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Water Coils & Circuiting

One of the biggest problems that most people have in regard to water coils is circuiting. This is probably due to the fact that most OEM's are "production oriented," and really limited in the scope of circuiting arrangements that they offer. Each circuiting arrangement either has a letter designation in the coil model number, or they have attached a name to it with little explanation. In any case, we feel that when you understand circuiting, it's much easier to design or buy hot water or chilled water coils, because you have a much better understanding of how they work.

What are circuits?

When you say a coil has 24 circuits, what does that really mean? It means that there are (24) tubes connected to the supply manifold, and that you are feeding (24) tubes with either hot or chilled water. The water enters through the supply connection, fills up the manifold, and then simultaneously feeds (24) tubes.

Why do you feed different numbers of tubes?

Water must be traveling through a coil at the proper speed. If the water is traveling too fast, then you get inefficient heat transfer and very high pressure drops. If the water is traveling too slowing, then you have a condition called "Laminar Flow," which means that there is no turbulence in the tube, and you get very little heat transfer. Either way, you're in big trouble! You control the speed of the water through the coil by feeding the proper number of tubes. If you feed more tubes, then you slow the water down. If you feed less tubes, then you speed the water up. The speed of the water is measured in Ft./Second. Water should travel through a coil at between 1 Ft./Second and 6 Ft./Second maximum. Most of the standard circuiting patterns that Carrier or any manufacturer offers keep the speed of the water in exactly this range.

How do I know the number of tubes to feed?

There are two answers to this question. If you are replacing an existing coil, then you simply duplicate the circuitry. You just walk over to the coil and run your hand down the back of the supply manifold, and count how many tubes are connected to the manifold. This equals the number of tubes, or the number of circuits that are fed.

If you have to design a coil from "scratch," then you need to understand how circuitry really works:

- (1) Think of the number of tubes in a coil as a matrix. A coil that is 24 tubes high by 8 rows deep has a total of 192 tubes. Multiply the number of tubes high by the number of tubes deep – that is the total number of tubes in the coil.
- (2) You could feed (1) tube if you really wanted to do that. In this case you would make the water pass through the coil 192 times, because of the total number of tubes. So if you really feed (1) tube, you would have a pressure drop of 20,000 or 30,000 ft. and a pump the size of a “house.” Needless to say, this won’t work!
- (3) If you feed (2) tubes, then you would have a coil with 96 Passes. 3 tubes = 64 Passes, 4 tubes – 48 Passes, 5 tubes won’t work! It doesn’t divide evenly into 192. You can feed any number of tubes that you choose, except that the circuiting arrangement and number of tubes that you choose much divide evenly into the total number of tubes in the coil (otherwise you’ll have a few leftover). 24 feed tubes work; 26 feed tubes do not work.
- (4) There is one other condition. That is most water coils have the supply and return connection on the same end of the coil. You must select the number of tubes that you feed, so that the number of passes becomes even and the connections are on the same end.

Typical Circuiting (192 tubes)

<u>Feed</u>	<u># Passes</u>	
24 tubes	8	
48 tubes	4	All of these combinations will give you same end connections.
16 tubes	12	
32 tubes	6	

HVAC manufacturers have applied names to these standard patterns that are now industry standards. (24) tubes = full circuit. (48) tubes = double circuit. The point is, you can feed any number of tubes that you choose; you just have to know how circuitry works.