USA COIL & AIR NEWSLETTER

Improve Performance on Coils

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Below are some things that USA has learned about the performance of coils over the years. We all use computer programs to select coils today, and it is certainly quicker and more accurate to use these programs than to do it long-hand. The problem is, however, that many of us do not know how these selections are arrived at. Yes, there really are formulas and methods and limitations built into these programs. It will help your understanding of coils greatly, when you not only select coils, but understand the selection process, as well.

1. The tubeside B.T.U.H. must match the airside B.T.U.H. When you select a coil you know that you require a specific amount of BTUs on the airside of the coil. You could select the biggest coil "in the world", but you must feed this coil with the proper fluid, steam, refrigerant, etc. so that the tubeside B.T.U.H. matches the airside that you require. If you do not, the coil will not work. This sounds like a rather basic guideline, but you would be surprised at how many jobs that USA receives that don't follow this rule. You can not get more out than you put in.
2. Air must travel across the face of the coil at velocities that can't be too low or too high. If the air is traveling too fast across the coil, then you get inefficient heat transfer and high air pressure drops. If the air is traveling too slowly, then you get practically no heat transfer, because there is no air turbulence. You control the velocity of the air by making the coil bigger or smaller based on the C.F.M. Below are guidelines for air velocities:

	Optimal	**Maximum**
Steam or Hot Water Heating	800 ft./min.	1200 ft./min.
Refrigerant Cooling	500 ft./min.	550 ft./min.
Chilled Water/Glycol Cooling	500 ft./min.	550 ft./min.
Condenser Coils	600 ft./min.	1000 ft./min.

   Cooling Coils require a lower velocity, because there is latent cooling going on, and you are pulling moisture out of the air. This water will be carried far beyond the drain pan located under the coil at velocities that exceed 550 ft./min. You still will get effective heat transfer, but you will also have huge water carryover problems.

3. The circuitry or number of tubes that you feed in any coil determines two things.

º which sides the supply/return connections will be on(same or opposite end)

º the speed of the fluid and the resulting pressure drops through the coil

It is very easy with steam. Performance on any coil is determined only by steam temperature and pressure. You are not required to control the velocity of the steam to control performance. You are required to control hot water or chilled water in any coil. Water must be traveling between 1 ft./second and 6 ft./second to get effective heat transfer. You also control your pressure drop by the number of tubes you feed. Water coils of any type almost always have same end connections.

4. You improve your performance by adding rows to a coil, adding fins to a coil, or by making hot or chilled water travel through the coil faster. This is how you make a coil give you more BTUs but there is a trade-off every time you do one of these things. Either air pressure drops, or water pressure drops, or both increase. You can not get one without the other. That is the trade-off. You get more performance, but you pay a price for it in coil size, weight, cost and pressure drops.
5. Fins are responsible for roughly 2/3 of the performance on a coil, and tubes only 1/3. There really is very little difference in performance between aluminum fins and copper fins. Aluminum is the material of choice because of the obvious cost difference between the two. You would use copper fins only where there is a corrosion problem or some other compelling reason to use copper. There is no performance reason to use copper rather than aluminum.
6. There is very little difference in performance between a 1/2" O.D. tube coil and a 5/8" O.D. tube coil, if you have the same number of rows. Yes, the tubes aren't as big, but there are more tubes per row, so that the overall tube surface is almost the same. The tubes are only responsible for 1/3 of the performance anyway, so there really is not a great deal of difference. Some, but not much.
7. A good, maximum water pressure drop is approximately 20 ft. on a hot water or chilled water coil. Most engineers do not want to exceed this number. You can circuit a coil to get better performance and come up with a pressure drop of 30 ft., 40 ft. or even 50 ft. Normally, this is not acceptable.
8. Increasing wall thickness has very little effect on performance. You may want to do it to please your customer, or make the coil last longer. It may be necessary, because of higher steam pressure. Performance is effected only slightly, so there should be no reason other than "upgrading" of the coil construction.

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