Ashe Morris

# A novel method for controlling heat exchangers

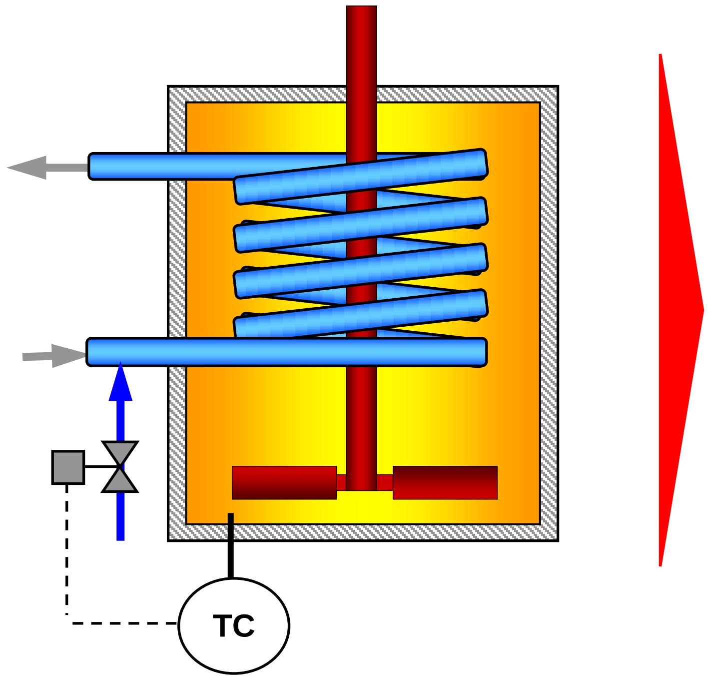
***Presentation to the 8th Meeting of the Process Intensification Network***

*14th November 2002*

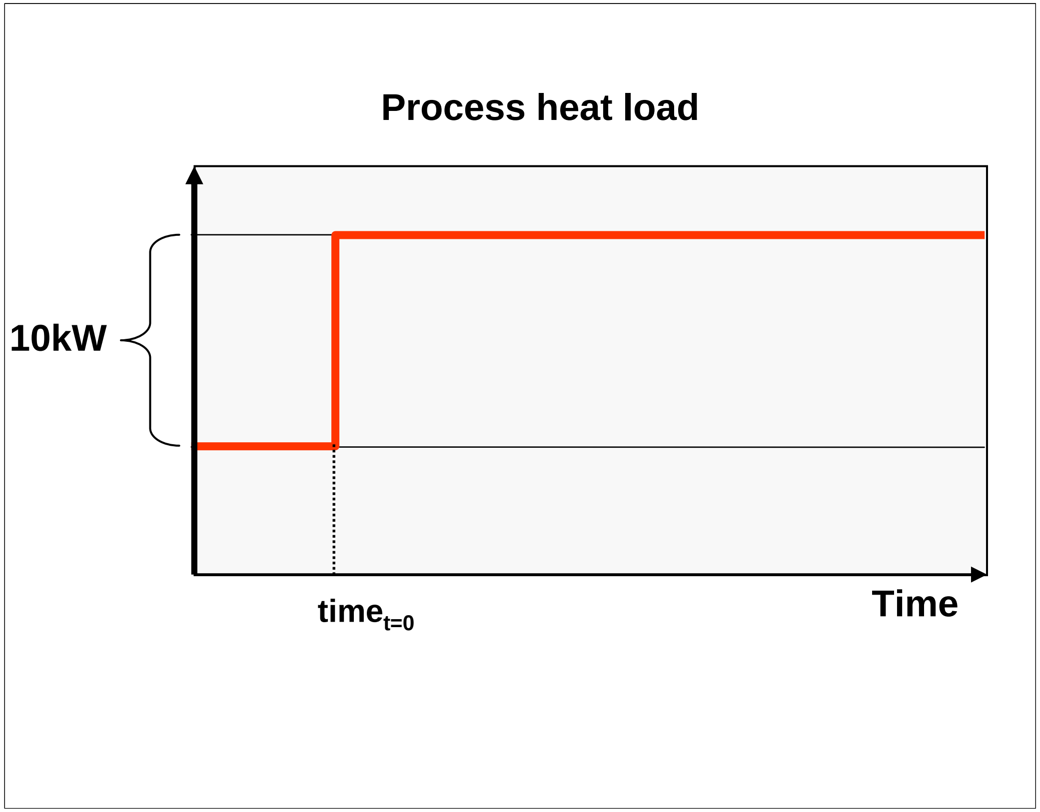
*Robert Ashe*

# Conventional temperature control

**Example: Batch vessel with internal cooling coil…**

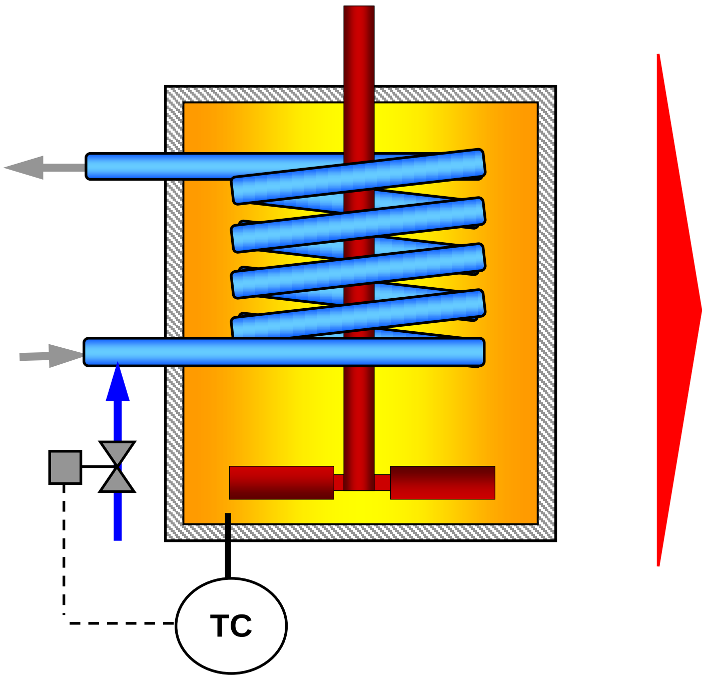



**… undergoes a step change in heat load**

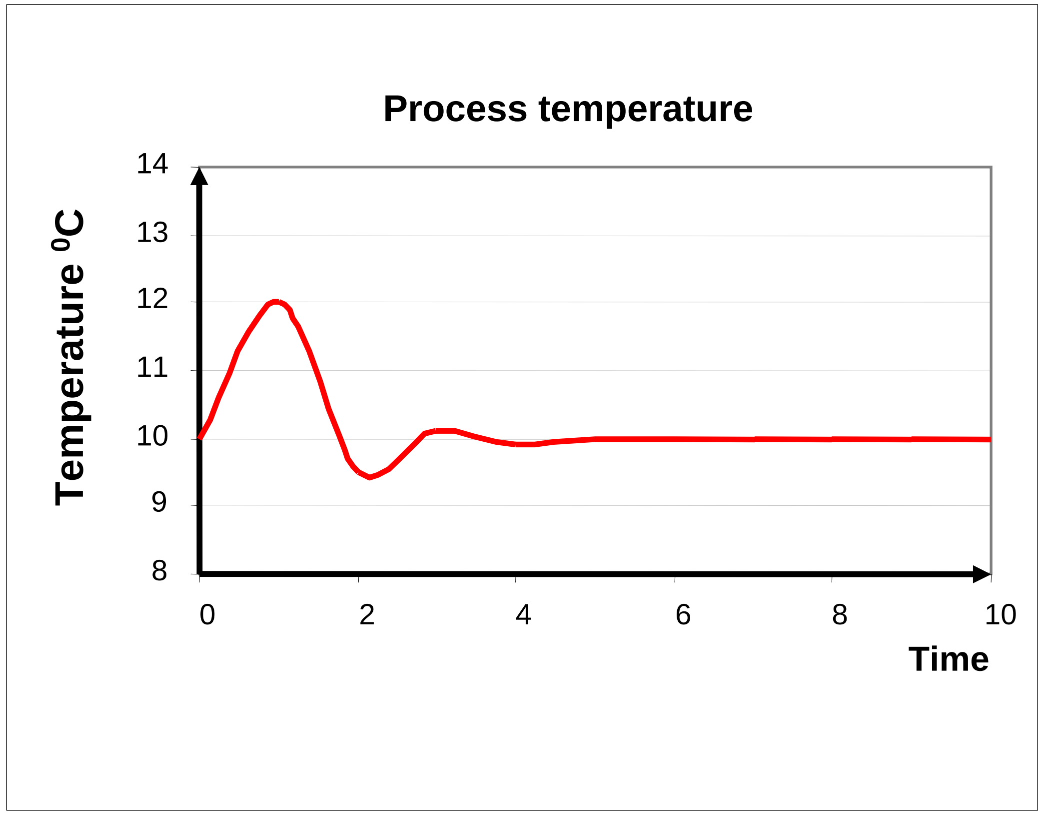


# Conventional temperature control

**Example: Batch vessel with internal cooling coil…**

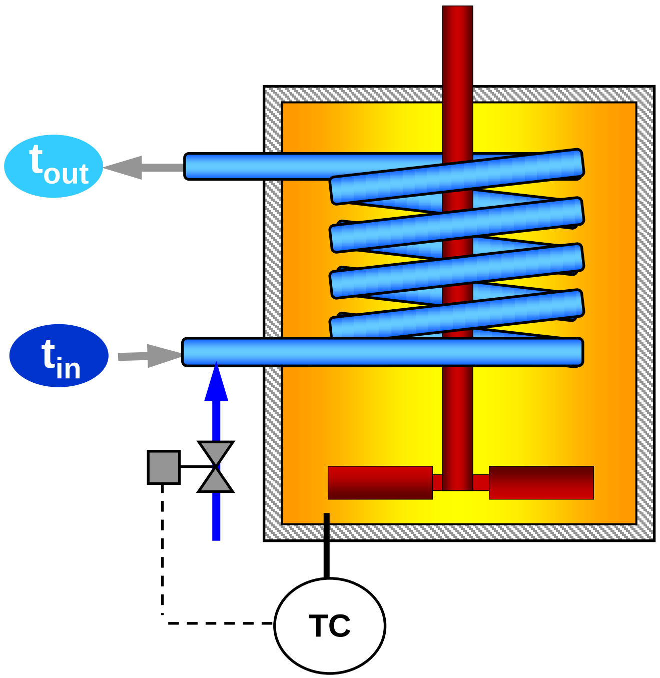



**… the temperature rise of the process is corrected by varying the cooling coil loading**



# Heat balance measurement

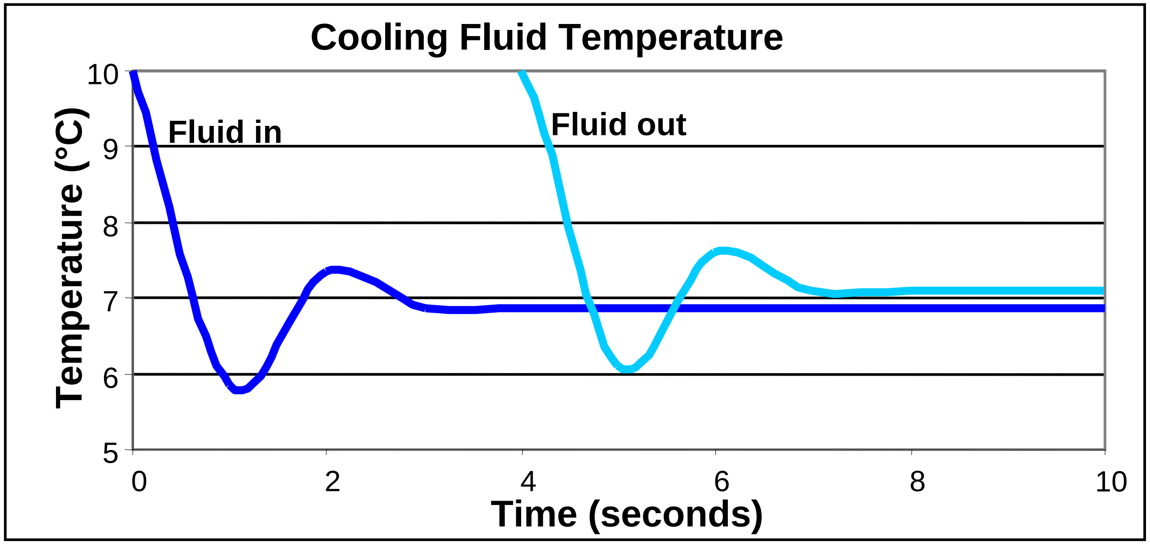
**Example: Measuring a heat balance across the coil…**




**Process heat load 10 kW**

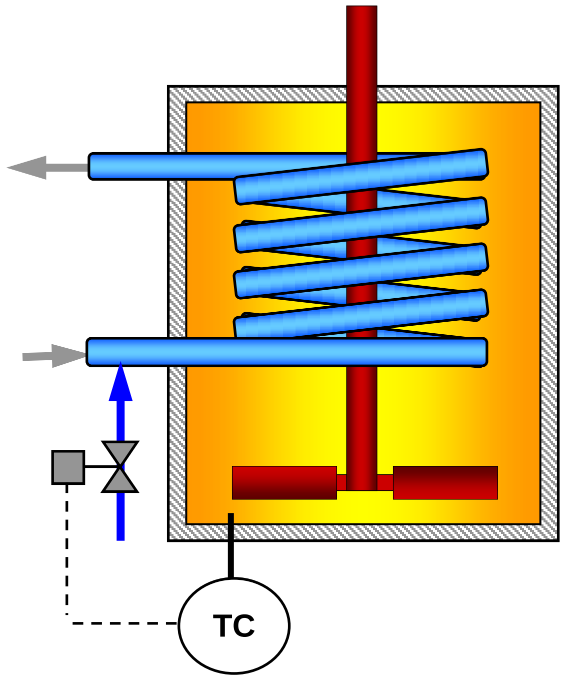
**Coolant flow 10 kg/s**

**… the cooling fluid temperature is varied to to control the process fluid temperature**



# Heat balance measurement

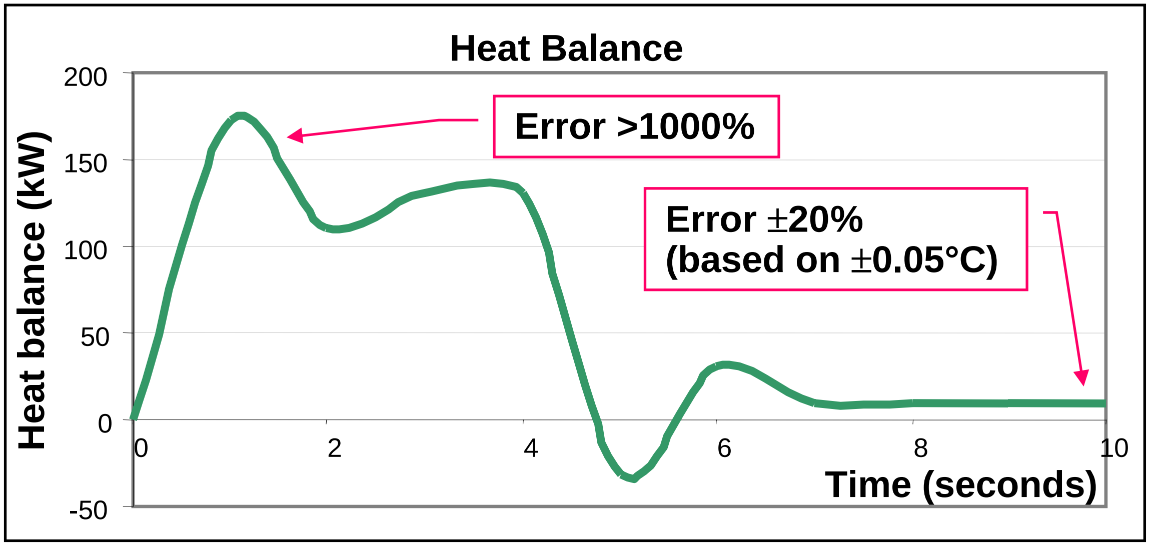
**Example: Measuring a heat balance across the coil…**




**Process heat load 10 kW**

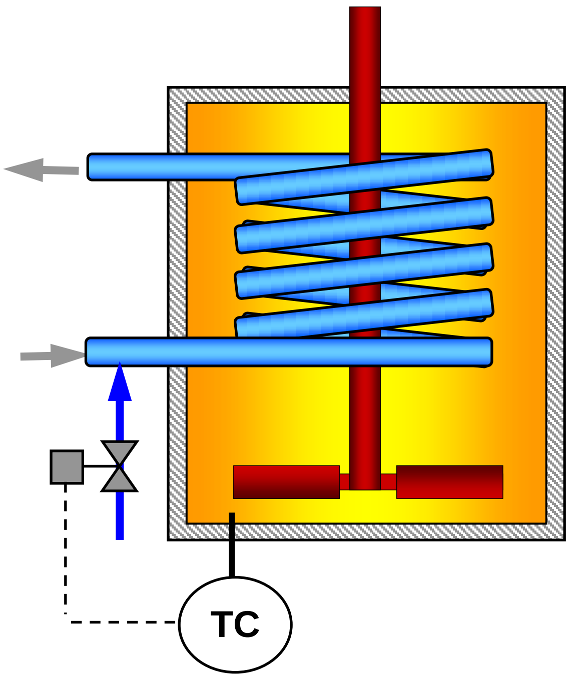
**Coolant flow 10 kg/s**

**… the subsequent heat balance yields large errors**

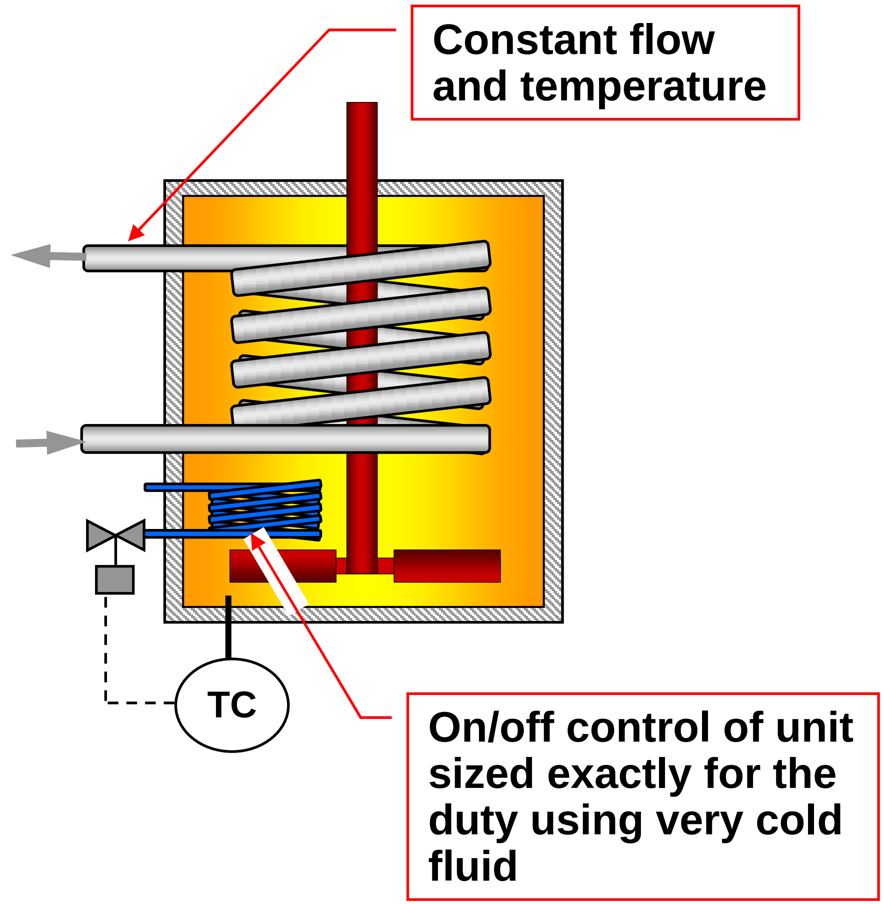


# Variable area control

**Conventional "Fixed Area" control**



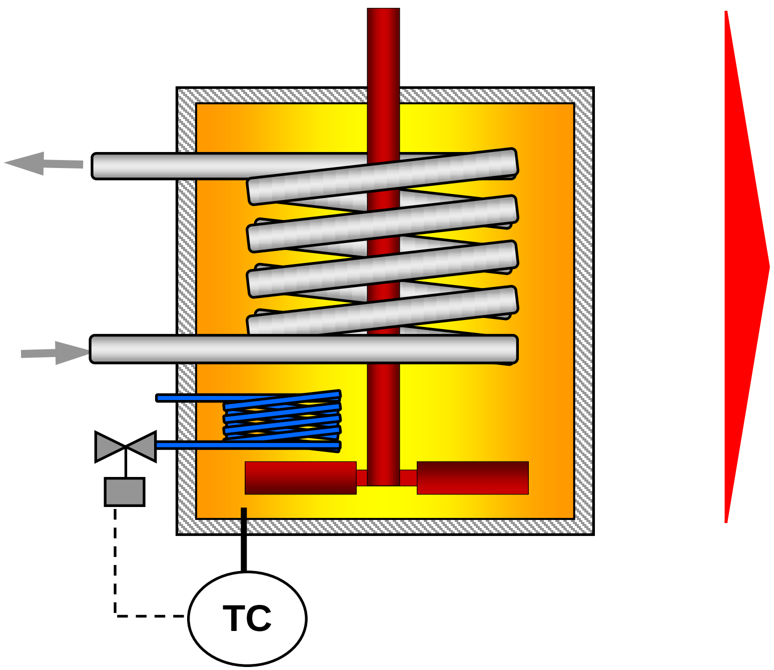

**Novel "Variable Area" control**

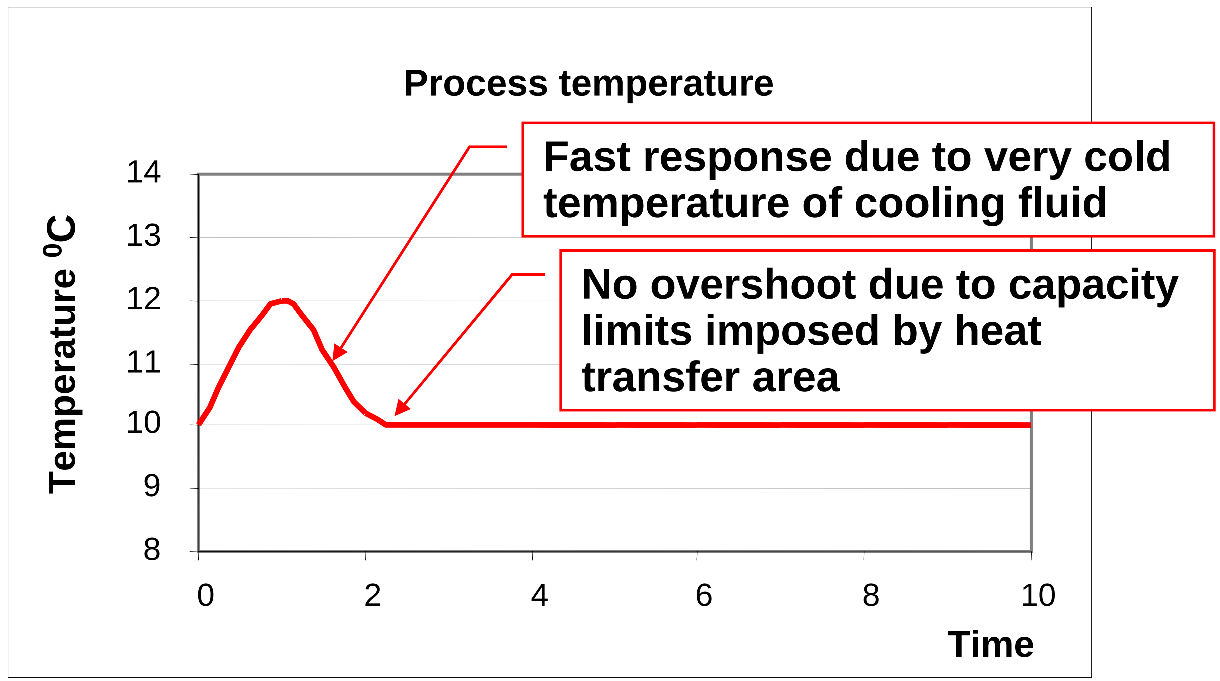


# Variable area temperature control

**Example: The same 10kW step change in heat load**

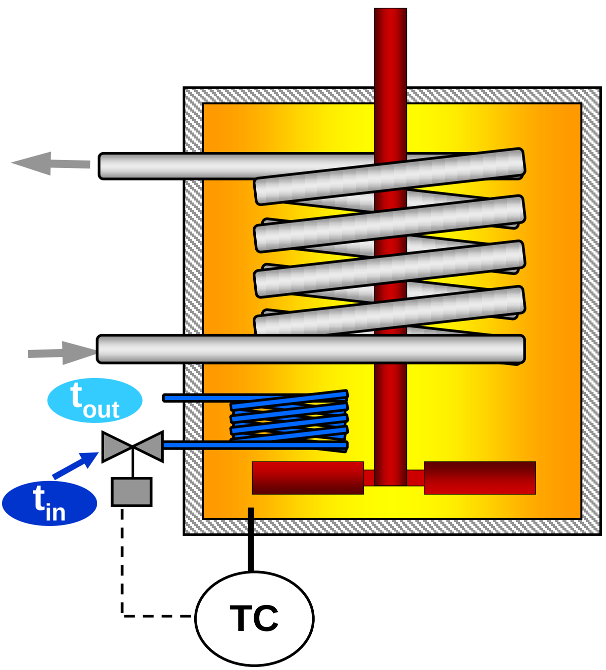
**… process temperature control is quicker and more stable**



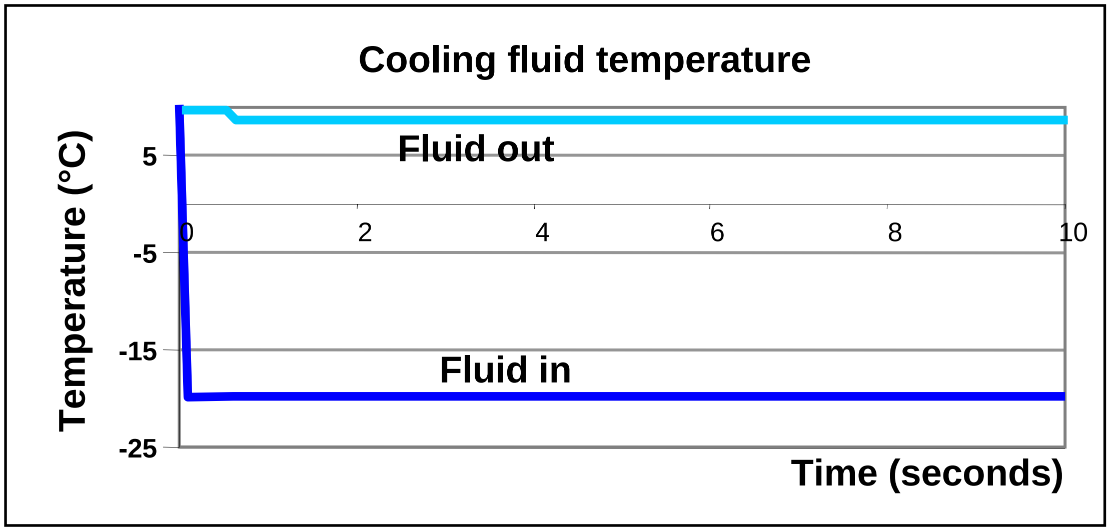



# Variable area heat balance

**Example: Measuring the heat balance across the <u>"on/off"</u> coil**



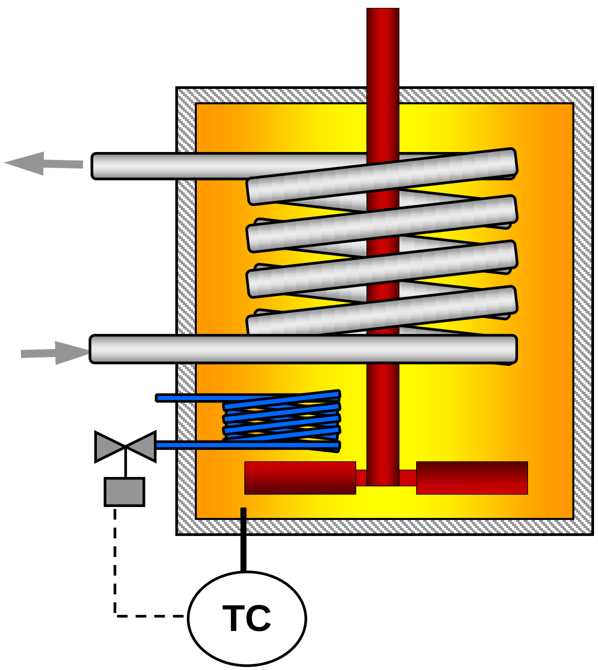

**… the cooling fluid temperatures look quite different**

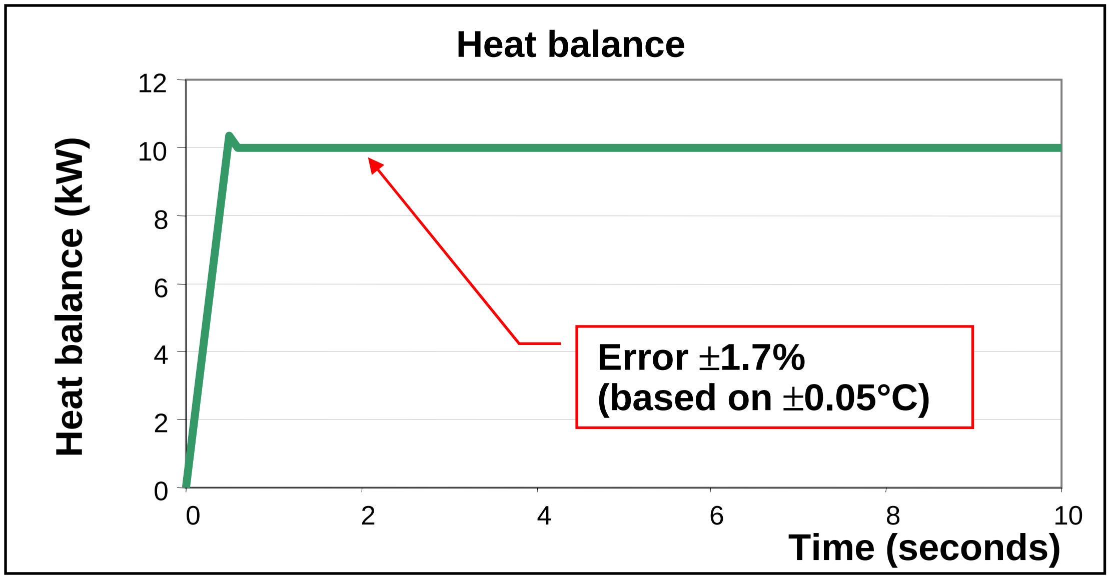


# Variable area heat balance

Example: Measuring the heat balance across the "on/off" coil

… the subsequent heat balance is very accurate

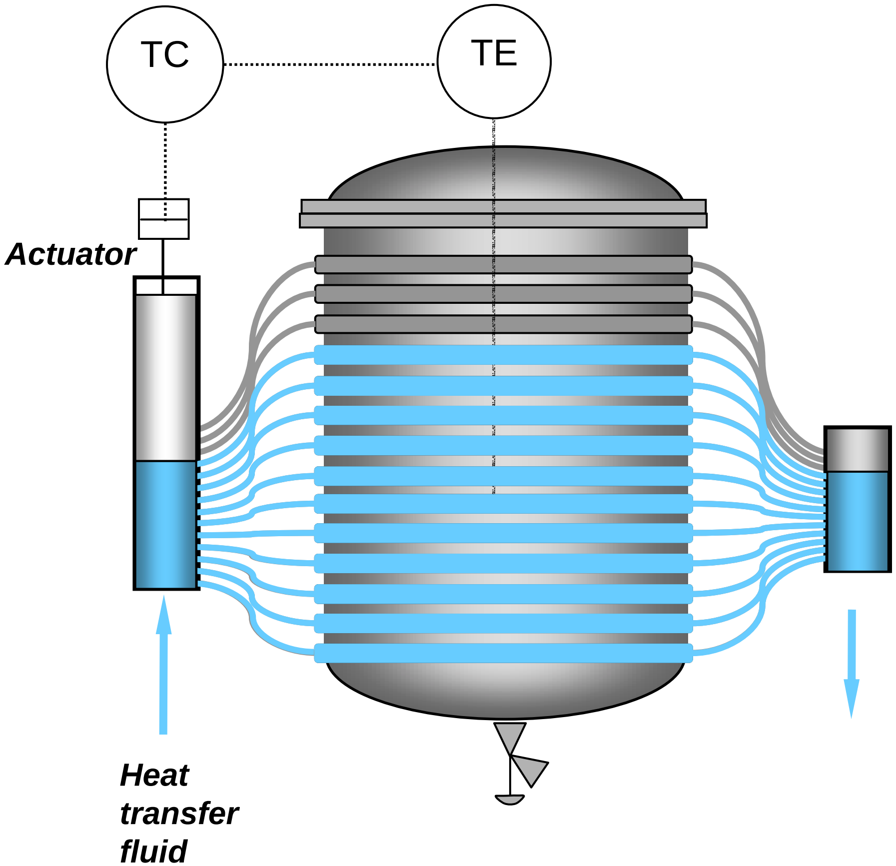


# So what?

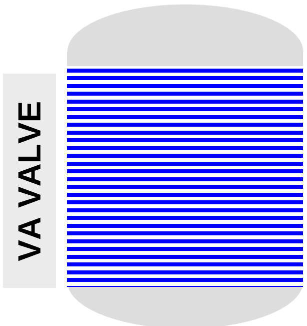
How can a heat exchanger be designed which matches heat transfer area to heat load at constant LMTD?

# Patented "variable area" jacketed reactor design

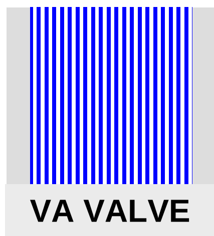



# “Variable area” design applications

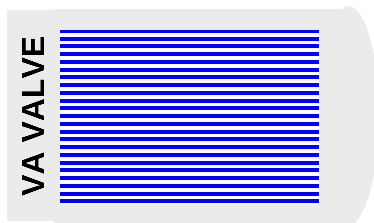
**Ashe Morris is exploiting this patented concept to develop better heat exchangers across a number of applications**



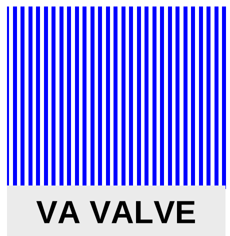

**Jacketed reactor**




**Plate**




**Shell and tube**




**Drilled block**

# Benefits of “variable area” control

**Existing batch reactors**

- Improved yield quality and safety from on-line reaction monitoring and better temperature control.

**Process intensification**

- Smaller reaction volumes
- Stable temperature control at higher thermal gradients
- Faster temperature control
- Accurate enthalpy data for on-line monitoring
- Transition from batch to continuous

**Tangible commercial impact**

# Ashe Morris Ltd.

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