

## Condensation Control | A Design Requirement for Below-Ambient (Cold) Mechanical Systems

Since water vapor will always be present within the building envelope, it is imperative to adequately protect building mechanical systems (piping, ductwork, and equipment) from the undesirable effects of excess moisture. If left unchecked, uncontrolled water vapor can create a domino effect – vapor drive, condensation, decreased energy efficiency, the potential for mold growth, corrosion, damage to expensive equipment and building components, slip/fall hazards, and eventual system failure/shut down.

Mechanical insulation is a proven solution that prevents condensation and conserves energy when properly specified and installed. There are numerous commercially available insulation products and accessories that provide system protection. Due to the variety of mechanical systems and their operating requirements, it's common for multiple insulation types and accessories to be specified and installed on a single project.

Calculating the correct insulation thickness is crucial and will determine success or failure with condensation control. An incorrect thickness will result in the outer insulation surface "sweating." Sweat (condensation) leads to reduced thermal efficiency, the potential for mold growth and corrosion under insulation (CUI), damage to equipment and finishes below, and safety hazards. The mechanical insulation industry offers two free online insulation thickness calculators:

- <https://3eplus.org>
- <https://insulation.org/training-tools/designguide/simple-calculators/condensation-control-calculator-for-horizontal-pipe/>

Closed-cell elastomeric insulation, such as AEROFLEX EPDM™, is proven for its ability to control condensation due to its closed-cell structure and built-in vapor retarder (skin). Elastomeric insulation is commonly specified for refrigerant and chilled water systems for its favorable low thermal conductively (K-value) and water vapor permeability (perm rating). For most applications, a supplemental vapor barrier (i.e. insulation jacket) is not required. Vapor barriers are usually recommended for cold systems operating in severe operating environments with high ambient temperature and relative humidity.

Condensation control will be achieved when the following parameters are addressed:

- Proper insulation type for the application
- Correct insulation thickness
- Insulation seams are fully adhered (glued, not taped) to provide a vapor seal
- Supplemental vapor barrier (when appropriate)

Click [here](#) to learn more about the performance benefits of AEROFLEX EPDM™.

Sources:

NAIMA 3E Plus - <https://3eplus.org>

National Insulation Association (NIA), Condensation Control Calculator for Horizontal Pipe - <https://insulation.org/training-tools/designguide/simple-calculators/condensation-control-calculator-for-horizontal-pipe/>