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Air in open cooling tower piping.

Open cooling towers cool water by direct contact with the cooling air. During this process the contact between air and water is made as intensive as possible to obtain optimal heat transfer. Therefore the water in the tower sump will always be fully saturated with air. Furthermore, the water droplets falling from the heat exchanging surface (fill pack) will drag some air into the sump water, so a small portion of air bubbles in the water cannot be avoided. This is especially true for counter flow cooling towers. Hence it is safe to say that some presence of air in the cooling tower water system cannot be avoided. The amount of air that can be dissolved in water decreases with increasing temperature and decreasing pressure. Long pump suction lines, especially with high pressure drop will allow the air to separate from the water. This air might accumulate in ‘air traps’ or in low velocity parts of the system. Proper piping design is paramount to prevent problems. The BAC-US website incorporates a document ‘Cooling Tower Pumping and Piping’* which includes extensive recommendations regarding tower piping design. In summary following rules should be followed:

- Keep pump suction lines as short and simple as possible.
- Install the pump as low as possible below the tower and certainly below the tower minimum operating water level in the tower.
- Keep suction lines below tower operating level.
- Install vertical drop lines as close as possible to the tower outlet to pressurize the suction lines as much as possible.
- Keep the velocity in suction lines low (typically below 1.2m/s)
- Avoid accessories that increase pressure drop (bends, strainers, valves, reductions,…) in suction lines.
- Avoid air traps and long horizontal suction lines.
- Piping design should consider pull-down to avoid overflowing towers at shut down and air suction during start up.
- By-pass lines should be designed properly to avoid air suction during bypass mode.

Besides piping design it is clear that the operating level in the tower must be kept correct to avoid excessive air suction. The strainer in the tower should be kept clean to keep suction pressure low. If a normal portion of air inherent to open tower systems cannot be accepted, an air separation device must be added to the pump suction line near the pump but this is no part of the BAC scope of supply. In some cases additional purging in pressure lines might be needed as well.

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*http://www.baltimoreaircoil.com/english/resource-library/file/552 (this link was valid at the moment this document was created. Search website for details if document is not found)