Armstrong®

EVAPACK VS. HIGH PRESSURE ATOMIZATION

WHITE PAPER

Contents

Introduction

The Armstrong Evapack is an evaporative media adiabatic humidification system. Both high pressure humidification and evaporative media use the same psychrometric process to humidify and cool the air at the same time. Figure 1 shows the adiabatic humidification process plotted on the psychrometric chart.

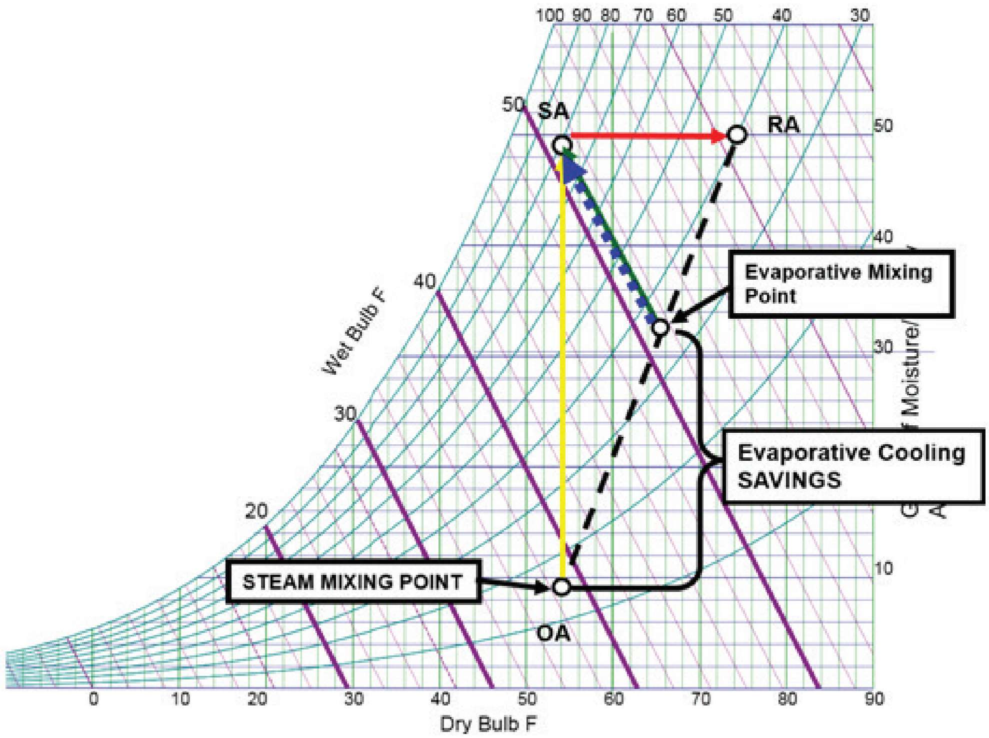

Figure 1: Adiabatic Humidification Process

While both high pressure and evaporative humidification use the same psychometric process to humidify, each system uses different methods to achieve this. High pressure atomization uses a high pressure water pump to force ultrapure water through a small orifice to atomize water into the airstream. Evaporative media such as the Evapack, saturates a corrugated media and as air passes through it becomes cool and moist.

Many applications can benefit from the evaporative cooling bonus adiabatic humidification offers. Applications with high heat loads such as data centers, public venues, and large manufacturing facilities can save on cooling costs when compared to isothermal humidifiers. It is worth noting that currently evaporative media is not acceptable for health care per ASHRAE 170. While all adiabatic humidifiers achieve the same goal, not every humidifier is the same. This article will compare the Evapack evaporative humidifier to more commonly seen high pressure atomization humidifiers.

Maintenance

The Evapack will have no pump or manifold with nozzles which will significantly reduce the maintenance and repairs required on the system. In plunger pumps, oil changes and seals will need to be constantly maintained in order for the system to function properly. Also, manifolds for high pressure systems will need routine nozzle and o-ring maintenance to keep the system running as expected. Since the Evapack does not require a pump or manifold in direct water applications, this maintenance will not be required. The Evapack media is also mechanically held together and not glued together. This allows for the use of ultrapure water sources such as DI or RO water to be used for humidification. Using an ultrapure water source will improve the pad life and theoretically will eliminate the need to routinely clean the media.

Lastly, high pressure atomization requires the use of ultrapure water to avoid clogging the nozzles. Not all applications will have ultrapure water available for humidification. The Evapack can also use tap water to humidify. To avoid scale buildup on the media in this case, the pad will continuously be oversaturated to flush mineral deposits out so they can be drained.

Controllability

Controllability is another important consideration when comparing an evaporative humidifier to high pressure. Due to the nature of high pressure atomization, turndown is limited to staged solenoid control. When using DI or RO water with the Evapack, and ECV control valve is used to fully modulate water to the media. Using a truly modulating valve allows the media to have just enough water to satisfy the humidification demand increasing relative humidity accuracy up to 1.4%.

Absorption Distance

In high pressure systems, water is sprayed into the airflow. In evaporative media, moisture is naturally absorbed into the air as it passes through the media. When water is sprayed into an airflow, it will require a certain distance for all the water sprayed to be fully absorbed. This distance requirement will commonly be anywhere from 4' up to 10'. In evaporative, since water is absorbed as it passes through the media, the absorption distance will be 0". This means the entire length of duct run or air handler length required for the Evapack will always be the length of the assembly which is always 24". Figure 2 illustrates this difference.

Air velocity will also have an effect on absorption distance. High pressure atomization will commonly require an air velocity in the range of 250 – 600 FPM. The Evapack will need a velocity between 0 and 984 FPM offering greater application velocity flexibility.

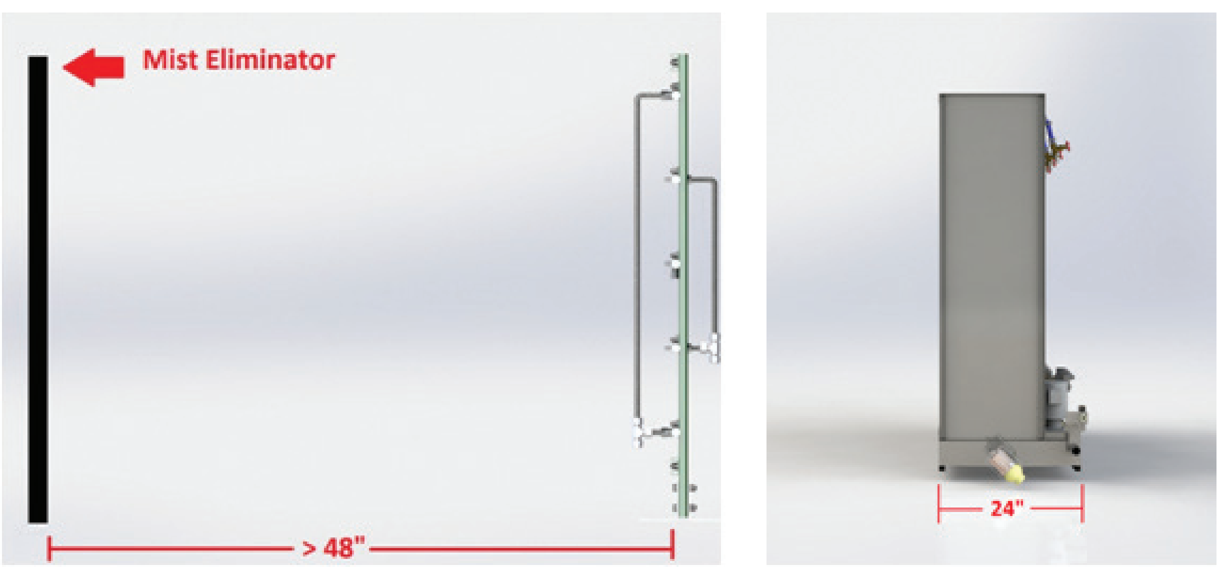

Figure 2: High pressure (Left) vs. Evaporative (Right) Absorption

Water Efficiency

When it comes to water usage, Evapack will be an overall more efficient humidification system compared to a high pressure system. Using a mist eliminator will decrease the efficiency in the case of a high pressure system. Typically the water in to air efficiency is 60-75% when a mist eliminator is placed 48” downstream of the dispersion manifold. An example of the actual water usage compared to the absorption distance for Pressure Fog can be found in Figure 3. For evaporative media, the air will pick up as much moisture it can from the media as it passes through it. The more media surface area in contact with the airstream, the more moisture the air will be able to pick up as shown in Figure 4. A direct water fed Evapack paired with an ECV valve in theory can achieve up to 97% water to air efficiency, cutting down RO or DI water waste significantly.

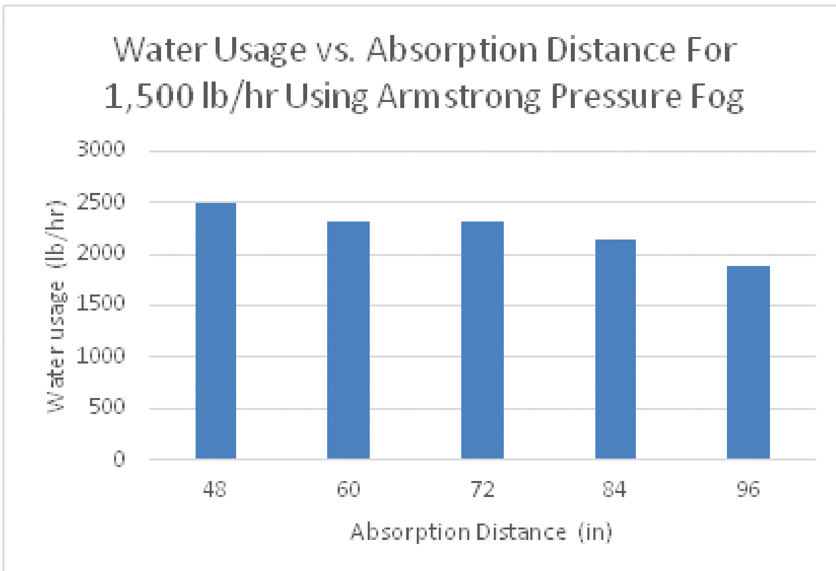

Figure 3: Pressure Fog Water Usage vs. Absorption Distance

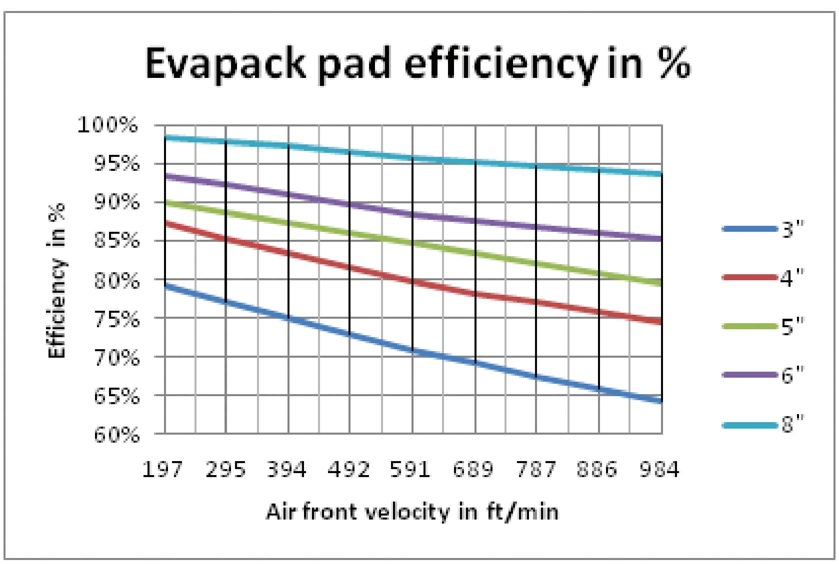

Figure 4: Evapack Pad Efficiency by Pad Thickness

Pressure Drop

The mist eliminator will cause in some cases a large pressure drop that will need to be accounted for. In addition to compensating for the energy loss from the pressure drop, high pressure systems will need energy for the electric pump. The Evapack on the other hand will only have the loss associated with its pressure drop which can be found in Figure 5. What makes the Evapack pressure drop lower is the 30°/30° flute angle the media uses. When compared to other media using a 45°/15° or 45°/45° flute angle, the 30°/30° flute angle offers superior performance with less of a pressure drop. Evapack applications over 500 FPM will require a droplet separator installed immediately after the media. A graph showing the droplet separator pressure drop can be found in Figure 6. Compared to high pressure atomization systems with mist eliminators, it has been found that the Evapack plus droplet separator is on par or even less.

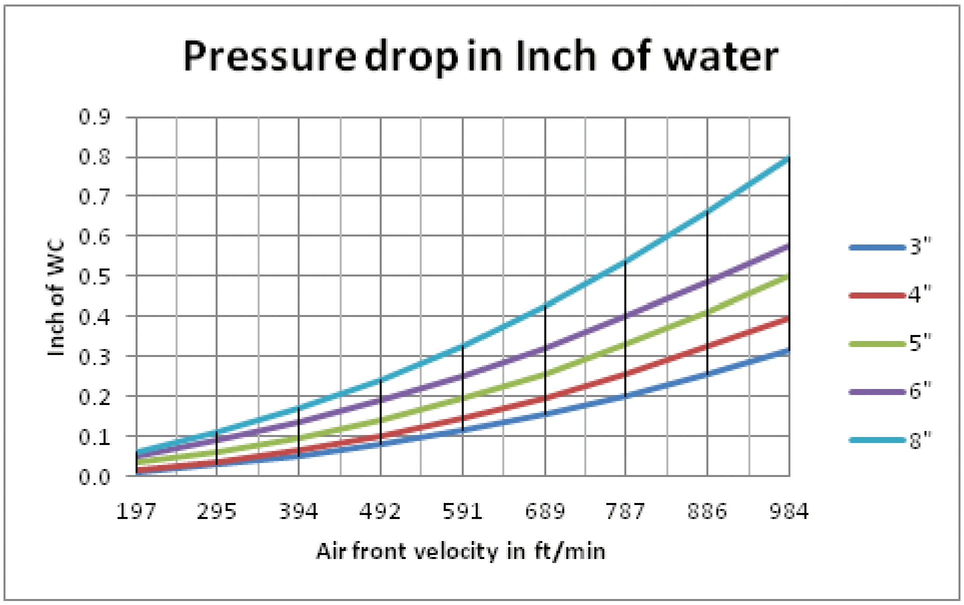

Figure 5: Evapack Pressure Drop vs. Air Speed

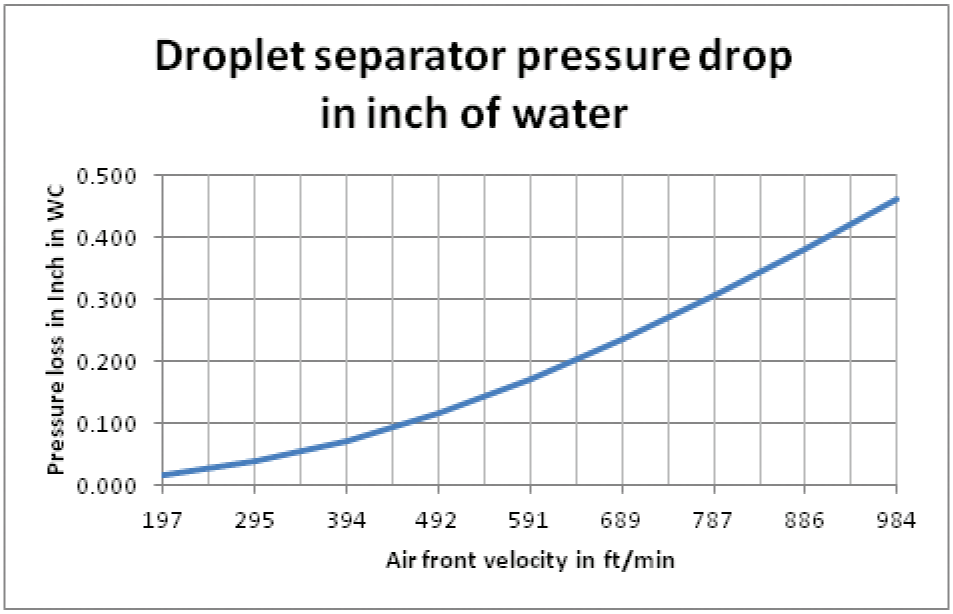

Figure 6: Evapack Droplet Separator Pressure Drop

Conclusion

Evaporative media humidifiers have many benefits when compared to high pressure systems in duct and air handler applications. They offer a system that is lower in maintenance, higher in water efficiency, and superior controllability. The Evapack's ability to use tap, DI, or RO water allows for it to be a viable humidification or cooling option in almost every application.

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Printed in U.S.A. - 1/3/19