

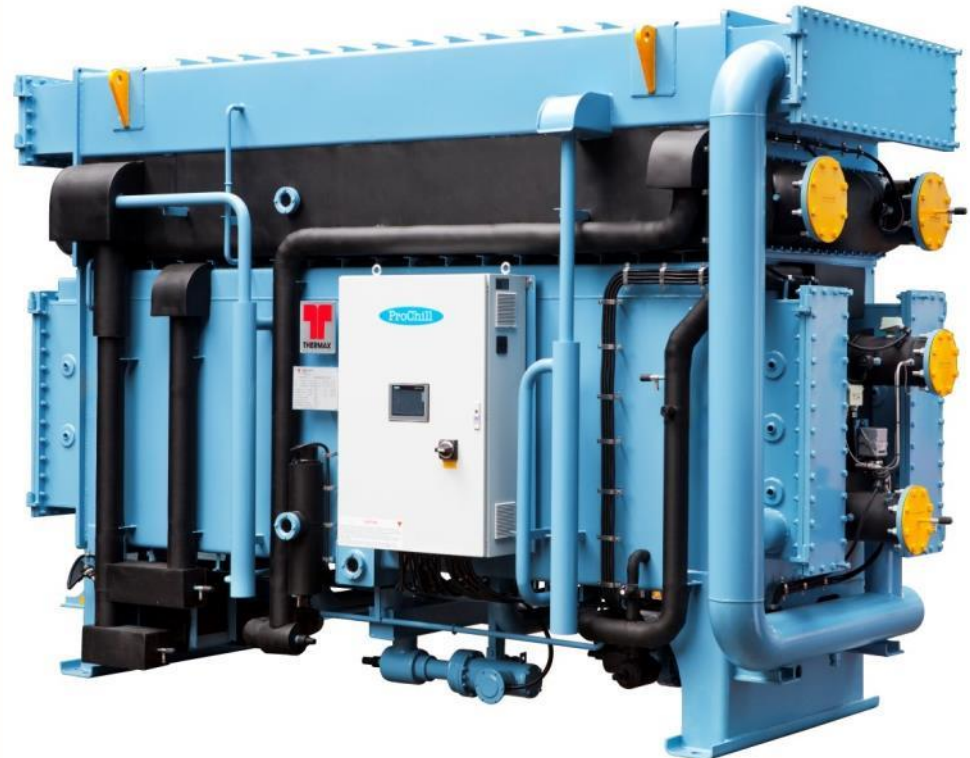


Welcome

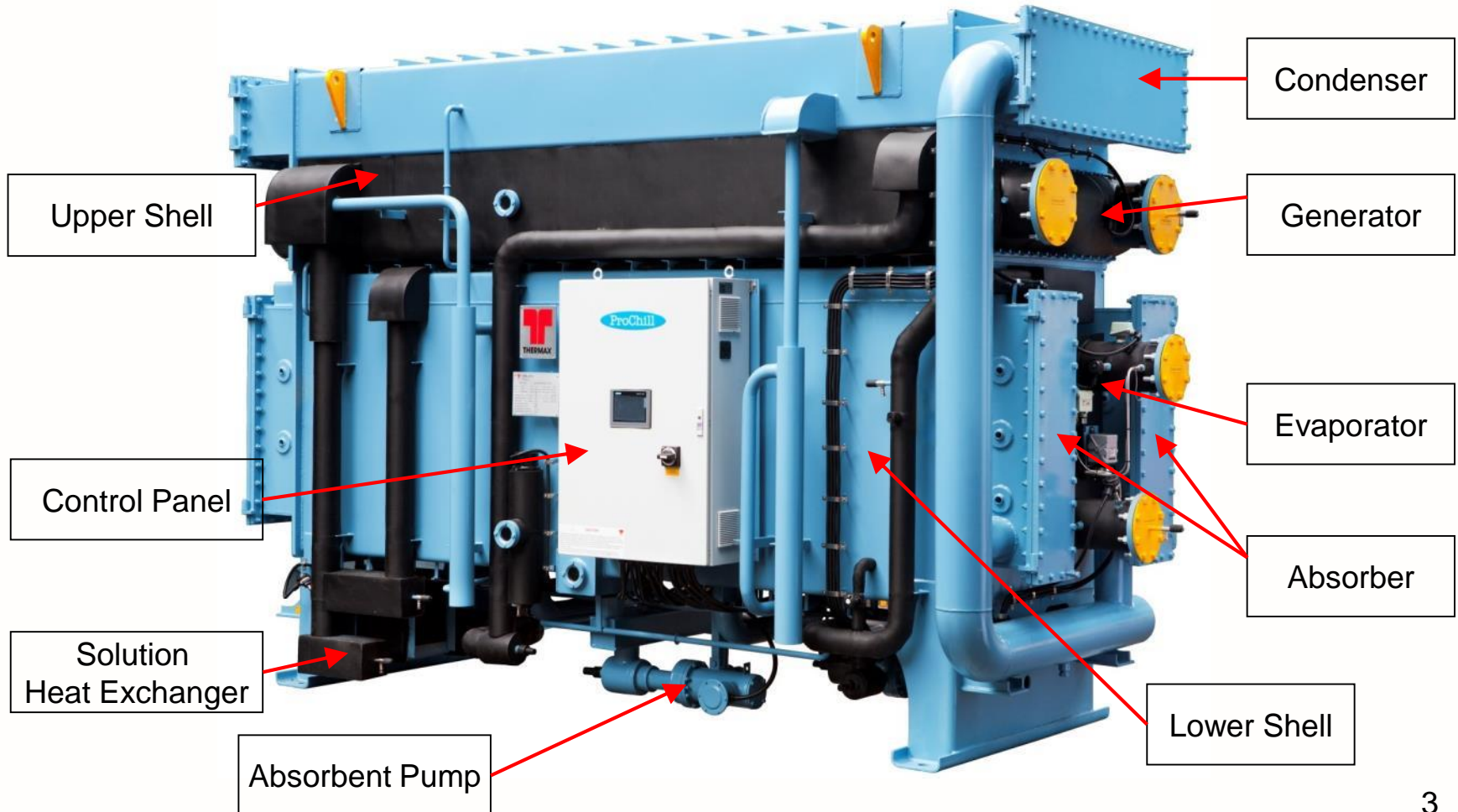
Sustainable Solutions in Energy and Environment

Single Effect Twin Type Hot Water Driven VAM

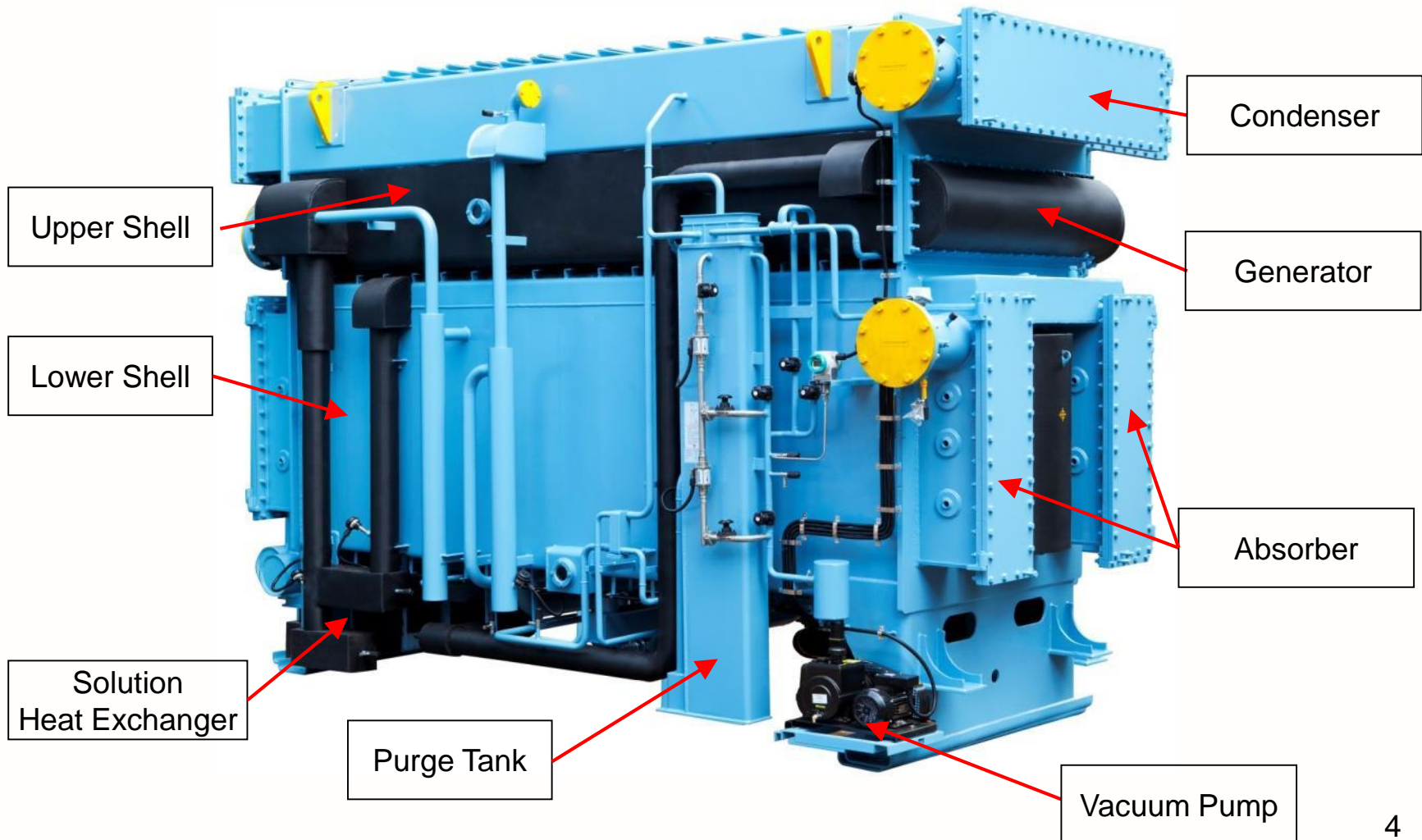
- Heat Source:
 - Low Temperature Hot water (75 – 120 oC)
- Capacity Range : 200 – 1800 TR
- COP : 0.76 – 0.81
- Unique Twin design



Single Effect LT Hot Water Driven VAM



Single Effect LT Hot Water Driven VAM



Key Features of Thermax Chillers

- Two stage evaporation & Two stage condensation technology – For higher output and COP
- Ferritic SS430 Ti tubes in generator – to prevent stress corrosion cracking
- Plate type solution heat exchanger – for higher COP
- Stand alone Siemens PLC based control panel with Touch screen HMI
- Variable solution flow rate** – for stable operation and better part load COP
- Non toxic corrosion inhibitor – Lithium molybdate
- Nozzle less Non Clogging Gravity feed solution distribution mechanism – for uniform and reliable spray through out the life of the chiller

** Optional Feature

Key Features of Thermax Chillers

- Online concentration measurement (for strong solution) and display
- Proactive crystallisation control – to ensure stable operation of chiller
- Refrigerant level control – for preventing cavitation of pumps
- Automatic purging system** – for easy removal of non-condensable gases
- Double seal isolation valves for canned motor pumps – easy maintenance
- Remote Performance Monitoring System** – for online monitoring of chiller performance

** Optional Feature

Operation at Low Hot Water Temperature

- Cooling capacity attained in the evaporator is directly proportional to the LiBr solution flow rate in the absorber and the LiBr concentration difference (ΔC) achieved in the absorber.

$$\text{Cooling Capacity} \propto (\text{LiBr solution flow rate}) \times (\Delta C)$$

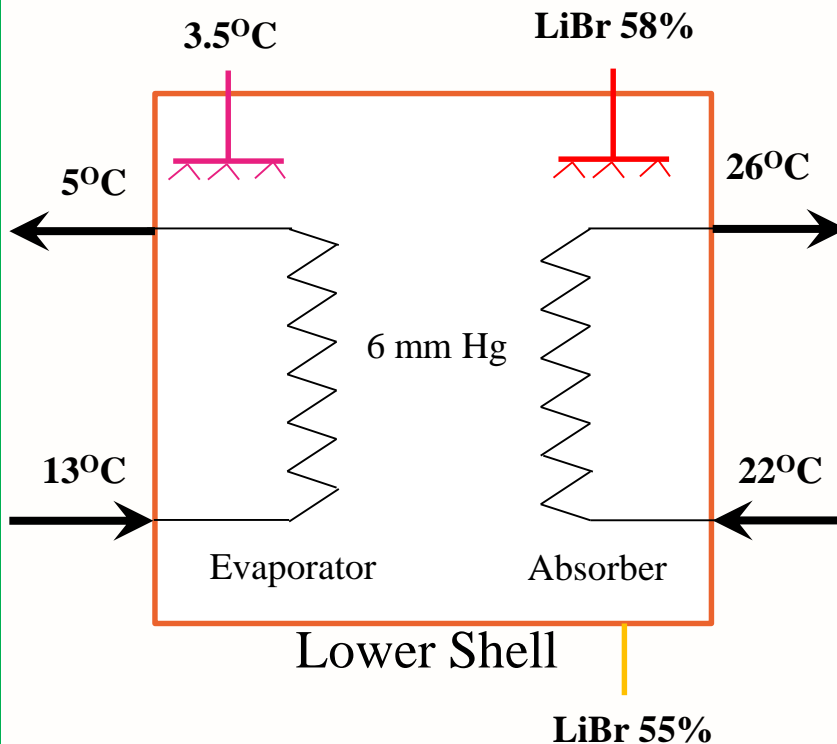
- For increasing the cooling capacity, the LiBr flow rate and/or ΔC should be increased
- LiBr solution flow rates cannot be increased beyond certain limit due to
 - Increase in film thickness reduces the heat transfer rate to cooling water
 - It also reduces the COP of the chiller due to increase in sensible heating in the generator
- Higher ΔC can be achieved by
 - Higher strong solution concentration
 - Lower Dilute solution concentration

Operation at Lower Hot Water Temperature

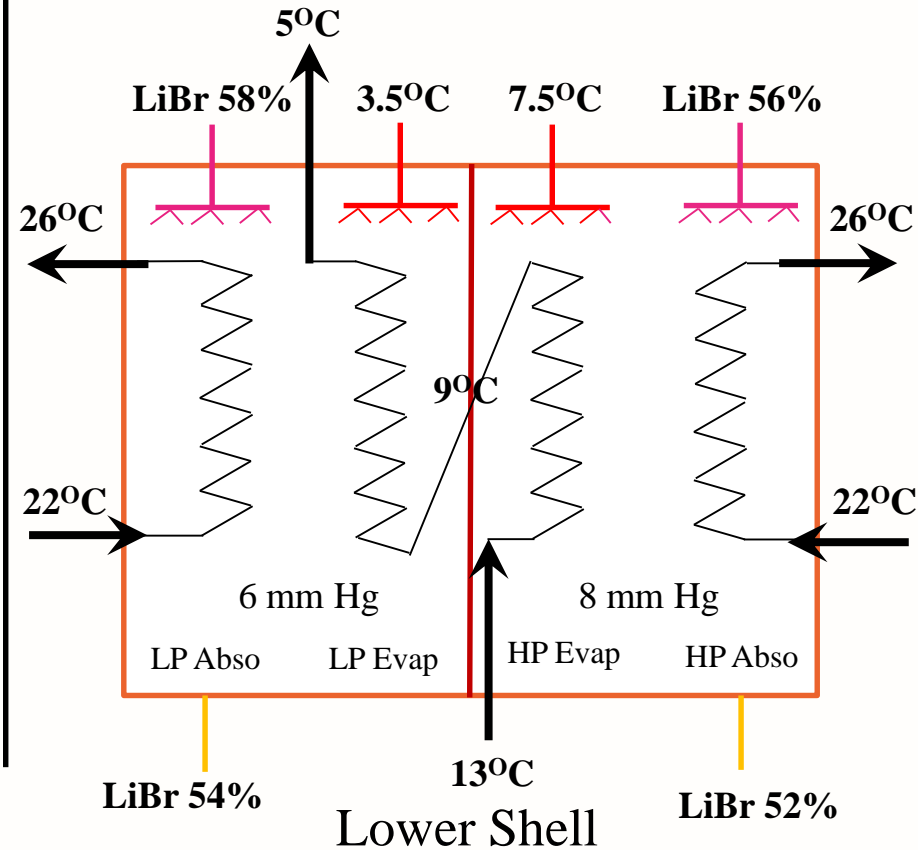
- In this case, since the hot water outlet temperature is low (65 °C), the LiBr temperature in generator remains low. Hence higher strong solution concentration is not achievable
- Since the chilled water outlet temperature is also low (5 °C), the dilute solution concentration tends to remain high. Hence the delta concentration in case of standard single effect chiller remains very low.
- This results in larger equipment size and hence larger solution flow rates, thereby negatively affecting full load as well as part load COP
- Hence reducing the dilute solution concentration is the only way to ensure heat recovery from lower temperature hot water
- To achieve lower LiBr solution concentration at absorber outlet, two stage evaporation is used.
- To achieve lower hot water outlet temperature at generator outlet, two stage regeneration is used.

Two Stage Evaporation

Single Stage Evaporation



Two Stage Evaporation



By the inherent properties of the Lithium bromide solution, as the vapour pressure of LiBr solution increases, the absorptivity increases

Benefits of Twin Design

- Two different pressure levels are maintained for evaporation as well as regeneration
- Chilled water temperature reduced in 2 stages
- High pressure evaporator is linked with low pressure regenerator
- Incoming chilled water (13 °C) gets cooled down to an intermediate temperature (9 °C) using a higher temperature refrigerant (7.5 °C) at a higher evaporator pressure
- So in the corresponding absorber, LiBr with lower concentration from the low pressure regenerator is sprayed
- To produce this lower concentration LiBr, lower hot water temperature (65 °C) is sufficient
- Low pressure in generator results in lower LiBr temperature

Benefits of Twin Design

- Low pressure evaporator is linked with high pressure regenerator
- The chilled water at intermediate temperature (9 °C) is cooled to required temperature (5 °C) using a lower temperature refrigerant at a lower evaporator pressure (3.5 °C)
- So in the corresponding absorber, LiBr with higher concentration from the high pressure regenerator is sprayed
- To produce this higher concentration LiBr solution, higher hot water temperature (80 °C) is required
- High pressure in generator results in higher LiBr temperature
- Twin design helps to optimise the chiller size and deliver higher COP compared to conventional single effect chillers

Metallurgy

5G Series	Standard	Optional
Evaporator	DLP Copper	Cu:Ni 90:10, SS316L Titanium
Absorber	DLP Copper	
Condenser	DLP Copper	
Generator	SS430 Ti	NA
Solution Heat Exchanger	Cu Brazed SS316 PHE	NA

Metallurgy Selection

Generator Tubes

- When tube expands more and shell expands less due to high temperature, stresses are generated in tubes. Hot and concentrated LiBr causes stress corrosion cracking.
- Ferritic SS430 Ti (SA 268 - Grade TP 430 Ti), 1 mm thick used for generator tubes has excellent stress corrosion cracking resistance. Ti grade for improved welding yield
- Composition - C- 0.1%, Mn - 1.00%, P-0.040%, S-0.030%, Si-1.00%, Ni-0.75% max, Cr 16.00-19.50%, Ti-5xC min, 0.75% max
- Stresses developed are low, as the difference in the expansion coefficient of shell (Carbon steel) and tubes (SS430Ti) are minimum



Thank You