information bulletin

Condensation

Condensation is a problem that frequently occurs in new buildings. Why is that?

Concrete contains approximately 30 gallons of water per cubic yard. Much of this moisture is released to the atmosphere, as water vapor, during the curing process.

During building construction, if the concrete for the walls and floor slab is poured during the spring or early summer, much of this evaporative process will have occurred by the time the building is closed up for the winter. During the spring and summer, exterior man doors and truck doors tend to be left open as much as possible. Mancooler fans are frequently in use. Summer ventilation fans may also be used. All of these factors contribute to ventilating the interior space and evacuating the water vapor from the building's interior.

If the concrete is poured late in the year, the building is likely to be closed up more tightly. Doors won't be open as much and fans generally aren't in use. This contributes to a more poorly ventilated space. The concrete, though, is still curing and releasing moisture to the indoor air, regardless of whether the building is well ventilated.

Relative humidity (RH) is a measure of the amount of moisture that air can hold. As the air temperature warms, the capacity of the air to hold moisture increases.

Condensation occurs when warm, moist air comes in contact with a cold surface that is at or below the dew point temperature of the air.

The chart below shows the dew points of air at various temperatures with varying percentages of relative humidity. Note that as the relative humidity increases, the dew point becomes closer to the temperature of the air.

At 90% RH, the dew point is only 2.4°F to 3.0°F below the air temperature. Insulation helps prevent the inside surfaces of the building from reaching the dew point. The more effective the insulation, the less the chances are of reaching the dew point temperatures. Ventilation may reduce the inside RH, which in turn broadens the gap between the inside air temperature and the dew point.

Heat transfer is the term commonly used to indicate the movement of heat from one region to another. The driving force for heat transfer is a difference in temperature between two regions or surfaces and will occur in a direction from hot to cold. Thermal resistance is a measure of a material's ability to resist the passage of heat. The higher the R-value, the less heat will flow through the material. Insulation is rated by R-value.

A vapor barrier is used to prevent the passage of warm, moist air into the interior of the wall or roof systems. It is critical that the integrity of the vapor barrier closest to the warm surface of the building be maintained.

Dew Points – Degrees F, for Various Humidities and Temperatures

	Inside Air Temperature				
Inside Relative Humidity	30°	40°	50°	60°	70°
90%	27.6°	37.3°	47.3°	57.1°	67.0°
80%	25.2°	34.4°	44.1°	53.9°	63.6°
70%	22.4°	31.2°	40.7°	50.3°	60.0°
60%	19.2°	28.0°	36.8°	46.3°	55.7°
50%	15.5°	24.0°	32.3°	41.5°	50.8°
40%	11.0°	19.3°	27.4°	36.9°	44.7°

Cambridge Air Solutions has studied the issues of condensation and humidity and how our heating systems can affect them. We have conducted engineering studies during the winter, measuring and recording the indoor, outdoor and dew point temperatures and the indoor and outdoor relative humidity's over a period of weeks. From these studies and numerous field visits to customer's facilities we have come to several conclusions:

1. If concrete is poured late in the year, there is a high likelihood that condensation will occur during the first winter of occupation. Usually, the problem goes away after the building has been ventilated during the ensuing warmer months.
2. The primary factor affecting indoor RH after the first year seems to be outdoor RH.
3. Cambridge heaters utilize 100% outside air. This can help purge the moisture generated by the curing concrete from the building.
4. Cambridge heaters are direct gas-fired, typically operate intermittently and do not recirculate. These heaters add moisture to the heated air stream due to the combustion process, adding the greatest amount when the outside air is coldest and driest. Our studies have shown that during cold spells, the indoor RH has actually dropped when the heaters were operating and increased when the heaters shut off.
5. Indoor relative humidities measured in these studies are in the 30%-55% range. This is consistent with desirable Indoor Air Quality and many industrial processes.