COILMASTER

RESHAPING COOLING

◀ Elliptical Tube

We live in a world where it is expected we will accomplish more with less. At **Coilmaster** we have dedicated our research and development resources to produce a coil technology that allows a **smaller** fan motor to achieve the same cooling capacity. With our new oval tube technology, we are able to reduce the air-side pressure drop of coils in an innovative way, resulting in considerable savings for myriad establishments, from data centers and hospitals to Universities and shopping malls.

440 Industrial Drive
Moscow, TN 38057

sales@coilmastercorp.com
coilmastercorp.com

P. 888.302.6049
F. 901.877.3335

When calculating the reduction in air-side pressure drop as it directly correlates to energy usage savings, it is helpful to reference the following formula:

$$\text{Fan Power (KW)} = \frac{\text{CFM x Pressure Drop (in } H_2O)}{6845 \text{ x Total Fan Efficiency (\%)}} \times 0.746$$

Component	Associated Air Pressure Drop (In H_2O)	Air Pressure Drop Reduction with Eco-Coil (in H_2O)
Pre-filters	1.0	-
Pre-heat Coil	0.4	0.16
Cooling Coil	0.8	0.32
Heating Coil	0.4	0.16
Final Filters	1.0	-
External Static	1.5	-
Total	5.1	0.64

Energy savings for a typical make-up air handler can be on the order of 12.5%.

Along with energy cost savings, we also considered noise pollution; we wanted to be sure our fan motors ran quieter than most. Since the total static pressure the fan has to overcome is lower, we were able to reduce the fan RPM, lending itself to an almost unnoticeable running noise. And, we were able to maintain capacity and fluid pressure drop, stabilizing performance and capability in our fans.

The Statistics

Before the fin design, we first tested an elliptical tube design. Let's look at the savings that would have been achieved from an actual data-center coil project if the elliptical tube design had been used. The air handlers in question used chilled water to reduce the air from 120°F to 78°F. The table below details the inlet conditions, physical characteristics of the coils, and the results for a single air handler:

Description	Round Tube Coil	Oval Tube Coil
Tube Diameter (in.)	0.625	0.500 (base stock)
FH x FL x Depth	55.5 in. x 84 in. x 6.0 in.	55 in. x 84 in. x 4.33 in.
Number of Coils per Bank	4	4
Fin Type	Waffle	Oval Raised Lance
Fins per Inch	11.5	10
Number of Feeds	19	44
CFM	76000 ACFM	
Entering Air Temps (DB/WB)	120°F/67°F	
Gallons per Minute	284 GPM	
Entering Water Temp	63°F	
Capacity	3,083,000 Btu/hr	3,073,000 Btu/hr
Water Pressure Drop	5.4 Psi	5.4 Psi
Air-side Pressure Drop	**0.47 in. H_2O**	**0.285 in. H_2O**

The table's data reveals two important bits of information: the air-side pressure drop has been reduced by nearly 40%, and the number of feeds required to maintain the same fluid pressure drop has increased.

If we translate this into financial gains, the estimated annual energy savings is approximately $3,100 per unit based on average utility rates. Not only is the cost savings clear, but the following benefits can also be leveraged:

- Reduced greenhouse emissions from power plants
- Reduced cost for motors and fans
- Reduced fan watts correlate to less energy added to the air stream
- Lower component costs
- Reduced aluminum usage

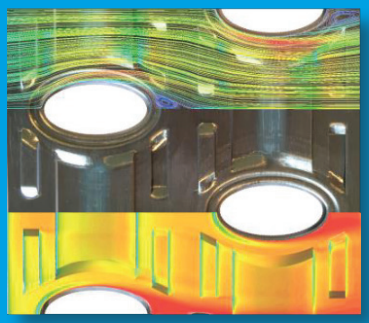
Elliptical tubes present pressure limitations, driven by cross sectional deformation, not the more common burst concerns. The next example is a comparison of an evaporator for an R410a system, where the tube wall requirement increases along with the working pressure. In the case of R410a, the maximum pressure the low side should see is the equalized pressure of the system, which should be less than 400 Psig. For this system the use of 0.025" wall thickness is appropriate.

Description	Round Tube Coil	Oval Tube Coil
Tube Diameter (in.)	0.500 x 0.025"	0.500 (base stock) x 0.025"
FH x FL x Depth	141 in. x 90 in. x 4.33 in.	141 in. x 90 in. x 4.33 in.
Number of Coils per Bank	1	1
Fin Type	Flat	Oval Pyramid
Fins per Inch	5	6
Number of Feeds	48	72
CFM	66000 ACFM	
Entering Air Temps (DB/WB)	107.8°F/73.9°F	
Evaporating Temp	63°F	
Capacity	1,226,000 Btu/hr	1,241,000 Btu/hr
Refrigerant Pressure Drop	9.5 Psi	9.6 Psi
Air-side Pressure Drop	**0.23 in. H_2O**	**0.161 in. H_2O**

In this scenario, the air-side pressure drop was reduced by 30%. Following the assumptions from above, this corresponds to a 955-watt reduction per unit, or 1.28 horsepower.

The above examples prove an aerodynamic tube profile lends itself to significant energy savings. The two coils shown are four-row coils with low-to-modest air-side pressure drop. Applications that have deeper coils and a higher air-side pressure drop will show larger energy savings.

Please contact our application specialists for assistance with your detailed application needs.



Conclusions

We presented two examples illustrating how switching coils from round to oval tubes leads to potential energy savings. The more aerodynamic shape reduces drag, reducing air-side heat transfer performance. However, by using computational fluid dynamics (CFD), Coilmaster has created a family of fin surfaces that can recapture this lost performance while sacrificing as little of the air-side pressure drop reduction as possible.

We believe our oval tube family offers viable solutions to help the buildings they serve substantially reduce energy consumption.

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