TENUTA TECH

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Hot water coils and chilled water coils are often thought of, and designated by the HVAC industry, as though they were completely different. The truth is that a water coil is equally capable of handling hot water or chilled water, and the construction for either is exactly the same. Let's first define what the HVAC industry means when it separates the two.

Hot Water Vs. Chilled Water Coils

Hot Water Coils

Coils are designated as hot water when they are one or two rows deep. Most of the time a hot water coil has 60° F entering air and a hot water temperature of anywhere from 140° F to 200° F. The spread between the entering water and the entering air is often 100° F to 140° F, so you just don't need very many rows deep to do the required load. Just about every hot water coil that you run across will be one or two rows. Is it possible to have a three or four row hot water coil? Sure it is, depending on your entering conditions! There are heat recovery or low temperature hot water situations when a coil has to have more rows to do the job, sometimes three or four rows.

Chilled Water Coils

Coils are designated as chilled water when they are three thru ten rows deep. Again, most chilled water coils have an entering air temperature of 75° F to 95°F with a chilled water entering in the range of 45° F. As you can easily see, the spread between the entering water temperature and entering air is much closer than the hot water example outlined above. When you factor in that the required leaving air might be close to 55° F, then you can see how close the temperatures become. You clearly need more rows to handle the load. In addition, you are dehumidifying and have a latent load to handle as well.

Construction

When you build a water coil, there is only one water coil design, and the coil doesn't really know the difference between hot water and chilled water. It's all the same to the coil. Tube diameter, wall thickness, fin design, casing and brazing procedures are all the same. Hot water is not any different from chilled water in the coil design. Simply, one or two row coils are hot water, and three thru ten rows are chilled water.

Water Velocity and Pressure Drops

The whole point of circuiting a water coil is to control the water velocity and ultimately the pressure drop and performance of the coil. Circuiting is nothing more than feeding a specific number of tubes based on the total G.P.M., and controlling the speed of the water through the coil. There is a lower limit and an upper limit. You should try and keep the water traveling through the coil between 1 ft./second and 6 ft./second. There are some pretty important reasons for doing this. If the water travels through the coil too slowly, then you are in a condition called "Laminar Flow". Anywhere below 1 ft./second can cause this to happen. The efficiency of any water coil is based on the water splashing against the inside wall of the tube. When this happens, you have turbulence in the tube. All performance testing is based on "turbulent" conditions. When the water travels too slowly through the tube, then some of the water gets caught in the center of the tube and never comes into contact with the tube wall. This is "Laminar Flow", and generally causes great unpredictability in coil performance. Basically, the coil just doesn't operate as designed. (As an aside, this is why some manufacturers put turbulators in some of their chilled water coils. You can do the same thing by circuiting the coil differently.) If the water travels through the coil too fast, then heat transfer drops and pressure drops increase exponentially. You should really try to stay below 6ft./second.

Circuiting

Circuiting is meant to do two things at the same time. It's meant to get the inlet and outlet connections on the same or opposite ends of the coil (depending on where you want them), and to control the speed of the water. Technically, you could build a coil with no headers and feed just one tube at a time if you really wanted to. The coil might work, but you would need a pump equal to the size of a house to get the water through it.

Or you could design a coil with no pressure drop at all, but the coil would have little heat transfer capability. The right design is to go down the "middle of the road" with a pressure drop you can live with, but still have an efficient affordable coil that works as designed. Because hot water coils often have a 20° F or even a 40° F water temperature drop in design, there is not a lot of G.P.M. available. In these cases, you have to feed fewer tubes to keep the velocity up to get heat transfer. Chilled water coils, on the other hand, often have an 8° or 10° rise with lots of G.P.M. It's necessary to feed many tubes to slow the water down and keep the pressure drop to an acceptable level. Circuiting is the key factor in any water coil selection and is the real differentiation between hot water and chilled water coils. Once you understand how this whole process works, then it's easy to select or replace an existing water coil.

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