FIN AND TUBE SPECIFICATIONS

A+Series™ Air Coolers

COLMAC COIL Manufacturing Inc.

Introduction

Colmac Coil A+Series™ air coolers are available with multiple fin and tube patterns, allowing them to be easily optimized for any operating conditions. Matching the cooler to the application will ensure the best performance and longest runtimes from your A+ Series™ cooler. This bulletin provides an overview of the available options, their effects on cooler performance, and when to use them.

Tube Diameter

The diameter of the tubes in a cooler has a direct effect on the flow pattern of the refrigerant traveling through them. This flow pattern is a major factor in the heat transfer efficiency and refrigerant pressure drop of the cooler. Matching the tube pattern to the refrigerant flow rate will help achieve the best flow pattern.

Because the refrigeration system type provides a general idea of what the flow rate of the refrigerant will be, it can be used as a guideline to select the tube size. A+ Series™ air coolers are available in two tube diameters: 5/8" and 7/8".

5/8" Tubes

This size is preferred for systems with lower refrigerant mass flow rates, such as DX and glycol coolers. The smaller tube area does, however, create more refrigerant pressure drop, which limits its use in certain applications. Pump recirculated coolers can use 5/8" tubes, as long as an acceptable refrigerant pressure drop can be reached. Colmac's A+Pro™ software automatically calculates this and will provide notification if it cannot be achieved. CO_2 systems commonly use 5/8" tubes, due to their higher working pressure.

7/8" Tubes

The increased area of this tube allows it to accommodate more refrigerant flow with lower pressure drops. It is the most common choice for pump recirculated coolers and is required for flooded operation. With a Colmac tube enhancement, it can also be used for glycol/brine or Low Temperature DX ammonia coolers.

TABLE 1

Common Tube Diameters Based on System Type*

Refrigeration System	Tube Diameter
Flooded	7/8" (required)
Pump recirculated	5/8 or 7/8"
Single phase liquids, brines	5/8" or 7/8" enhanced
Standard DX	5/8"
CPR	5/8" or 7/8"
Low Temp DX Ammonia	7/8" enhanced (required)

*Always verify design using Colmac's A+Pro™ software or by contacting your local Colmac representative.

Tube Pattern

The arrangment of the tubes in the cooler determines how the air will flow around them. This affects the air side heat transfer of the cooler as well as the air pressure drop. There are two basic styles of tube patterns, staggered and inline. A staggered pattern causes more air turbulence, which increases heat transfer, but also causes a greater air pressure drop. Inline patterns allow the air to pass more easily for a lower air pressure drop, but more evaporator surface is required with this pattern. The A+ Series™ coolers combine these patterns with the tube diameters for three options: 5/8" staggered, 5/8" inline and 7/8" staggered.

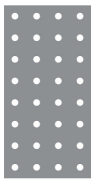
5/8" tubes, 1.5" Staggered Pattern (Fig. 1)

Figure 1

This is a compact pattern for high heat transfer efficiency in a small envelope. This results in the cost effective solutions for warm temperature (>32°F) applications that have low refrigerant flow rates. Because of the compact nature of this pattern, it is more quickly blocked by frost buildup and therefore not recommended for room temperatures below 35°F. Common feed methods for this pattern are DX, single phase liquids/brines, CPR, and low overfeed pump recirculated systems.

5/8" Tube, 2" (50mm) Inline Pattern (Fig. 2)

Figure 2

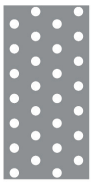


This is a wider pattern with the lowest fan power requirement of the three options. With more space between the tubes, it is also well suited for frosted conditions (<32°F) when a 5/8" tube is required. The clear line of sight through the evaporator also increases the cleanability of the inline pattern. The large amount of secondary (fin) surface also helps distribute frost buildup over a large area, allowing for the longest runtime between defrosts of all three patterns.

Electric defrost A+ Series™ coolers are only available in this pattern due to its ability to accommodate heating elements without dropping tubes.

7/8" Tube, 2.25" Staggered (Fig. 3)

Figure 3



This is a widely spaced staggered pattern for high heat transfer efficiency while minimizing the effect on air pressure drop. This pattern has the widest tube spacing and large amounts of secondary surface area for excellent frost carrying capacities and runtimes. The A+ Series™ Engineering Catalog is designed exclusively with this pattern.

Fin Spacing

Fins make up the majority of the heat transfer surface of the cooler and have the greatest effect on its overall heat transfer, air pressure drop and runtime. More closely spaced fins are good for getting the most capacity out of a given envelope, but are more sensitive to blockage by frost and debris. Wider spaced fins provide a lower air pressure drop and more space for frost buildup, but require the cooler to be larger. The most common fin spacing choices are detailed below.

6 FPI (Fins per Inch)

This is the tightest fin spacing available on A+ Series™ coolers. This provides the maximum heat transfer surface area, but can quickly become blocked by debris or frost. It is recommended only for high temp applications (> 35°F) with light condensation and minimal airborne debris. Air velocities must be kept below 600 fpm to prevent water carryover.

4 FPI

By increasing the space between fins, more room is provided for frost to build without blocking the air flow. Because the fins are wider, there are less of them, resulting in slightly less heat transfer surface. This is the standard spacing for medium temperature applications (0°F – 35°F) and is also recommended for high temperature applications (> 35°F) when large amounts of airborne debris are expected. In applications above freezing, air velocities must be kept below 600 fpm to prevent water carryover.

3 FPI

This is the widest standard fin spacing available on A+ Series™ air coolers. It provides extra room for frost buildup, particularly when used with variable fin spacing, as explained below. This spacing is recommended for low temperature applications (< 0°F).

Variable Fin Spacing (Fig. 4)

Variable fin spacing reduces the fin spacing by half on the first two rows of tubes, providing added space for frost buildup where it is needed most. This is recommended in applications with heavy frost accumulation due to airborne ice crystals, such as blast freezers and in cold stores near doorways. Variable fin spacing will provide the longest runtime between defrosts.

Figure 4
Variable Fin Spacing

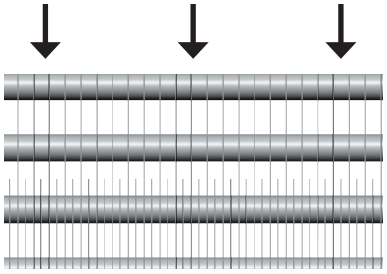


TABLE 2

Recommended Fin Spacing Based on Operating Condition

Room Temp	Conditions	Fin Spacing
> 35°F	Standard	6 FPI
	Fouling/Debris	4 FPI
0°F – 35°F	Standard	4 FPI
	Heavy Frost	Variable: 2/4 FPI or 1.5/3 FPI
< 0°F	Standard	3 FPI
	Heavy Frost	Variable: 1.5/3 FPI

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