These problems generally center around negative-pressure systems, since trap failure in a positive pressure environment simply results in air being exhausted through the drain line.

Under normal conditions, condensate runs down the coil fins and drips into a condensate pan. In situations where no trap is installed, the unit is functioning without a seal, and negative pressure causes air to flow through the drain line. This incoming airstream has sufficient velocity to launch the water droplets forming at the base of the coil into the air, with an action reminiscent of a percolating coffee pot.

Air flowing through the coil can then spray condensate into the fan intake, which can propel the moisture into other parts of the system. The resultant aerosol mist can be carried through the ducts and into the conditioned space, possibly causing bacterial growth and transmission.

Another problem with air inflow is the source of that air. Drain lines typically flow into waste or sewage lines, giving the potential to introduce methane and other biocorrosion products from the drain system into the airstream.

Trapping pitfalls

Without a trap (Figure 1), static pressure within the air handler lenses usually associated with incoming air — even though the trap is designed and functioning properly. Each drain pan should be individually trapped to avoid this situation.

In rare cases, a drain line that is not properly supported will sag, forming an “air lock” that results in water backing up into the system.

There seems to be a misconception that “a good, deep trap” is a cure-all for most trapping situations. Unfortunately, visual estimates and arbitrary trap heights often result in trap failure. The dynamics of “blow-through,” or positive-pressure systems, and “draw-through,” or negative-pressure traps rises until there is a constant outflow.

Improper trap design accounts for some condensate drainage system failures, but certainly not all. Incorrect use and maintenance of condensate drain traps can also cause problems. The combination of airborne particles and moisture in the air handler often results in algae formation in the drain pan and trap.

Sloped drain pans help eliminate this problem in the pan, but the trap must be cleaned regularly to avoid blockage that can slow or stop water flow, resulting in backup into the system. Due to this inherent maintenance concern, many traps are equipped with clean-out openings.

The common problem is that these drain “clean-outs” are left open to facilitate easier access in the future. When open, untreated air can flow directly into the system, causing the same problems as no trap at all. In some cases, the remedy to a plugged trap or drain line has been to simply remove the trap, evacuating condensate water from the hvac system without allowing the inflow of ambient air. Proper trap design, system start-up procedures, and maintenance (debris removal, water level check, etc.), will result in a functional and worry-free trap. A good place to start is to carefully follow the equipment manufacturer’s trapping instructions.

The few simple measures discussed here can prevent a wide array of serious problems, such as property damage, health concerns, and even litigation. By understating the importance of proper condensate trapping, you might end up in a trap of your own!

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FIGURE 1: No trap on system. Water is carried over to ductwork, admitting contaminated air, leading to bacterial growth and possible water backup.

FIGURE 2: Seal destroyed at startup from a too-short trap outlet; same consequences as Figure 1.

FIGURE 3: Too-tall trap outlet leads to improper drainage, water backup, unit damage, and bacterial growth.


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