

USA COIL & AIR NEWSLETTER

Computer Coil Selections - How They Really Happen!

We're going to get very "old fashioned" and very technical in this Newsletter. This one is for all you closet engineers out there who actually want to know how coils are selected, and the factors that go into picking a coil. If all you are interested in doing is bringing up the newest coil selection program on your computer screen, and you don't really care about how the whole process works, then stop reading now. If you really are interested in how all this information is developed and the inter-relationship between this data, then this Newsletter is for you. Read on!

Example: Heat 7900 CFM from 50°F to 142°F using 190°F water, Lvg. at 170°

We're going to give you the actual "longhand" formulas and loads that people used to select this coil. By actually seeing the formulas you will get a much better idea of the selection process. You will also better understand how changing the input also changes the final selection. See if you can follow this! By the way, there used to be people who did this longhand on every job. Hard to believe, but true!

Step #1 - Calculate the load

$\text{CFM} \times 1.08 \times (\text{lvg. air temp} - \text{ent. air temp}) = \text{BTU/HR}$
 $7900 \times 1.08 \times (142 - 50) = \underline{785,000 \text{ BTU/HR}}$

Step #2 - Calculate G.P.M.

$\text{BTU/HR} \div (500 \times \text{water temp. diff.}) = \text{G.P.M.}$
 $785,000 \div (500 \times 20) = \underline{78.5 \text{ G.P.M.}}$

Step #3 - Calculate face area

$\text{CFM} \div \text{air velocity} = \text{Face area}$
 $7900 \text{ CFM} \div 500 \text{ F.P.M.} = 15.8 \text{ sq. ft. required}$

Step #4 - Pick a coil size (any size you like)

27" F.H. X 84" F.L. = 15.75 sq. ft. (18 tubes/row)

Step #5 - Select a water velocity (charts available)

$\text{G.P.M.} \div \# \text{ tubes feed} \times \text{factor } (5/8" \text{ O.D.})$
 $78.5 \div (18 \times 1.17) = \underline{5.1 \text{ ft./second}}$

Step #6 - Select a "U" Factor

There used to be charts that showed each individual "U" factor based on ft./minute air velocity, ft./second water velocity, and fins/inch. This "U" factor is the actual heat transfer coefficient tied to a particular coil. You'll have to trust us on this one, but the

"U" factor for 5.1 ft./second, 500 ft./minute and 8 fins/inch is 176.

Step #7 - Figure the MTD (mean temperature difference)

| | |
|----------------------------------------|--------------------------------------------|
| Ent. Water - Lvg. Air (190 - 142) = 48 | Relationship between the air |
| Lvg. Water - Ent. Air (170 - 50) = 120 | temperatures and the water |
| | temperatures. Higher is <u>better</u> than |
| | lower. |

MTD (counterflow) = 78.6 MTD

Step #8 - Actual # Rows required

B.T.U./Hr. ÷ (MTD X "U" factor X Face area) = Theoretical # rows required
 $785,000 \div (78.6 \times 176 \times 15.8) = 3.6$ Rows

Above is the actual formula required to calculate rows. Since it's impossible to build a coil exactly 3.6 rows, you must round up to 4 rows.

Believe it or not, when you plug all your numbers into a computer program, this is the set of calculations that takes place. Step #8 is exactly how coils are calculated. Everybody is always trying to build a coil with the fewest rows possible. Well, the way that you do that is to make the MTD larger, increase the "U" factor, or increase the face area. When you make any of those numbers larger, you decrease the number of rows. How can you make the "U" factor larger? Make the water go faster, make the air go faster, or increase fins/inch. How do you change the MTD? Make the water hotter, or the steam pressure higher. How do you change the face area? Make the coil bigger. There are other factors that increase "U". Coils operate at higher coefficients when wet rather than dry. "U" factors are different for 1/2" tube coils than 5/8". Really it comes down to making the MTD larger, the "U" factor larger, or increasing face area. If you do any of the above, you decrease the number of rows. These are all things that the computer does automatically for you when you change the data. Oftentimes, we are all guilty of just mechanically changing the data and never knowing how the actual calculation process takes place. Now you know! Knowledge is power, and the more knowledge that you have regarding how coils work, the better you will be at the selection process. Now you might say, "who cares?" I just use the computer anyway. That's true, but it's certainly better when you understand what the computer is actually doing. Please let us know if we can help you with any of your coil selections or problems.



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