

Pressure Drop Through Tube Bundles

Matt Boelens and Professor Sykes

This past summer, I was blessed with the opportunity to study the pressure drop through tube bundles with Professor Sykes. A tube bundle is essentially a cluster of tubes/pipes packed tightly together inside of a larger pipe (see top picture). Tube bundles primarily serve two purposes. The first is as a heat exchanger. In a heat exchanger, one fluid flows through the smaller pipes of the tube bundle while another fluid flows inside the larger pipe containing the tube bundle. These two fluids are at different temperatures, and as they flow by each other they exchange heat. The initially cooler fluid heats up and the initially warmer fluid cools.



The second purpose of tube bundles, the aspect Professor Sykes and I focused on, is to act as flow straighteners in a pipe. As a fluid flows through a pipe, its flow is chaotic with fluid moving in every direction (picture water flowing through rapids). This is called turbulent flow. When a tube bundle is inserted into the flow, it forces the particles to move straight through a smaller

area, which straightens out the flow.

Completely straightened flow is called laminar flow. However, when a tube bundle is inserted into a pipe it increases the flow resistance because now the fluid has to move around the tube bundle. The increase in resistance results in a decrease in pressure of the fluid.



Professor Sykes and I analyzed the decrease in air pressure associated with several different tube bundle designs. To perform these tests, I designed and built an 8-foot test

section for Calvin's wind tunnel (see picture to left). As air flows through the PVC pipe in the test section, the air pressure is measured before and after the tube bundle. We haven't yet been able to test in the wind tunnel due to availability issues, but we are looking forward to testing very soon.

Working on research at Calvin this summer has given me more hands-on engineering experience than any job I had prior. In building the test section I gained more experience with the design process and I became very experienced with Calvin's wood and metal shop equipment. I feel very prepared and am very excited to continue in the engineering field as an intern next summer.