Controlling Condensation

Keeping dry in below-ambient temperature conditions was made easier by insulating process pipes.

Dangerous water puddles on the floor and brown stains on the ceiling can be caused by chilled water pipes that drip condensation onto surfaces below. A problem like this in your plant can result in:

- Safety hazards.
- Health and structural issues.
- Reduced thermal performance of pipe insulation, forcing the cooling system to work harder to maintain a chilled water temperature.
- Ceiling tile replacement.
- Lower property values due to the impression of deteriorating conditions.

Why are the problems created by chilled water pipes so pervasive? Most chilled water lines average about 40 to 45°F (4 to 7°C). In a manufacturing environment that can be hot and humid, condensation is nearly impossible to avoid. The resulting moisture within the pipe insulation -- from a damaged jacket, improper installation of seams, porous material or improper insulation thickness -- creates thermal loss and operational inefficiencies. When this insulation becomes saturated, the moisture escapes onto ceilings, floors and machinery.

Despite these issues, many companies do not replace insulation because they do not want to shut down the system. And, piping needs to be dry for replacement insulation to be applied.

Insulation technology for these chilled pipe issues is designed specifically for below-ambient temperature applications in hot and humid operating environments. In one type, a wick material in the insulation transports condensed water to the outside of the system for evaporation. This keeps the fiberglass insulation dry so that dripping and loss of thermal performance are prevented. Water vapor that enters the system and condenses on the cold pipe surface is removed to the outer surface by capillary action, where it then evaporates to the ambient air.

After nearly three years of service in a hot and humid mechanical room in Norfolk, Va., this wicking-type pipe insulation was checked at the site and found to be dry to the touch. There were no telltale stains on the insulation or floor that would indicate dripping since the product was installed in 2001.

Samples were removed and taken to a laboratory for microscopic examination by a university professor of microbiology. After checking the samples with a 40 to 400X binocular microscope using fiber-optic illumination for improved visibility, the testing professor declared the samples free of visual mold growth. According to the professor, no characteristic patterns of fungal growth (mycelia) or reproductive fungal structures were observed.

The professor then tested fresh samples of insulation to see if mold growth would take place. For this test, he placed samples in an environmental chamber with 90 percent relative humidity and a temperature of 90°F (32°C). After three months, no mold was found. According to the professor, even under conditions normally conducive to mold growth, none of the pipe insulation samples supported growth of fungi. Then, the professor subjected all the individual components of the pipe insulation to a 28-day ASTM C1338 mold-resistance test. Again, the insulation passed. Even with the addition of inorganic or organic nutrients, mold growth in excess of that occurring on the standard tongue depressor did not occur on any of the components. According to the professor, this study verifies that all components of the wicking-type insulation will not support the growth of mold, even in the presence of added nutrient.