

Bulletin # 8 coil myths

DEHUMIDIFICATION COIL MYTH

If you are looking for an engineering myth that has whiskers on it, you need to look no further than, "If you need to dehumidify, you must specify a 6, 8, or 10 row coil. The more rows the better."

The preceding statement is obviously false if you just think about it for a minute. The very first heat-transfer equation everyone learns is: $q = U A \Delta t$. The "A" stands for surface area. A coil's surface area can be increased by adding rows, increasing face area and adding fins. To prove that a 4-row coil can dehumidify just as well as a 6-row coil, I ran a series of selections through a major coil manufacturer's coil selection program. I began with a 6-row, 4-pass, 8 fins-per-in. (FPI) coil that would reduce the moisture content of 5000 CFM of air at sea level from 123 gr per lb. to 74 gr per lb. The program gave me a coil with a face area of 11.46 sq. ft. I then changed to a 4-row, 4-pass, 8 FPI coil and began increasing the face area until I achieved the same leaving-air conditions as the 6-row coil. My chosen 4-row coil had a face area of 19.79 sq. ft., and increase of almost 73 percent, but it dehumidified the air just as well as the 6-row coil.

In order to eliminate the possibility that this was a fluke, I ran similar selections with the same entering and leaving conditions at 10,000 CFM, 15,000 CFM and 20,000 CFM. The results are summarized in the table below. In each case I was able to select a 4-row coil that would do the same duty as the 6-row coil.

One of the arguments for multi-row coils is the increase in the dwell time, the amount of time that the air is in contact with the coil surface. The longer the dwell time, the more dehumidification is accomplished. As you can see by the comparative face velocities between the 6-row and the 4-row coils, increasing the face area not only increases the surface area, it also increases the dwell time by decreasing the face velocity. I maintained the same 8-FPI for both the 6-row and the 4-row coils. I could have decreased the face area of the 4-row coil and still increased the surface area by increasing the FPI. This course of action, however, has its trade-offs. By increasing the FPI, you increase the airside pressure drop and increase the fan hp. Not only that you make the coils harder to clean, it doesn't take long for a wet coil with 14 FPI to become a filter.

4-row and 6-row coil comparison

5000 CFM	5000 CFM	10000 CFM		10000 CFM	15000 CFM	15000 CFM	20000 CFM	20000 CFM
ROWS/FPI/PASSES	ROWS/FPI/PASSES	ROWS/FPI/PASSES		ROWS/FPI/PASSES	ROWS/FPI/PASSES	ROWS/FPI/PASSES	ROWS/FPI/PASSES	ROWS/FPI/PASSES
6/8/4.	4/8/4.	6/8/4.		4/8/4.	6/8/4.	4/8/4.	6/8/4.	4/8/4.
11.46	19.79	19.79	Face area (sq ft)	35	30	50	40	75
436.4	252.6	505.3	Face velocity (fpm)	285.7	500	300	500	266.7
286.8	283.2	556.4	Total capacity (MBH)	576	867	890.2	1208	1187
111.8	110.2	217.1	Sensible (MBH)	223.9	337.6	345.8	469.7	461.3
0.55	0.14	0.71	APD (in. w.g.)	0.18	0.7	0.19	0.7	0.16
2.31	2.21	3.27	WPD (ft)	5.54	4.9	14.56	10.51	5.82

The Perfect Balance of Water and Air

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