



PRODUCT APPLICATION GUIDE | AIR SOURCE HEAT PUMPS



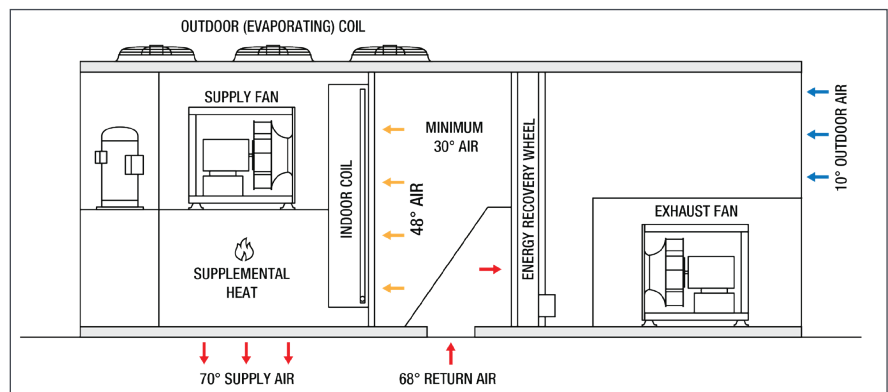
ACHIEVING CONSISTENT SPACE COMFORT WITH AIR SOURCE HEAT PUMPS

As the availability and utilization of air source heat pumps continues to grow, it is critical to make design choices that optimize HVAC system performance and reliability. Depending on the climate and unit features, air source heat pumps can be challenged while operating in heating mode. This guide outlines some of the key considerations when designing an air source heat pump unit to avoid wide swings in discharge air temperatures that create uncomfortable spaces for occupants.

TEMPER INCOMING AIR WITH ENERGY RECOVERY

Some areas are beginning to require electric heat vs. gas in new and renovated buildings regardless of climate. While air source heat pumps are an all-electric solution, extreme temperatures can cause the unit to shut down, especially when using high amounts of outdoor air. The air source heat pump shuts down in these scenarios in order to protect the compressor. To ensure the compressor is able to start and is within its operating envelope, the air approaching the indoor coil must be at or above 30 °F.

Optimizing the unit design by pairing energy recovery with the air source heat pump can help avoid this issue. Energy recovery devices temper incoming air using previously heated return air, thus ensuring the incoming air is warm enough when it reaches the indoor coil.



Energy recovery can be accomplished with several different technologies. However, some air source heat pump units may not include the optimal energy recovery device. Choosing the right energy recovery technology can extend the applications where an air source heat pump is most efficient and effective.

Energy recovery options that offer both sensible and latent recovery are the most effective choices. Enthalpy wheels are highly efficient but have moving parts that require maintenance. If maintenance is not done on a routine basis, the wheels can fail and thus yield no system benefit. Enthalpy core devices are great, no moving parts solutions and most do meet ASHRAE 90.1 standards for efficiency. Manufacturers that offer several energy recovery options will enable each customer to choose what best fits their application.

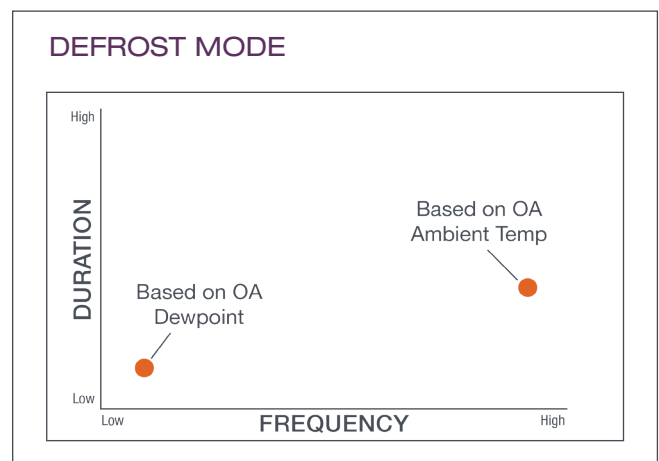
ENERGY RECOVERY COMPARISON		
ENTHALPY WHEEL	CATEGORY	ENTHALPY CORE
Polymer or Aluminum	Heat Transfer Medium	Fiber or Polymer
70-85%	Sensible Performance	60-70%
65-80%	Latent Performance	35-50%
Moderate	Internal Pressure Drop	High
Low	Leakage and Cross Contamination	Very Low
Moderate, rotates	Maintenance	Low, no moving parts

UNDERSTAND DEFROST SEQUENCES AND THEIR IMPACT

Despite the benefits of providing an all-electric heating source, air source heat pumps have an inherent application challenge where frost can accumulate on the outdoor (evaporating) coil in heating mode. An effective defrost control sequence helps to mitigate potential frost issues on the outdoor coil and keeps the unit operating. The ultimate goal should be to reduce the frequency and duration of defrost cycles.

Extreme temperatures, especially in cold climates, create the toughest condition for air source heat pumps to operate. However, cool, humid conditions can also create a challenge. This is because frost will likely form on the outdoor coil when ambient conditions are above freezing with high outdoor air dewpoint (due to snow or rain). Frost accumulation degrades the heating performance of the system and requires a defrost cycle to remove the frost and allow the coil to operate at maximum effectiveness. When the unit is in defrost mode, the heat of the compressor is re-directed away from distributing warm air to the space and instead toward the outdoor coil in order to melt the frost.

Some units trigger defrost based on only the ambient temperature, which may cause them to go into defrost mode regardless of whether the outdoor coil is truly frosted or not. Using input data from the unit such as suction pressure and outdoor air dewpoint is the best way to determine if there is actually frost on the coil and if defrost mode is needed.



SECONDARY HEAT PROVIDES RELIABLE HEATING PERFORMANCE

Ensuring supply air meets the setpoint is a critical consideration when designing any HVAC unit and especially when designing an air source heat pump unit. While heat pumps are highly efficient, there are limitations to their cooling and heating capacity.

Generating enough heat to satisfy building needs can be challenging with air source heat pumps which usually cannot operate below certain incoming air temperatures. While energy recovery devices help precondition entering air, additional heat is often needed to achieve proper space temperatures.

Secondary heating options allow owners to get the most out of the air handling unit, even in extreme temperatures. The use of secondary heat ensures consistent control over supply air temperatures. Secondary heat may be offered as an electric heater, hot water coils, or even a gas furnace. There are two different types of secondary heat:

- **Supplemental Heat** can run at the same time as the air source heat pump.
- **Back-up Heat** is another source of heat that kicks in when the air source heat pump is locked out.

By combining an air source heat pump with secondary heat, the unit can generally meet the required space conditions, keeping occupants comfortable.

OPTIMIZING AIR SOURCE HEAT PUMPS

Designing a commercial air source heat pump HVAC unit to create consistent, comfortable spaces for occupants doesn't have to be challenging. However, it is important to understand the technology and its nuances to design the most efficient unit. By pairing energy recovery, understanding how and when the unit will activate defrost mode, and making the appropriate secondary heat selection, you can effectively utilize air source heat pumps in many efficient applications.



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