Applications

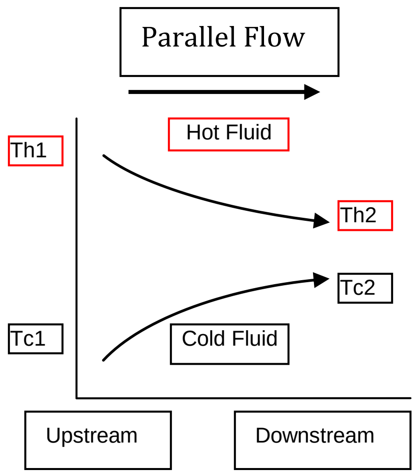
Jacketed pipe

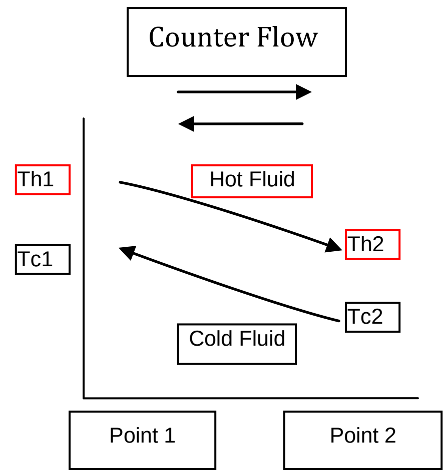
Log Mean Temperature Difference (LMTD) used in derivation of heat transfer solution.

Assuming fluids specific heats do not vary with temperature and convection heat coefficients are constant throughout the heat exchanger.

Fluids may flow in parallel or counter flow directions.

Temperature profiles are as follows.





The convective heat transfer coefficient for forced convection is a function of the *Prandtl* number and the *Reynolds* number.

Heat transfer from the wall of a pipe uses the area of the pipe expressed by A=pi*d*l *(circumferential area).*

$q_{cv} = hA(t_w - t_\infty)$

Two dimensionless numbers used to predict the temperature of an object over time include the *Biot* number and the *Fourier* number.

To determine heat transfer to a fluid in a pipe

$q_{cv} = \dot{m}c_p(t_e - t_i)$

Where

ṁ= mass flow
$\dot{m} = \rho A v$
Where
ρ= density of fluid
*A=pi * r^2 (cross sectional area)*
v=fluid velocity
c_p= specific heat value

To calculate the convective heat transfer coefficient *(h):*

- Flow in a tube: use *average bulk temperature*
- Flow outside a tube: use *film temp*
- Natural convection outside a tube: use *film temp*

To increase convective heat transfer coefficient:

- *Increase velocity of the fluid*
- *Increase Prandtl number (Pr)*
- *Decrease viscosity of the fluid*
- *Increase thermal conductivity*