

**Technical Bulletin OPP-TB-23 21 13.100**

**Cooling Coil Condensate Drains**

**Proper Trapping**

**Background**

Incorrect condensate piping can create several unwanted operational issues ranging from carryover, and ponding, to overflow and non-flow conditions. The attached bulletin addresses most major condensate issues, the appropriate solution.

**Diagnosis/ Correction:**



Machine generated alternative text: Resu Its:
Consequences: Water curr-eser to ductwork
Admission of potentially contaminated air
Bacterial growth
Potential water back-up and unit damage
¡n situations where no trap is installed, the unit is functioning without a seal and negative
pressure causes air inflow 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 biocontaminants from the drain
system into the airstrearn. Without a trap. static pressure within the air handler can also
prevent proper drainage, causing water overliow. air handler flooding and possible
property damage.
Problem: No trap on s stem
No seal, air inflow, improper drainage

Machine generated alternative text: ReuIts:
Seal desroycd at start-up. air inflow, improper drainage
Consequences:
Waler carr>-oer to ductwork
Admission of potentially contaminated air
Bacterial growth
Potential water back-up and unit damage
Improper trapping leads to several problems. If the trap outlet is too short (Figure IB).
the negative pressure created at system start-up will pull water from the trap into the air
handler. The seal” is destroyed. producing the sanie effect as an untrapped system.
r3..!!!&w
—J
Problem: trap outlet is too short

Machine generated alternative text: Trap outlet is too tall
Improper drainage
Water bacL.up and wilt damage
l3acterial grni1h
¡f the trap outlet is too tall (Figure ¡C). negative pressure will prevent drainage, causing
the condensate to hack up into the system resulting n property and equipment damage.
Problem:
Results:
Consequences:
Problem:
Results:
Drain pans “ganged” together on single trap
Air inflow through drain line, seal bypassed. improper drainage
Water carry-over to ductwork
Admission olpotentially contaminated air
Consequences:

Machine generated alternative text: llactcrial growth
Potential water hack-up and unit damage
Sometimes two or more drain pans (from the same unit or separate units) are connected
to a single trap. lithe fans are operating at different static pressures (or if one fan has
cycled oíl), the unit operating under greatest negative pressure will draw air through the
drain line of the other unit. This air completely bypasses the trap (Figure ID) and can
cause all of the problems 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.
Results: Improper drainage
Consequences: Wager back-up and unit damage
Batcrial growth
In rare cases, a drain line that is flot supported properly will sag, forming an “air lock”
that results in water backing up into the system (Figure 1 E).
Proper Trapping
There seems to be a misconception that “a good. deep trap” is a cure-all for most trapping
situations. Uiitòrtunatelv. visual estimates and arbitrary trap heights often result in trap
failure. The dynamics of’blow-through.’ or positive pressure, and ‘draw-through.’ or
negative pressure, systems result in slightly different trapping solutions Rut the
fundamentals are the same.
Problem: “Air lock” in drain line

Machine generated alternative text: ¡n a positive pressure situation, the fan is forcing air through the cooling coil, with the
condensate pan on the other side. The trap must he of sufficient height to account for the
static pressure in the unit under normal operating conditions.
H = 112W pIus maximum
total static pressure
Figure 2 shows the relevant dimensions for a properly constructed positive pressure trap.
In a ‘draw-through’ system, the fan is pulling air through the cooling coil. Since the
condensate drain pan is on the fan side, there is a negative pressure at (lie drain relative to
outside the unit. I lere, too, the trap height must account tor static pressure: but in the
reverse direction. Worst-case static pressure conditions, like those caused by a dirty filter,
must be used to calculate the correct trapping height. If the trap isn’t tall enough, the
water seal won’t hold and air will be dran through the drain pipe into the system. If too
tall, water will back up ¡lito the system as discussed above. As condensate forms during
normal operation. the water level in the trap rises until there is a constant outÍlow.
2C - Normal Operation
K = min. 112”

Machine generated alternative text: 3C . Mo’maI Operation
H=(1foreach 1” of
maximum negative
static pressure) + 10
J= half of H
L= H + J + Pipe Diameter + Insulation
Figure 3 illustrates the appropriate dimensions for trapping a negative pressure system.
Maintenance Issues:
Improper trap design accounts for some condensate drainage system failures, hut
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.
J

Machine generated alternative text: Due to this inherent maintenance concern, many traps are equipped with clean-out
openings as indicated in Figure 4. One common problem is that these drain “clean-outs”
are lefl open to facilitate easier access in the future. When open, untreated air can tiow
directly into the system causing the saine 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 entirely, apparently to relieve the need for future maintenance. It’s also common tiir
the water seal to evaporate during the noncooling season. It may he necessary to
manually fill the trap at system start-up, or to run the unit for sufficient time to build up
condensate and then turn it off at which point the trap will 1111 on its own.
Condensate drain traps are the accepted industry standard for 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
tòllow the equipment manufacturer’s trapping instructions. The few simple measures
discussed above can prevent a vide array’ of serious problems such as property damage.
health concerns and even litigation. Ay underestimating the importance of proper
condensate trapping, you might end up in a trap of your own!
CIean-oL
1.11 op.ri

*Publisher:* Penn State University, Office of Physical Plant, Energy and Engineering Division, Engineering Services

*Editor:* Stephen Oskin, Continuous Commissioning Engineer, Ph: (814) 867-4715, email: [seo110@psu.edu](mailto:seo110@psu.edu)

*Document Credits:* American Standard Corporation; source: <http://0323c7c.netsolhost.com/docs/Trane_-_Trapping_Design_Flaws%5B1%5D.pdf>

*Last Revision:* August 21, 2013