Heat Pump Chillers

YORK Industrial Systems

Johnson Controls

Heat Pump Benefits

Why use heat pumps?

Economic Advantages

- Operational savings

Social / Environmental Advantages

- CO_2 reductions
- Reduced water consumption

Industry Compliance

- LEED
- ASHRAE

Definition of a Heat Pump

ASHRAE Handbook 2008:

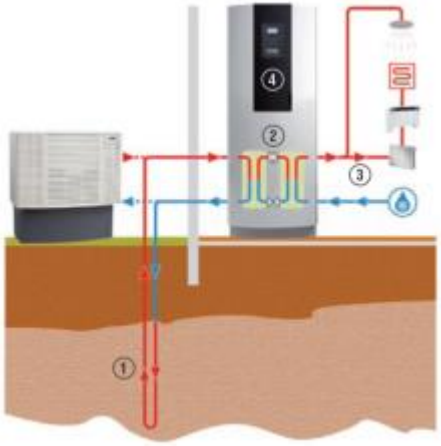
- "A Heat Pump extracts heat from a source and transfers it to a sink at a higher temperature."
- "In Engineering, … the term Heat Pump is generally reserved for equipment that heats for beneficial purposes, rather than that which removes heat for cooling only."

Capacity is determined by the heating requirement.

Types of Heat Pumps

Air-Source

Ground-Source



Water-Source

- **This discussion limited to large, non-reversing, Water-to-Water Heat Pumps (WTWHP).**

Sources and Sinks

SOURCES

- Large body of water at a relatively constant temperature
- Geothermal system
- Exhaust air
- Cooling tower water
- Sewage effluent
- Low grade waste heat
- Chilled water loop

SINKS

- Space heating
- Reheat for humidity control
- Domestic hot water requirements
- Process heating

Heat Recovery vs. Heat Pump

- **Heat Recovery Chiller –** Specifically designed to chill water
  - **Provides a percentage of heat as warm water**
  - Capacity controlled by **Leaving Chilled Water Temperature**
  - Condensing temperature is uncontrolled
  - Additional condenser bundle used to capture cooling tower heat rejection typically at temperatures 95°-115°F (35-46°C)

- **Heat Pump –** Specifically designed to heat water
  - **Provides 100% of heat as hot water**
  - Capacity controlled by **Leaving Condenser Water Temperature**
  - **Evaporator fluid temperatures uncontrolled**

Equipment Characteristics to Consider

- Heating Capacity (max & min)
- Maximum Leaving Condenser Water Temperature (104°F - 180°F, 40°C - 82°C)
- Maximum Lift Capability (60°F – 140°F, 16°C - 60°C)
- Part load capability
- Functionality and Control as Heat Pump and/or Chiller
- First Cost

Large Water-to-Water Heat Pumps

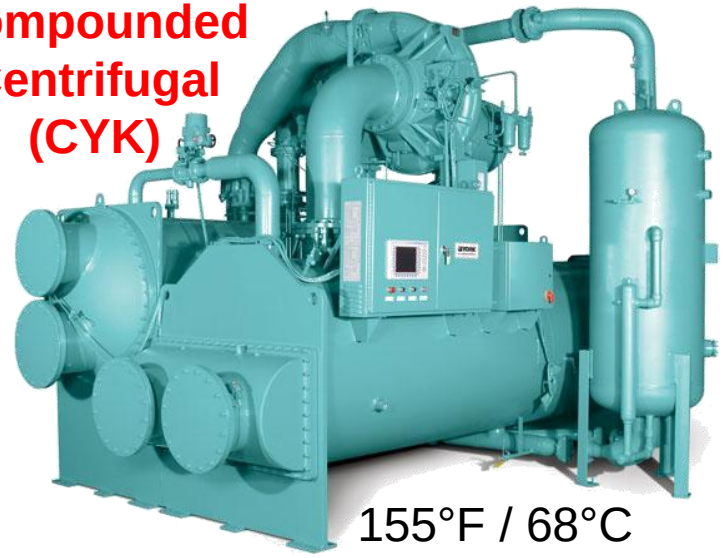
Scroll Chiller (YCWL)

125°F / 52°C
3,200 MBH / 940 kW

Screw Chiller (YVWA)

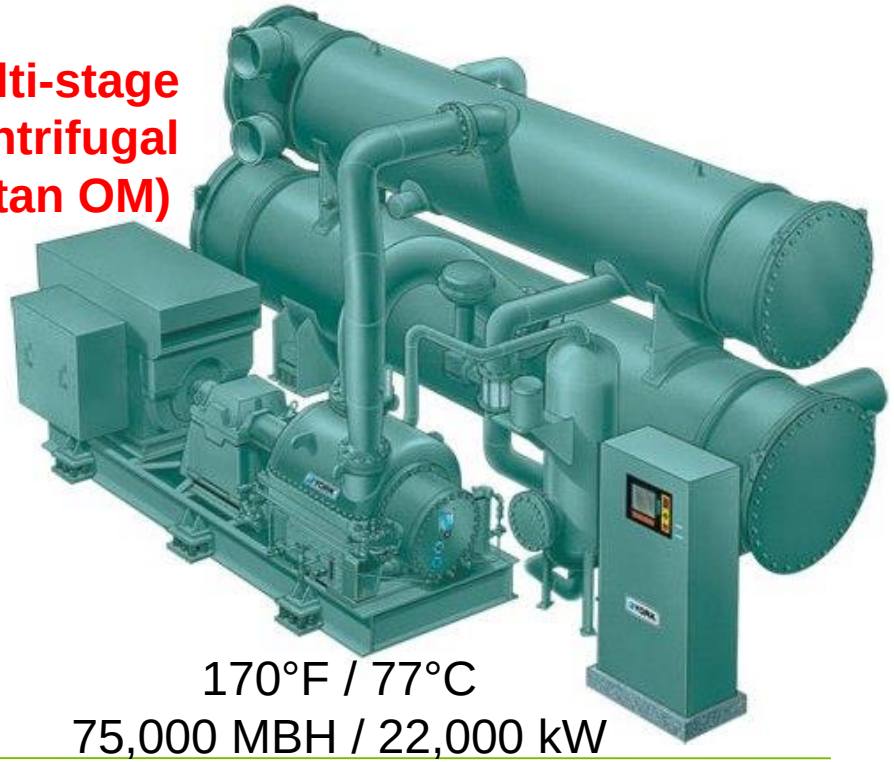
150°F / 66°C
3,800 MBH / 1,100 kW

Externally Compounded Centrifugal (CYK)



155°F / 68°C
40,000 MBH / 12,000 kW

Multi-stage Centrifugal (Titan OM)



170°F / 77°C
75,000 MBH / 22,000 kW

YCWL Scroll Heat Pump

- Max leaving hot water = 125°F (51.7°C)
  - 138°F (60°C) for some models
- Max Lift = 80°F (26.7°C)
- Max heat per unit = 3,200 MBH (940 kW)
- Simultaneous heating & cooling
- Multiple scroll compressor package

Cooling Capacity:
50-200 Tons (170-680 kW)

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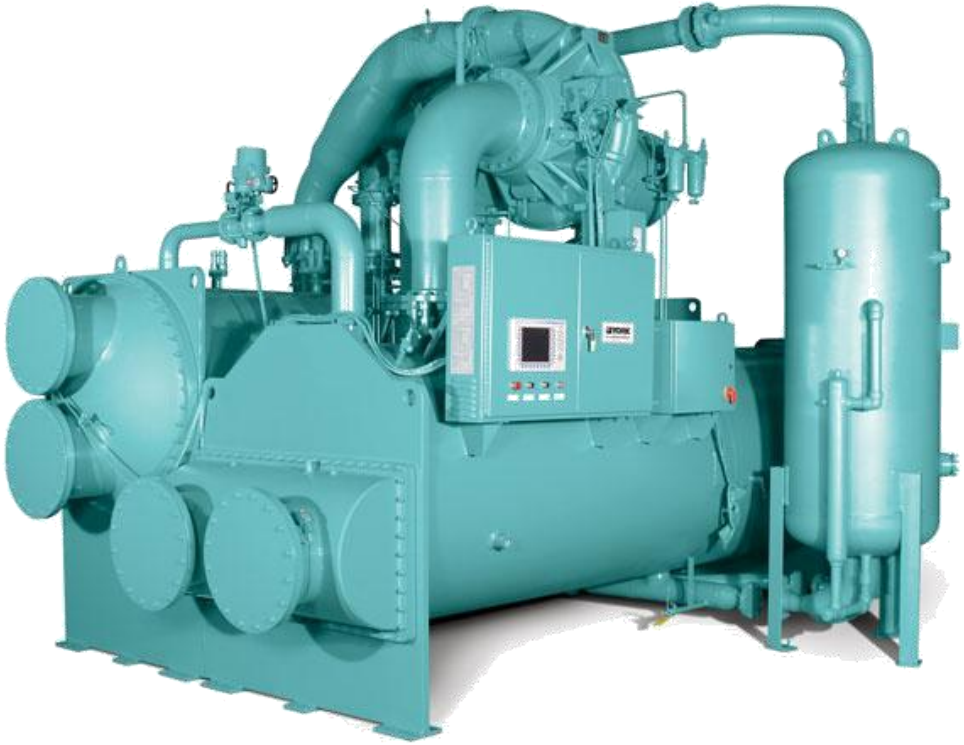
YVWA Screw Heat Pump

- Max leaving hot water = 150°F (66°C)
- Max heat per unit = 3,200 MBH (1,100 kW)
- Max Lift = 120°F (67°C)

- Simultaneous heating & cooling
- Dual screw compressor package

Cooling Capacity:
200-300 Tons (700-1050 kW)

Externally Compounded (CYK)



170°F FOR SOME MODELS

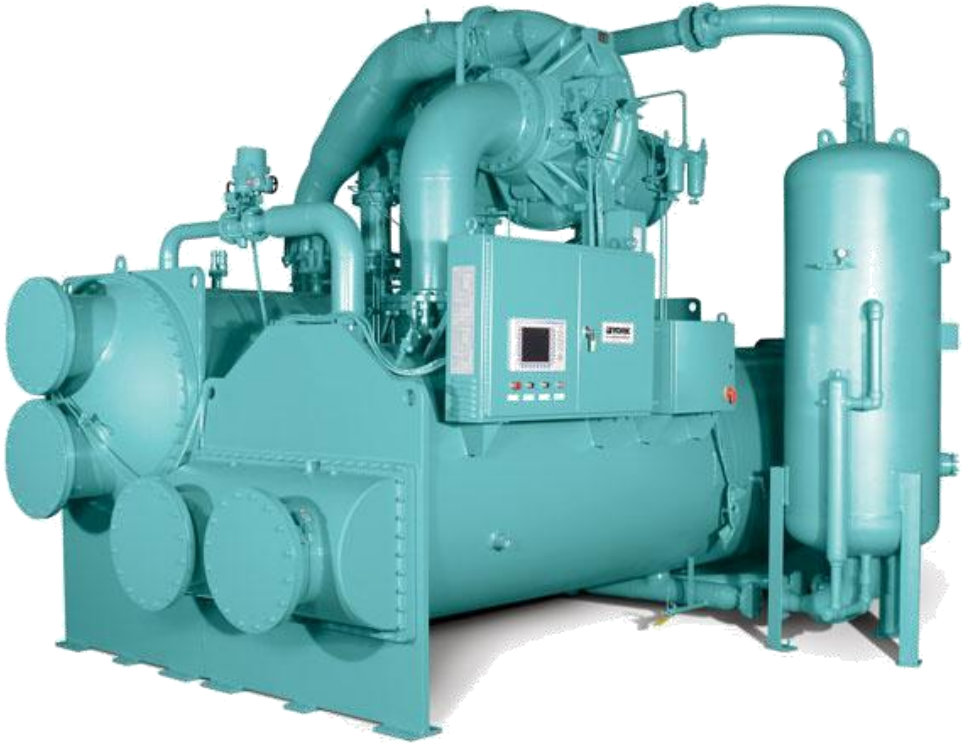
To 155°F / 68°C

40,000 MBH / 12,000 kW

600 – 2500 Tons Cooling

Max Lift = 140°F / 78°C

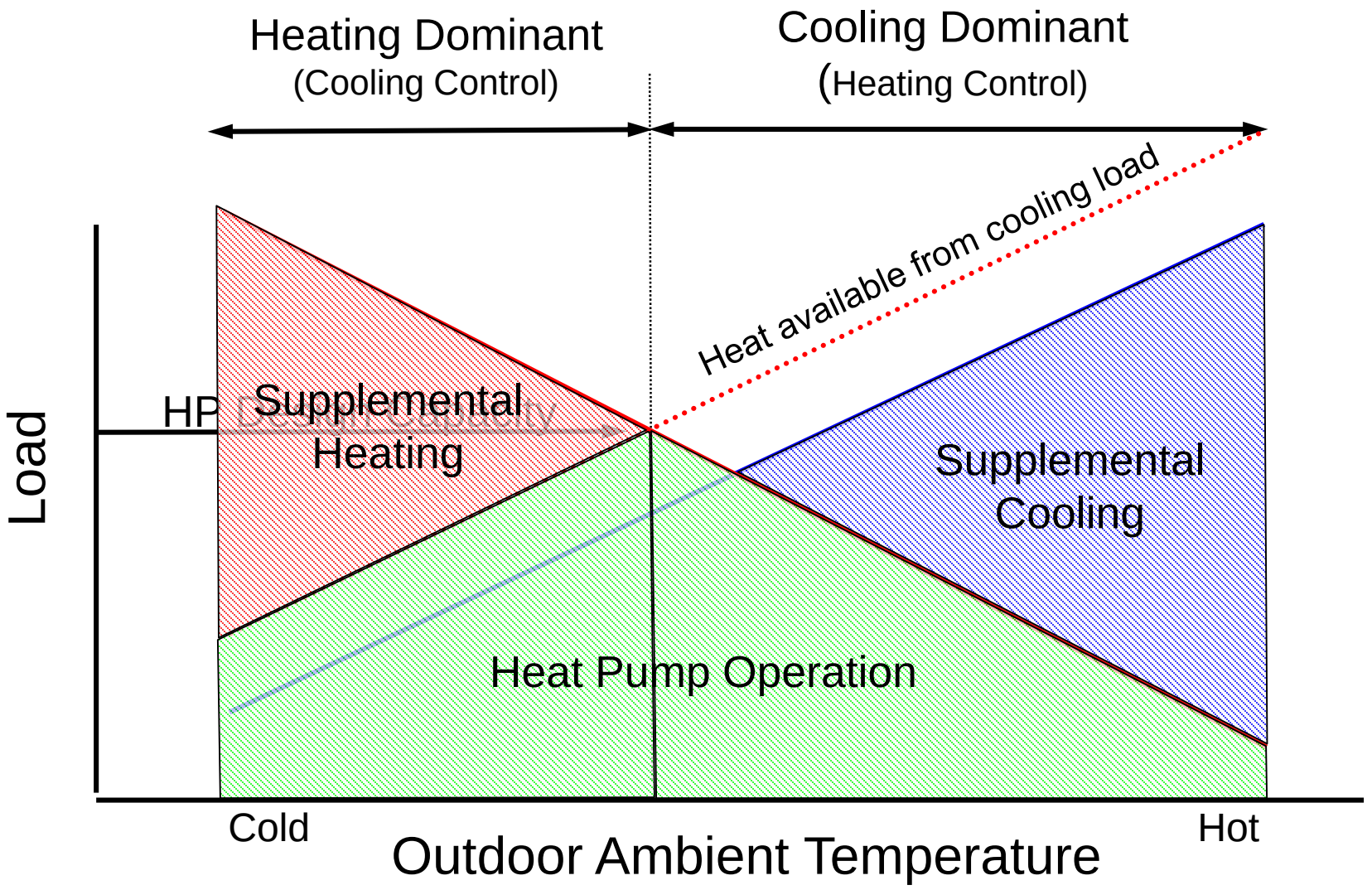
Externally Compounded Heat Pump



CYK Heat Pump

- Second (high stage, high pressure) compressor
- Vertical Intercooler to increase cycle efficiency by up to15%
- System piping arrangement for multiple duty
- Custom Control Panel (PLC or equivalent) provides for more customization

Sizing and Control



Summary

- Economics, environmental issues, and industry design standards are three compelling reasons to consider heat pump installations.
- Utilize the lowest possible hot water temperature that satisfies the requirement, to maximize the Heat Pump COP and minimize supplemental boiler use.
- Heat pumps typically utilize vapor-compression equipment which are capable of high lift (compared to chillers).
- Simultaneous heating and cooling applications offer the greatest paybacks.
- Proper sizing and control of heat pumps is critical to ensure maximum utilization and full payback.

Questions?