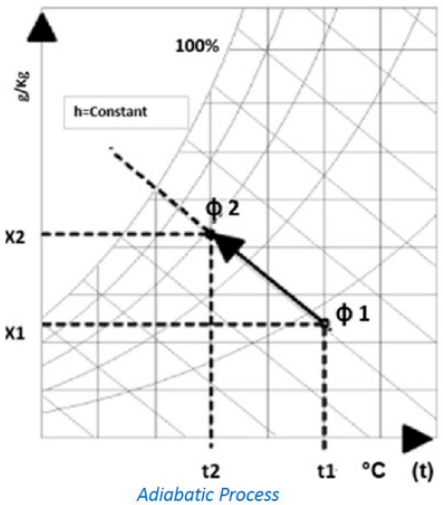
Taking a closer look at...

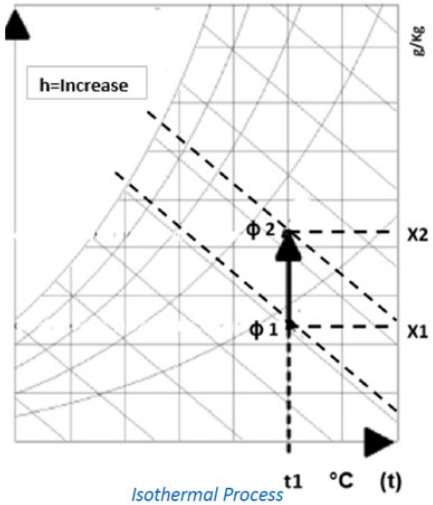
Pre-Heat

Unlike isothermal humidification where external energy sources (e.g. electricity or gas) are used to vaporize water and inject it as steam into the air, adiabatic humidification uses energy from the air itself to drive the phase change from liquid to vapor. This process does not require direct heat input but instead removes sensible heat from the surrounding air, resulting in evaporative cooling. Adiabatic humidification can be achieved through:

- Atomization (e.g., ultrasonic or high-pressure nozzles),
- Evaporation (e.g., wetted media),
- Or a combination of both (e.g., hybrid systems like the Condair DL).



Adiabatic Process



Isothermal Process

On a psychrometric chart, adiabatic humidification follows a line of constant enthalpy. As water evaporates, air temperature decreases (sensible cooling), and humidity increases (latent gain). This is contrary to isothermal humidification where heat is added to vaporize water before it's introduced to the air, increasing humidity without affecting air temperature (moving vertically upward on the chart). Because adiabatic systems do not

require energy to boil water, they are generally more energy-efficient on a per pound of moisture added basis compared to isothermal systems.

The cooling effect of adiabatic systems can be advantageous in situations where both cooling and humidification are desired (e.g., in data centers or hot, dry climates). However, in colder or temperature dependent environments, this cooling effect can pose issues if not accounted for. In these cases, pre-heating the air before it enters the humidification zone is essential.

While pre-heating does require additional energy and can reduce the overall efficiency of an adiabatic system, it may still offer greater efficiency than isothermal humidification, especially when utilizing waste heat or low-cost energy sources. Ultimately, evaluating the total system efficiency is essential when deciding between isothermal and adiabatic solutions.

PRE-HEATING ENSURES:

- The air has enough thermal energy to support evaporation.
- The leaving air temperature remains within design specifications.

Accounting for Preheat in Condair's Help Software

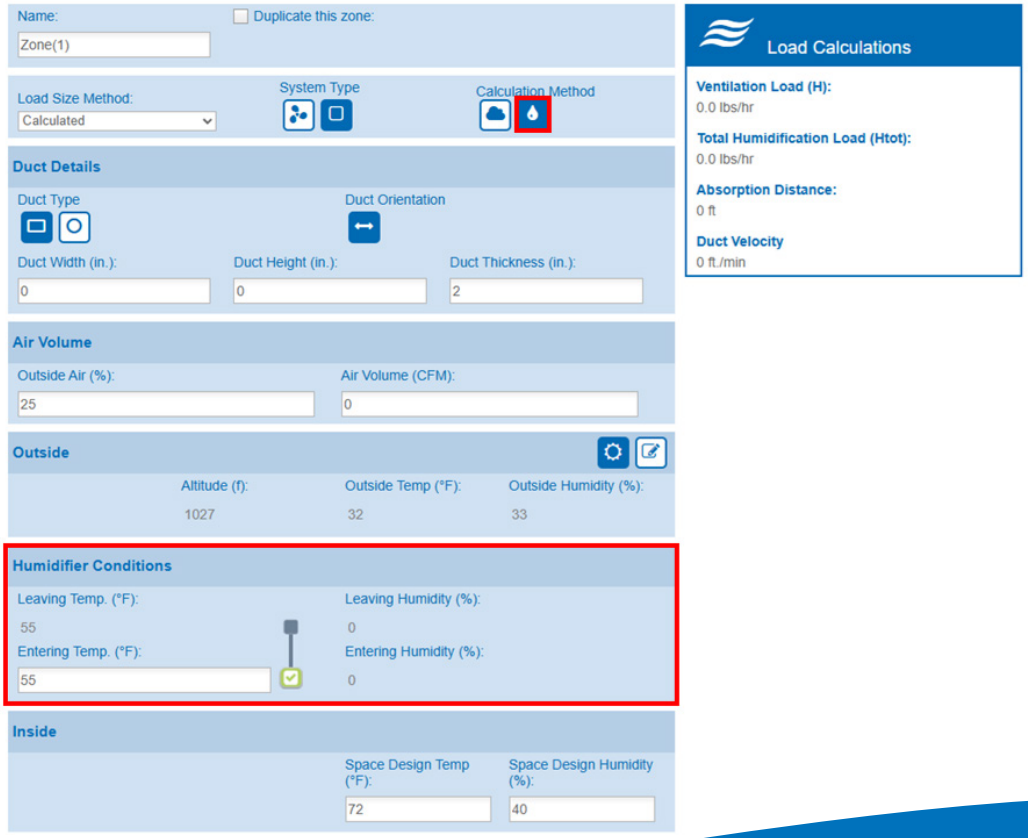
When switching to an adiabatic humidifier selection in the Help software, a new toggle appears in the Humidifier Conditions section. The toggle allows you to specify either the entering air temperature or the leaving air temperature. This functionality helps account for the cooling effect that occurs across the humidifier when operating at full capacity. By accurately setting these parameters, the software can properly model the system behavior and ensure correct performance predictions.

When evaluating entering and leaving air conditions for an adiabatic humidifier, it is best practice to target a minimum leaving air temperature of 55°F and a maximum relative humidity of 75%. This ensures the air downstream of the humidifier does not approach saturation, minimizing the risk of condensation and protecting the air handling unit (AHU) and ductwork.

It is critical not to artificially raise the entering air temperature to force the selection of a humidifier without ensuring it can be achieved. The entering temperature used in the design should reflect the actual preheat requirement for worst-case design conditions.

Using an inaccurate entering air temperature will lead to incorrect load and efficiency estimates, potentially resulting in:

- Increased water waste due to lower efficiency
- Difficulty maintaining space humidity setpoints
- Possible wetting inside the air handling unit (AHU)



Form #25-975

USA 1021 S 6th Street, Racine, WI 53403 Canada 2740 Fenton Rd, Ottawa, Ontario K1T 3T7
Tel 1.866.667.8321 Email na.info@condair.com Website condair.com