Mercy Medical Center
Canton, Ohio

HUMIDIFIER CASE STUDY

DRISTEEM®

Mercy Medical Center is a 476-bed hospital serving several counties in northeastern Ohio.

Unsuitable substitutions: Learning the hard way about absorption

This is a story about product substitutions, and the problems caused by two humidifiers that saturated a filter bank and left water on an AHU floor. Read on to learn how you can avoid a similar costly — and frustrating — scenario.

The story begins

Managers at Mercy Medical Center, a regional medical center in Ohio, were planning to refurbish an air handling unit. The design engineering firm, LRM Engineers in Akron, specified replacing many of the AHU components, including the humidifier.

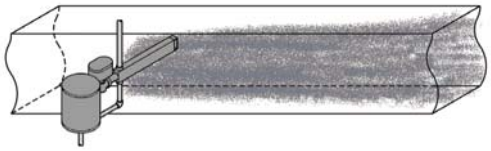
There was 5 psi steam available on site, and so for humidification the engineer chose a steam dispersion panel to disperse boiler steam directly into the airstream. This type of humidifier is called "steam injection" and, depending on the load and absorption requirements, includes a dispersion tube or set of tubes. Several manufacturers make this type of product, as it can be a fairly straightforward and economical way to provide humidity.

The distance from a steam injection dispersion tube(s) to the point of absorption varies greatly among products and manufacturers, with short absorption (non-wetting) distances the most difficult to achieve. If there is plenty of room in a duct or AHU for absorption to occur, a humidifier that requires a long non-wetting distance may be adequate. But in a duct or AHU with elbows, fans or filters downstream of the humidifier, it is absolutely essential that absorption occurs before steam hits those objects or it will condense and cause dripping, which can cause microbial growth resulting in foul smelling, unhealthy air. In addition, if humidification steam is not absorbed, desired conditions will not be met.

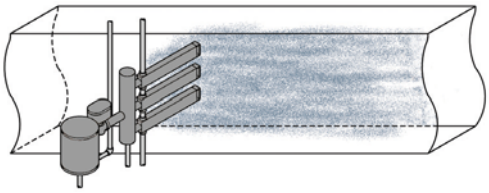
At Mercy, the new humidifier was to be installed about four feet upstream of a filter bank within an AHU, and so absorption had to occur completely before the filters to ensure nonwetting. The

Steam absorption comparison

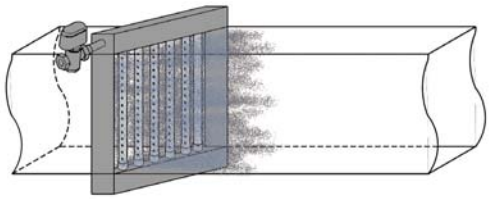
The drawings below show how increasing the number of steam discharge points shortens the non-wetting distance.



Single-tube humidifier
Of the three examples shown here, the single-tube humidifier will have the longest non-wetting distance. In addition to the number of steam discharge points, non-wetting distance is determined by entering and leaving RH, load, airflow and duct temperature.



Multiple-tube humidifier
With the same conditions, absorption will occur in a shorter distance with a multiple-tube humidifier because it has more steam discharge points.



Multiple-tube dispersion panel (Ultra-sorb)
With the same conditions, this humidifier will provide the shortest non-wetting distance. The humidifier not only has multiple tubes, it has two rows of discharge points on each tube, and also has an additional header for managing condensate.

engineer understood this and specified DRI-STEEM's Ultra-sorb® humidifier panel, a multiple-tube assembly with separate steam supply and condensate headers. He sized this panel to span the width and height of the available airflow in the AHU to maximize air/steam mixing. He also wrote a performance specification that stated the humidifier must provide absorption to preclude water accumulation on any surfaces within 15 inches downstream of the humidifier.

And then what happened?

First, a non-DRI-STEEM single-tube humidifier, bought as part of a package, was installed and started up. It proceeded to completely saturate the filter bank. On-site staff quickly removed the filters and noted that steam was absorbing several feet downstream of the filter bank location.

A second humidifier – this time, a multiple-tube assembly provided by the same manufacturer to replace the first humidifier – was installed. When started up, it absorbed a bit better than the first humidifier, but it still fully saturated the filters, causing dripping. Again, staff promptly removed the filters and noted that the non-wetting distance was two feet past the filter bank – much more than the required 15 inches from discharge.

Finally, the originally specified DRI-STEEM Ultra-sorb panel was installed, started up, and provided full absorption within 12 inches, actually improving on the engineer's specification of 15 inches.

Factors that affect absorption

In the construction world, product substitutions are made all the time, and often the substituted product works as well as the specified product. To make a successful humidifier substitution, however, requires an understanding of some often-misunderstood absorption basics. Absorption is affected primarily by three things:

1. **Duct or AHU temperature.** Cool air absorbs less than warm air and will require a longer non-wetting distance.
2. **The difference between entering and leaving RH.** The more humidity that needs to be dispersed into the airstream, the longer the non-wetting distance.
3. **Mixing of air and steam.** Uneven airflow, non-uniform mixing of steam with air, and the number of steam discharge points in the airstream will affect non-wetting distance. How steam and air mix to affect absorption is often misunderstood, and so it is not surprising that it was a misunderstanding of this principle that caused the selection of an inadequate substitution.

Why was the Ultra-sorb just right?

The first humidifier installed was a single tube (not made by DRI-STEEM). There is no single-tube humidifier on the market that could have met the absorption requirements of this job.

The second humidifier installed (another not made by DRI-STEEM) was a multiple-tube humidifier installed to cover about one-third

of the available airflow. Even if this humidifier had covered the full airflow, it would not have been able to provide absorption before the filter bank because each tube had only one row of steam discharge points.

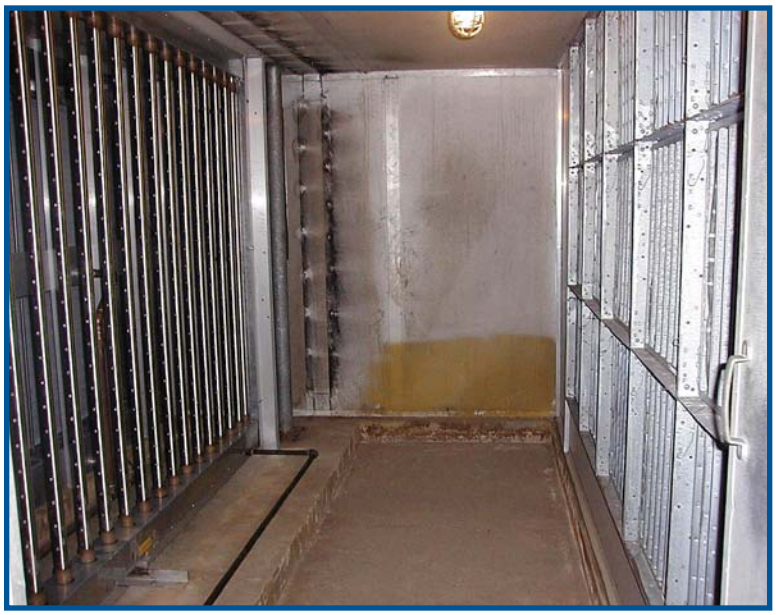
The third installed humidifier easily met the specification of absorption within 15 inches for many reasons. First, the Ultra-sorb has two rows of steam orifices on each tube, allowing superior mixing. Second, the panel was sized to span the height and width of the available airflow, optimizing mixing. And third, the Ultra-sorb has a second header designed for managing condensate, so discharged steam is always dry, with no entrained condensate.

Why did this happen?

Why are product substitutions made? Usually because another product is available at a lower up-front cost, or, as in this case, was available as part of a package. We're confident that if all parties involved had a better understanding of the often misunderstood complexities of absorption, none of this would have happened.

The moral of the story

When making a product substitution, consider not just the price or convenience of the substitution, but the long-term value as well. As the saying goes, "The bitterness of poor quality remains long after the sweetness of low price."



AHU at Mercy Hospital showing the Ultra-sorb dispersion panel installed on the left and the filter bank on the right, four feet downstream.

Lessons learned

1. **Find a representative you can trust.** Most engineers don't design humidification systems nearly as often as they design heating systems, and so they are not as familiar with humidification system design. And given the complexities of providing proper humidification, it is important to work with a manufacturer's representative who really understands humidification. This is especially important with critical applications, where either short non-wetting distances or accurate control are required.
2. **Write a performance specification.** Because the design engineer wrote a performance specification, the contractor was required to meet that specification, regardless of how many times he tried a substitution. Anticipate substitutions and cover yourself with a performance specification.
3. **Consider the reputation of the manufacturer.** The manufacturer of the first two humidifiers did not stand behind their product, at great cost in time and money to the contractor and engineer.
4. **Insist on published non-wetting distances.** Only the last installed humidifier had a non-wetting distance guarantee with absorption data published in a printed catalog. One way the engineer might have improved his specification would have been to add a note to the "acceptable manufacturers" section stating, "The manufacturer must provide published data guaranteeing the required non-wetting distance." Don't settle for a note on the product order guaranteeing absorption. Insist on data printed in a catalog or published on a web site.
5. **Improve mixing action to reduce non-wetting distance.** Add tubes, or add tubes that have double rows of steam orifices, to increase the amount of steam mixing with available airflow. To ensure absorption upstream of a filter bank, install a fan or heating coil downstream of steam discharge to improve air and steam mixing action. And size dispersion assemblies to span the full height and width of the available airflow to maximize air/steam mixing.
6. **Manage condensate.** Some condensation is inevitable in steam dispersion, but condensate can be controlled and directed away from where it will cause problems. A double-header multiple-tube dispersion panel uses gravity to remove condensate. Steam enters the top header, escapes through the steam orifices, and condensate drains out the bottom header. Many large-capacity steam injection systems will have strategically-placed steam traps to ensure that only the hottest, driest steam is discharged into the airstream.

Ultra-sorb steam dispersion panel

Ultra-sorb panel with High-efficiency tubes

The superior Ultra-sorb takes steam absorption to a new level

Highest capacity, shortest non-wetting distance. With the High-efficiency Tube option for new installations or as a retrofit for existing installations.

The Ultra-sorb steam dispersion panel established industry standards for meeting short absorption requirements. Ultra-sorb performs to guaranteed non-wetting distances and can be installed within inches of downstream devices without condensation worries. It can be factory assembled for easy installation or shipped unassembled.

- Works with any steam pressure. From just ounces of steam pressure to boiler pressures. Steam capacity up to 4000 lbs/hr (1815 kg/h).
- No unnecessary heat gain. Because the tubes operate drip-free without steam jackets, no extra heat is added to the airstream when the humidifier is idle.
- Two rows of tubelets on each tube, perpendicular to airflow. Just another way to ensure complete absorption.
- Guaranteed and published absorption data. Years of testing and thousands of successful installations back up our absolute guarantee. If we say it will work, it will work!
- Requires less than 1 psi of pressure to disperse steam
- Models available from 12” x 12” up to 144” x 144” (305 x 305 mm to 3658 x 3658) for horizontal or vertical airflow.
- Available with High-efficiency dispersion tubes

Your DRI-STEEM representative is:

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