JB Tech Talk No. 19: Counter Flow for High Heat Transfer

We have all kinds of acronyms in our industry, e.g. cfm, btuh, gpm, OMG! One of the most important and least understood is LMTD, which some of you may be surprised to find out is not a Ford sedan, but rather *logarithmic mean temperature difference*. It's important because almost everything we do involves heat transfer, and temperature difference is the voltage that drives heat from one medium to another; water-to-water, water-to-air, air-to-air.

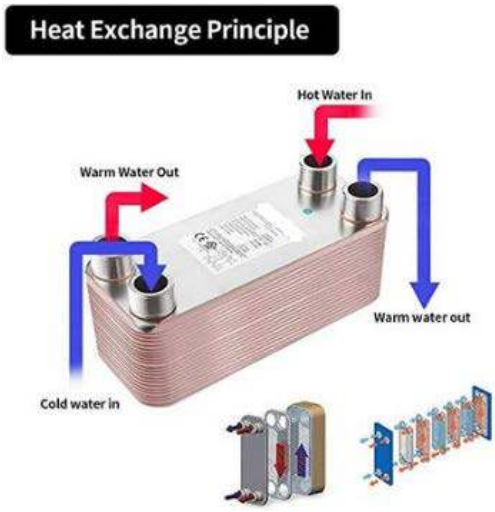
From the training I've done over the years, I've noticed that when square roots come up the crowd becomes concerned, and if logarithms are mentioned a few become visibly distressed. Relax. We're not going to get deep into the math, but here's the basic formula for heat transfer:

$$Q = U \times A \times LMTD$$

Q = amount of heat transfer, U = heat transfer co-efficient, A = heat transfer surface area, and LMTD = logarithmic mean temperature difference.

In most applications, U doesn't vary much and A doesn't vary at all. LMTD; therefore, is the controlling factor and the higher it is, the more heat can be transferred for a given area A.

A high LMTD application would be cold outside air coming into a coil fed with a hot glycol solution. You can get the job done with a low heat transfer area (A) coil. The other extreme is a radiant floor with a surface temperature close to the space temperature; low LMTD, but big A.



In most heat exchangers, LMTD will be higher if the two flows are counter-current, rather than parallel current. The easiest way to describe this for installers is hot-to-hot, cold-to-cold. Or, for coils, air in/water out. For people who work in HVAC this is one of the fundamentals that should be tattooed on their body someplace where they don't need a mirror to read it. As a visual aid, many heat exchangers, including coils, have their connections clearly labelled to indicate which way the flows should be going.

I have seen several installations where these labels have been gleefully ignored, with negative consequences. Plate heat exchangers with low approach temperatures and chilled water coils will suffer most from being piped for parallel flow.

So, as usual, follow the instructions. The cheapest way to do anything is once.

Here's a web address for a LMTD calculator that will give you both counter and parallel flow numbers. No math required.

https://engineeringunits.com/log-mean-temperature-difference-calculator/