How to Select and Size a Chiller

-What is process cooling
-Which chiller type is best for your application

Dimplex Thermal Solutions

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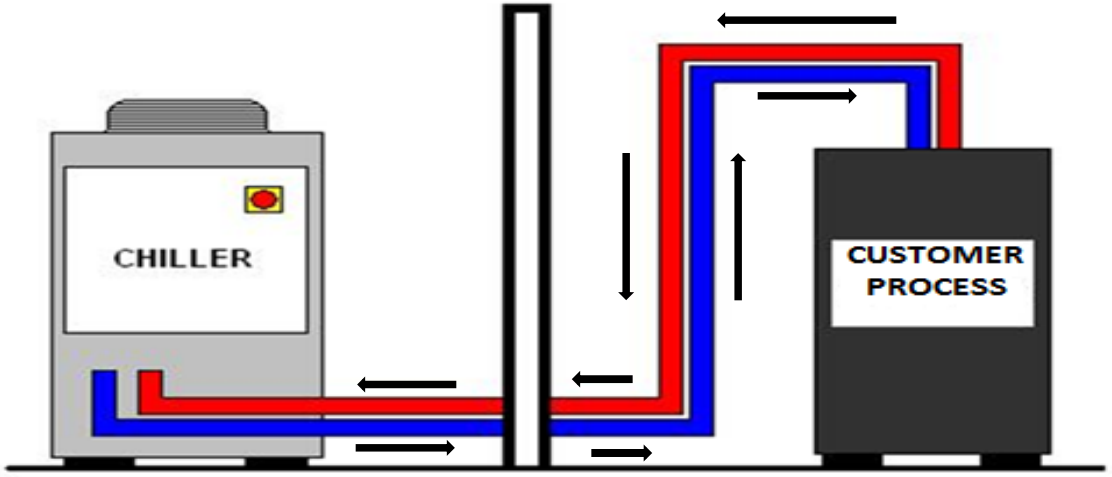
What is an Industrial Process Chiller?

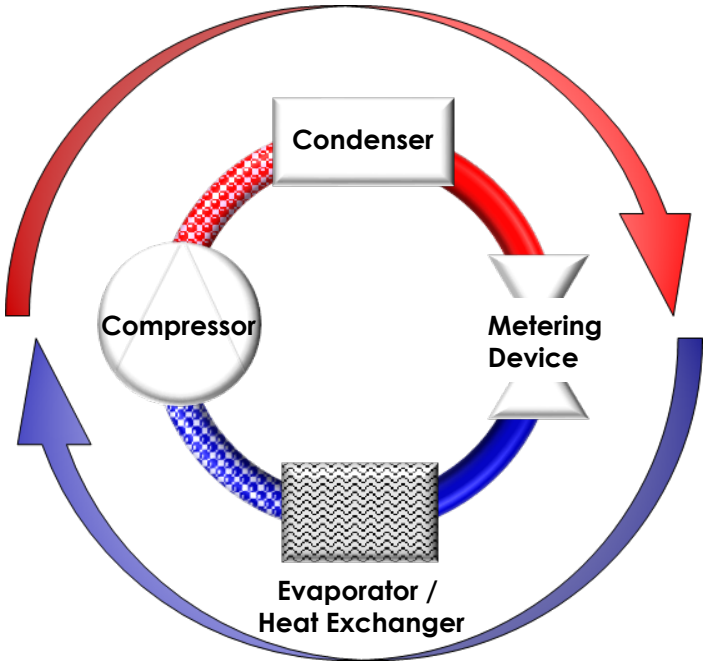
- Uses refrigeration to remove a heat load from processes such as machining, grinding, lasers, welding, hydraulics, etc.
- Maintains a constant fluid temperature and flow regardless of load
- Operates within the specified ambient conditions as designed



Process vs Air Conditioning Chillers

- **Process Chiller**
  - Made to operate at different temperatures, different fluids, different flow rates
  - Able to work with multiple pumps, multiple cooling loops, etc.
  - Systems typically includes pump and reservoir designed by the manufacturer and integrated into the chiller
  - Energy efficiency rating follows NPLV (Non-Standard Part Load Value) rules
- **Air Conditioning Chiller**
  - Made to run one temperature, one flow rate, one fluid type
  - Pressurized system most common
  - Pump and reservoir usually designed and sourced by the installing contractor
  - Energy efficiency rating follows IPLV (Integrated Part Load Value) rules

Refrigeration Circuit



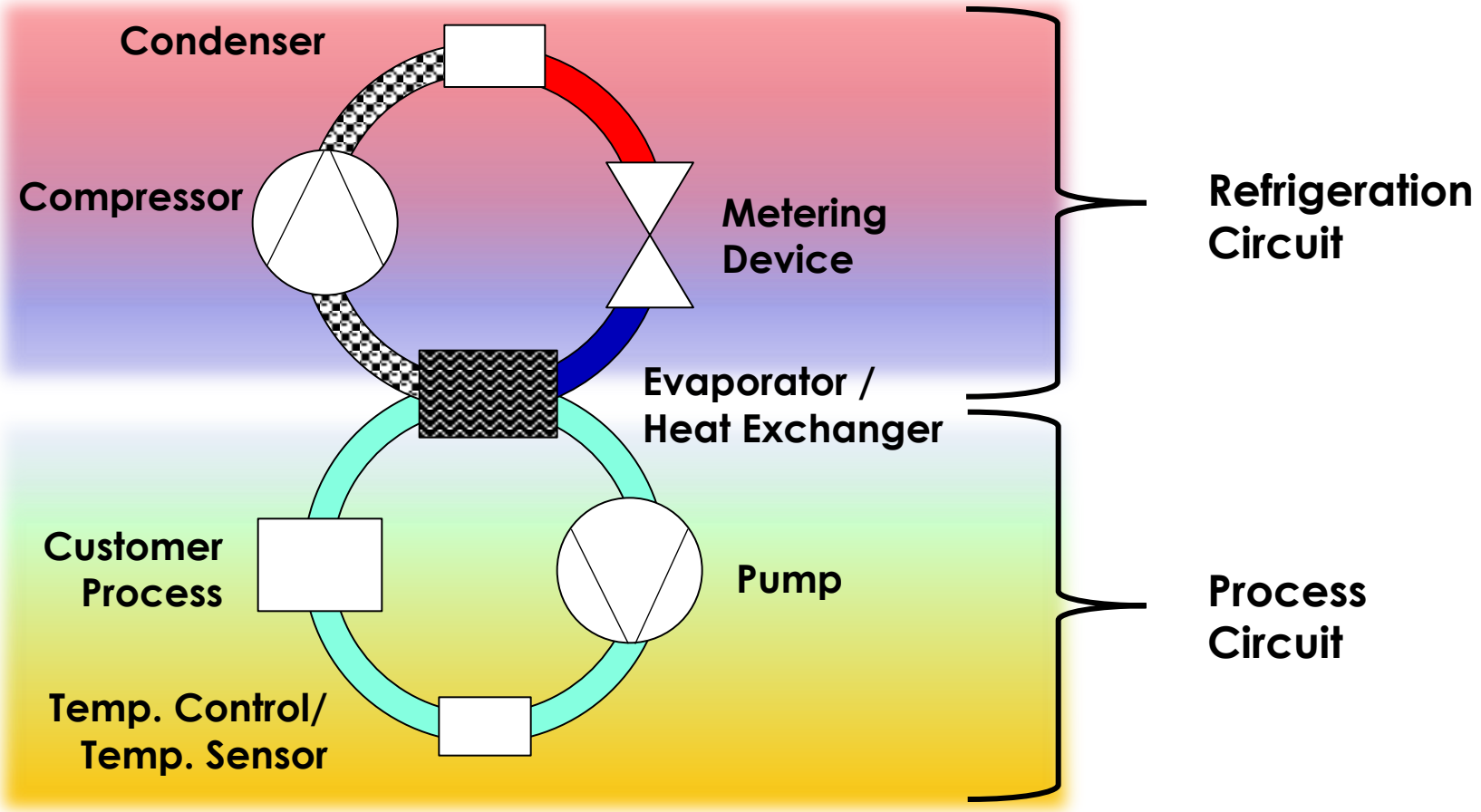
Types of Compressors
- Scroll
- Reciprocating
- Welded Hermetic
- Semi Hermetic
- Screw

Types of Condensers
- Air cooled
- Water cooled

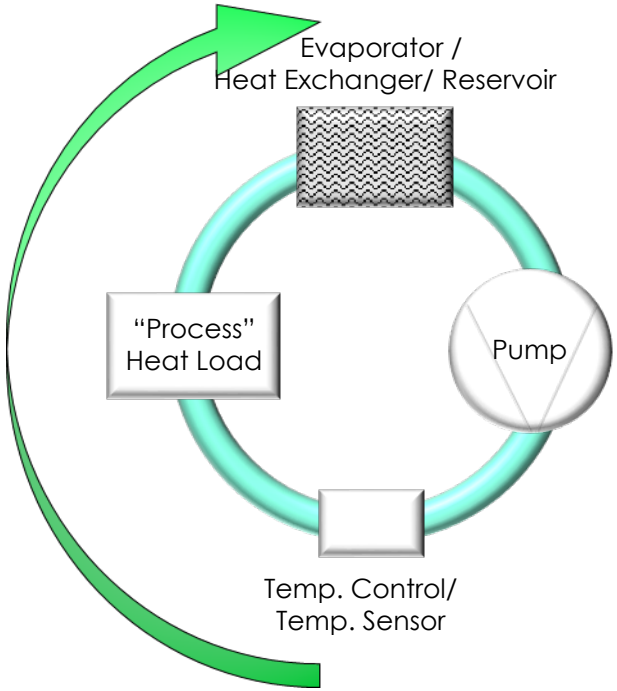
Types of Metering Devices:
- Capillary Tube
- TXV – Thermostatic Valve
- EEV – Electronic Expansion Valve

Types of Evaporators
- Brazed Plate
- Submersed Coil
- Shell and Tube
- Cleanable

Chiller Circuit



Process Circuit



Heat Load may require 1 or many Circuits

Types of Evaporators
- Brazed Plate
- Submersed Coil
- Shell and Tube
- Cleanable

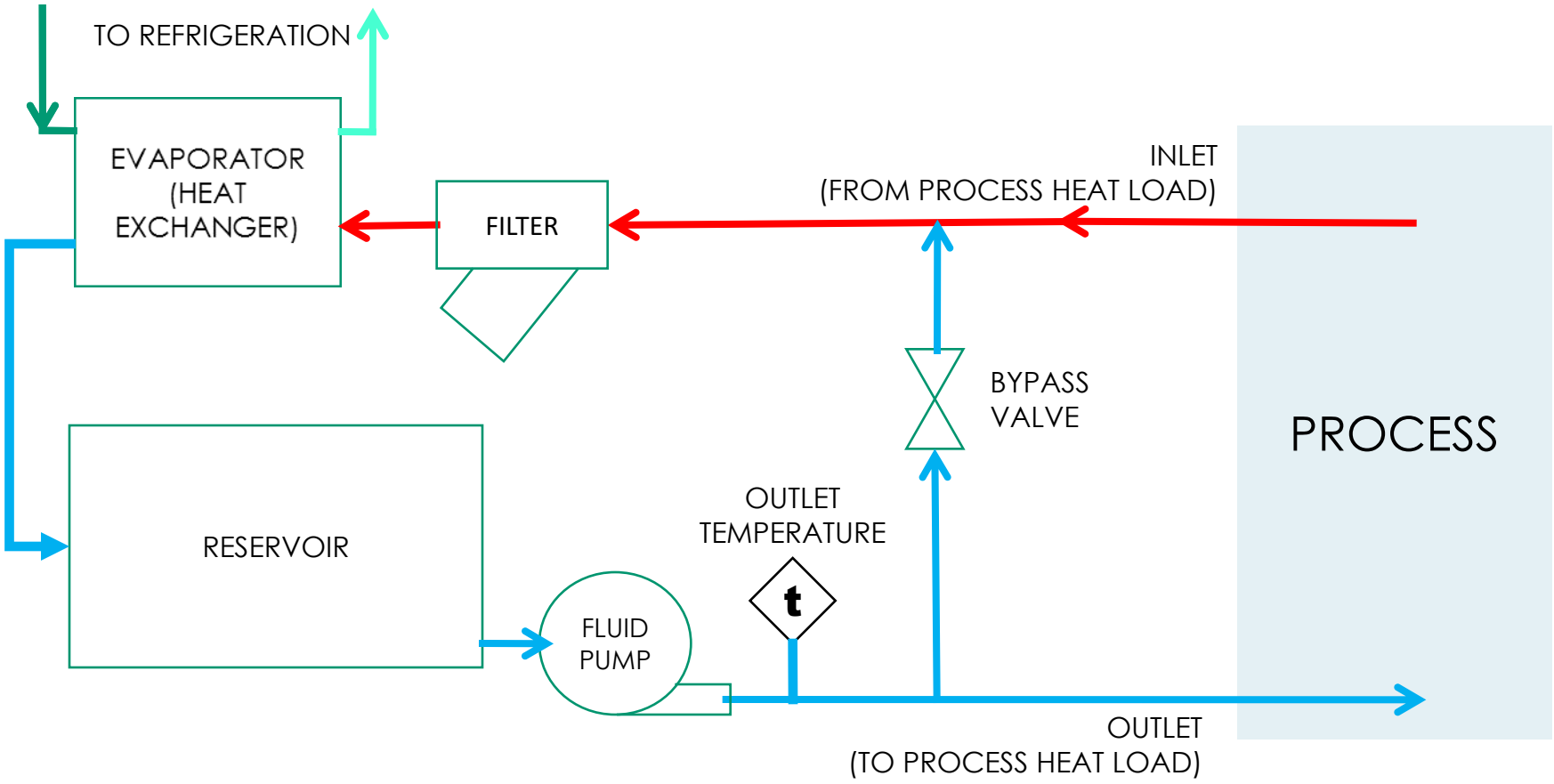
Types of Pumps:
- Centrifugal
- Single Impeller
- Self Priming
- Multi Impeller (Vertical, In-line)
- Positive displacement
- Vane
- Gear

Tank / Reservoir
- Internal to the Chiller
- External to the Chiller (part of the "process")

Temperature Control
- Simple
- Intelligent Control

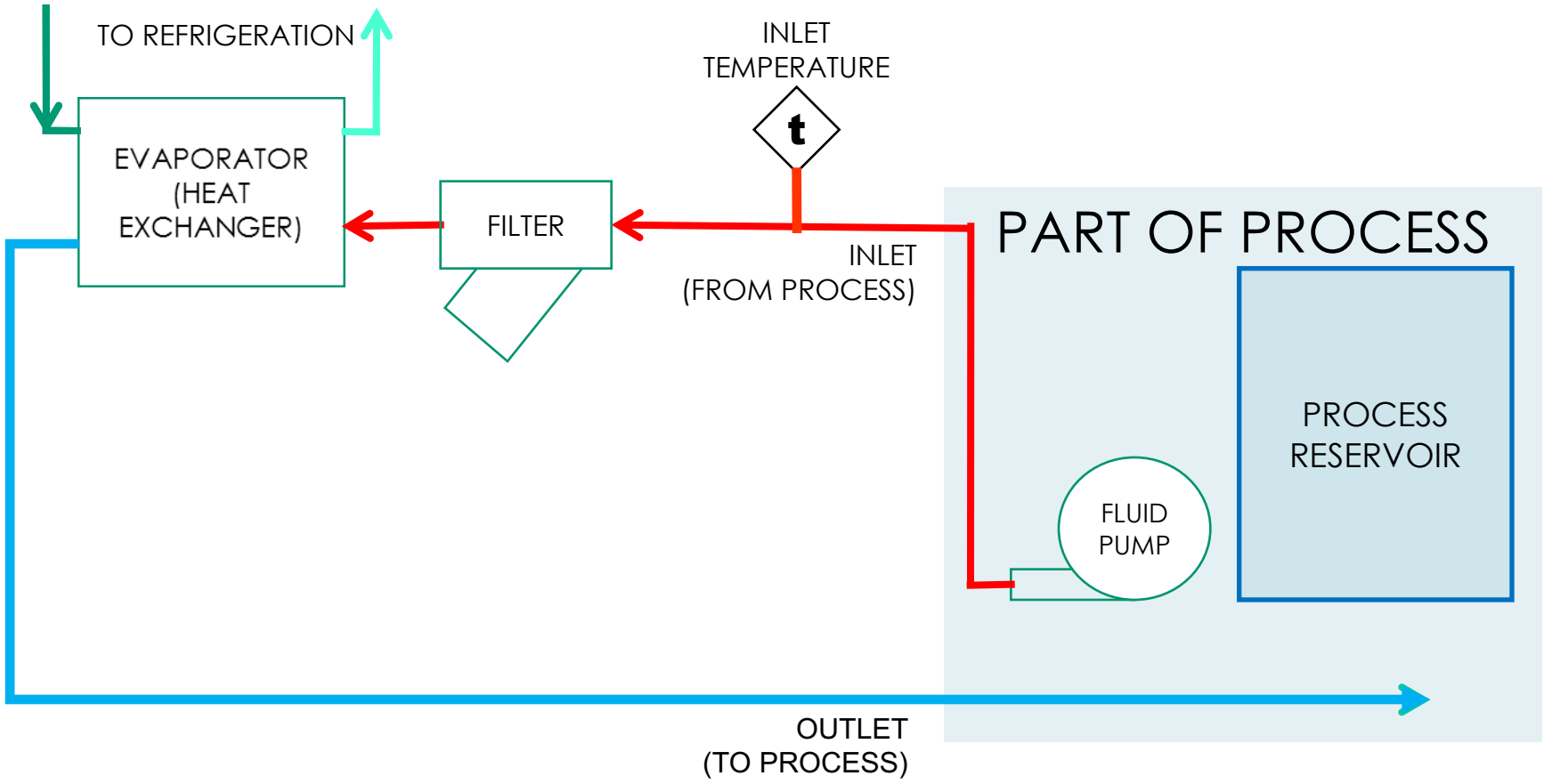
Basic Plumbing Circuit

Tank/Reservoir in the Chiller



Basic Plumbing Circuit

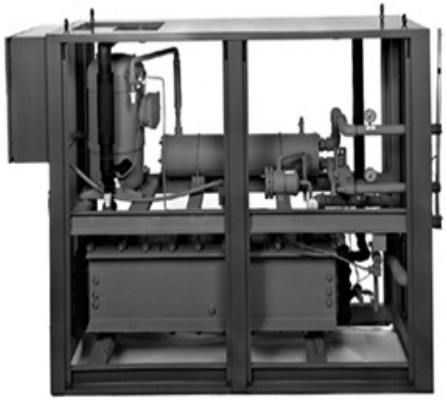
Tank/Reservoir/Pump in the Process



How do you choose and size a chiller to an application?

or

or



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Choosing a Chiller

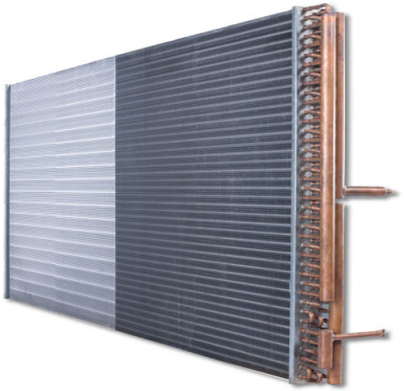
- One size does not fit all
- Where do you want the heat to go?
- What will you be absorbing heat with? (Process Fluid)
- How clean is the fluid?
- Reservoir, is it part of the process or in the chiller?
- Pump, is it part of the process or in the chiller?
- Portable / Stationary / Indoor/ Outdoor/ Split System
- Redundancy?
- Temperature Accuracy?
- Special Process Needs?
- Not Sure??? Don't guess, ASK!

Where do you want the heat to go?

- Heat does not magically disappear, it has to go somewhere!
- Air Cooled or Water Cooled?
- Must have air in / air out, air circulation
- Prevent warm air recirculation and condenser air starvation

Condenser

Air cooled



- Refrigerant condenses 20 to 30° F above air temperature
- Fans are used to enhance heat transfer
- Room must be large enough to reject heat from process plus heat of compression

Water cooled

- Rejects heat to tower water
- Lower condensing temperature than air allowing more capacity
- Improves system reliability due to lower refrigerant discharge temp

What will you be absorbing heat with? (Process Fluid)

- Water
- Water/Glycol
- DI Water
- Oil
- Water Soluble Oil
- Special Fluids

Glycol

- Use Industrial Inhibited Glycol
  - Keeps PH neutral
  - Straight Glycol without inhibitors is very base and will corrode copper
  - Do not use automotive anti-freeze
- Minimum mixture of **25-30% required** for inhibitors
- Less than 25% will promote algae and bacteria growth
- **Over 50%** decreases thermal transfer and will result in capacity loss in chiller
- Ethylene Glycol, toxic
  K-Kool E®, Dowtherm SR-1® (pink) or similar
- Propylene Glycol, non-toxic
  K-Kool P®, Dowfrost® (yellow/green) or similar

Fluid Tips

What you need to know about using/replacing:

- **DI Water** – (Maintained/Not Maintained) Monitor resin filter/ they typically have monitors that will tell you the resistivity of the water and let you know when it needs attention. All applications below 5 uS (Micro Siemens) require high purity plumbing.

- **Oil and Water Soluble** – The biggest concern here is to keep the oil and water soluble coolants free of debris and filtered to at least 50 microns.

- **City and Well Water** – City and well water must be checked in a system monthly, buildup of sediments and leaching of metals can build up in the system and lower cooling capacity as well as eat through seals. ***Distilled water is recommended wherever possible.***

How Clean is the Fluid?

Clean fluids (50 micron or finer filtration required)

- Brazed Plate heat exchangers (Evaporators) require clean fluid

Dirty fluids

- Submersed Coil, Shell and Tube or Cleanable Heat Exchangers (Evaporators) are better suited for dirty fluids each has advantages and levels of tolerance to dirty fluids
- Drop In chillers, which are evaporators whose tubes come in direct contact with the fluid, require agitation or movement of fluid

Brazed Plate Heat Exchanger

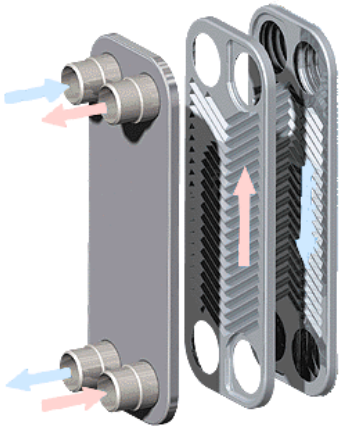
Stainless steel plate copper brazed or nickel brazed together

High turbulence

Compact

Must have clean fluid

Must be protected from freezing



Submersed Coil Evaporator

Can be copper tubes in an open tank or stainless tubes at the bottom of the chiller which is lowered into the process tank

Not damaged by accidental freezing

Not damaged by fouling

Tolerates dirty fluids

Tolerates wide fluid flow rate range

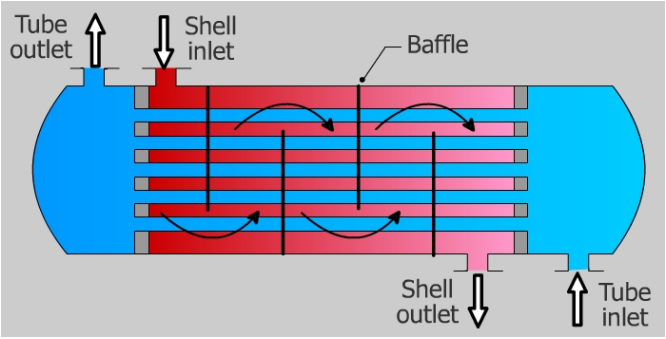
Shell and Tube Evaporator

Direct expansion of refrigerant in tube

Fluid side baffled to create turbulence

Fluid side is not cleanable

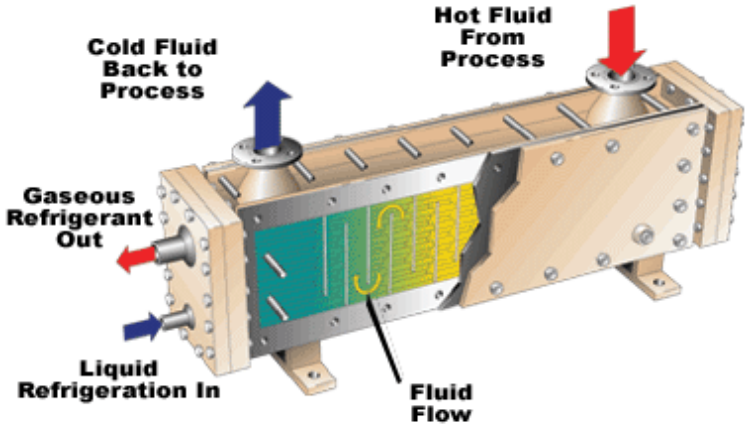
Must provide freeze protection

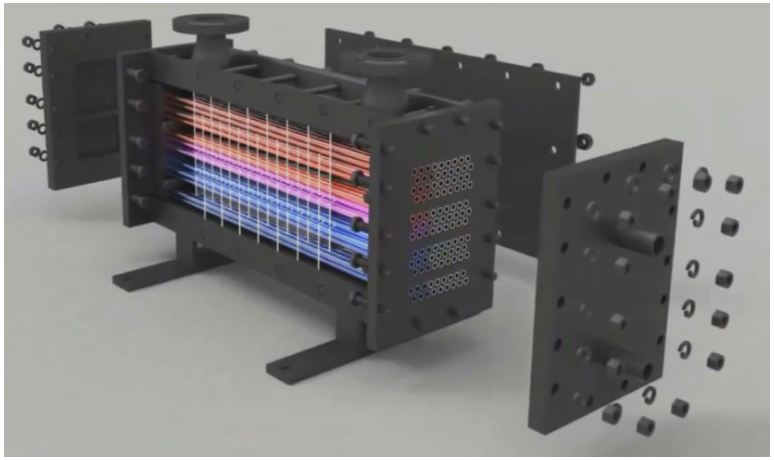


Cleanable Heat Exchanger

Allows cleaning without removing refrigerant or fluid piping

Allows direct cooling of cutting fluids





Types of chillers?

- Indoor Chiller Systems
  - Portable
  - Stationary
- Outdoor Chiller Systems
- Split Systems (Indoor process/Outdoor Heat rejection)
- Drop-in Chillers
- Redundant Systems
  - Redundant Pumps
  - Redundant Refrigeration Circuits
  - N+1
- Modular Systems
  - Expandable
  - Cooling for multiple processes at a central outdoor chiller
- **ASK!** Your chiller manufacturer

Modular and Redundant Systems

Split System

COMMENTS?

QUESTIONS?

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THANK YOU!