Pressure drop formula in straight pipe:

Where *delta P* is pressure loss, *f* is the Darcy factor we will find below, *L* is the length of a pipe, *D* is the diameter of the pipe, *rho* is density of fluid, and *V* is velocity.

The fD can be calculated from

Where is roughness of pipe, *D* is inner diameter , and Red can be calculated from below

The Red can be calculated from

Where *rho* is density of fluid, *V* is flow speed, *D* is characteristic length (in this case pipe diameter), and is viscosity of fluid.

Pressure drop in elbow and Valves:

Where *K* is coef. we can look up, *V* is velocity of the fluid, is density of fluid

Delta P total is (1) + (2) for a number result. Larger is bad.

Scenario 1

5. based on the graph observed we can see more fluid speed will cause more pressure drop since the calculated Re is at 30000, meaning the flow was turbulent in all pipes. However the lower pressure drop increases slower than the upper, meaning more coolant will flow through the lower if nothing but the flow speed change from 1 Lpm to 10 Lpm. The ratio between upper and lower also supports this conclusion(upper pressure drop was about 1.2 of lower, but is close to 2 when high flow). The fluid will enter lower pipe (heat exchanger) more, and bring the ratio flatter.

Scenario 2

5. The chart indicates that the valve resistant coefficient change from 0 to 10. Higher coefficient means the liquid is harder to pass through the valve. We can see when K is below 1, more fluid tend to pass through the upper bypass with valve. When the K is larger than 1, more fluid like to go through the heat exchanger. As K increases (maybe the valve is closing), more fluid is passing through the heat exchanger. We can see the pressure drop is constant in the lower path. This is because the lower part has no valve, and the flow speed is constant.

Scenario 3

5. In this case we see how viscosity changes will affect the flow between the two paths. We can see as the viscosity increases, the pressure drop increases faster in the lower path. The more stickie the liquid, it is less wanting to go through the heat exchanger. The ratio between upper and lower pressure drop chart support this claim, and as the viscosity approaching 0.01, the ratio is going close to 1 (upper was 1.7x of lower, but then 1.1x of lower at 0.01 Pa.s). This means the pressure drop number is getting close, and it is because the lower piping pressure drop is increasing very fast.