



U-3ARC TRAINING WEBINAR N° 12

ABSORPTION CHILLER SYSTEM

MESHACK ODHIAMBO

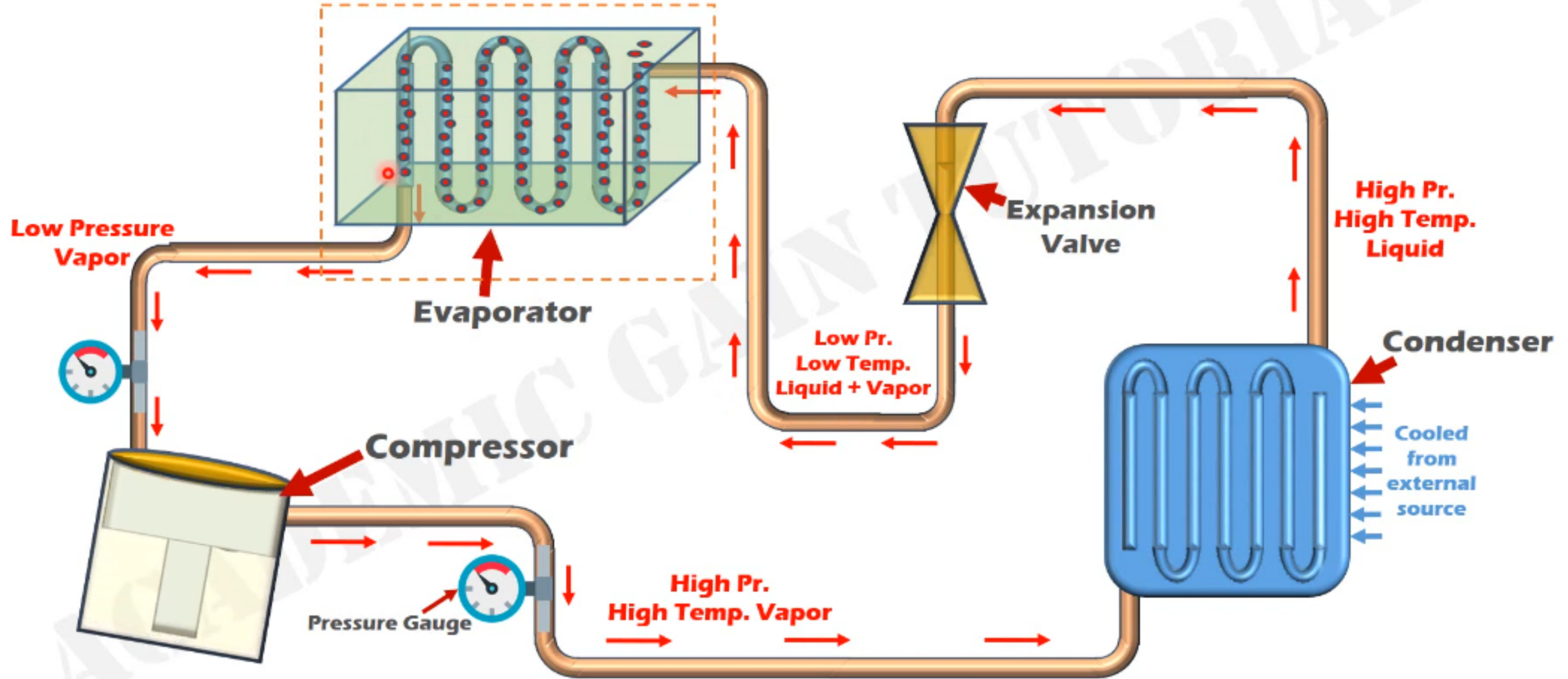
AUG 27TH 2022

TO BE COVERED

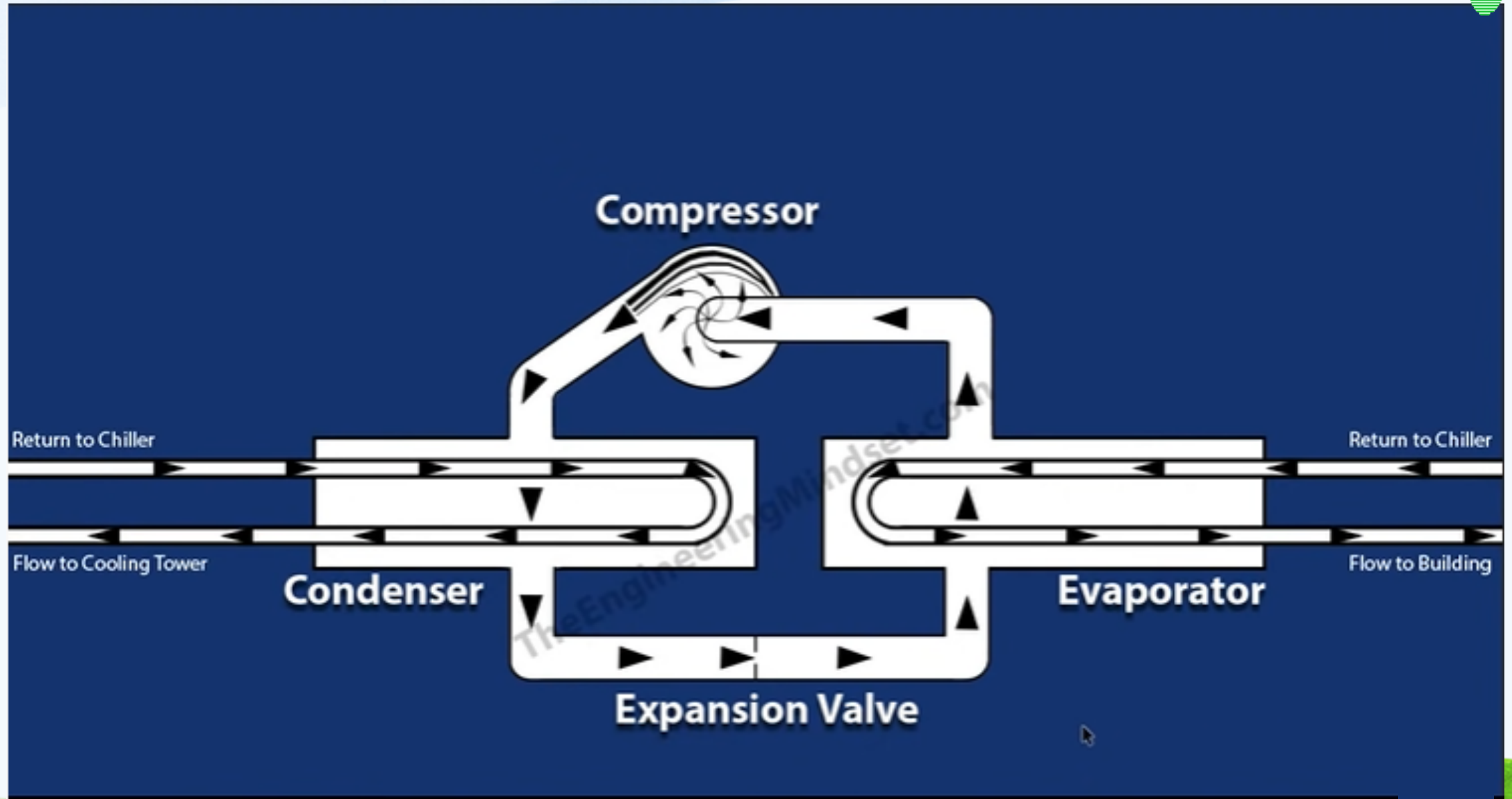


1. REVIEW OF VAPOR COMPRESSION CYCLE
2. CHILLER SYSTEM OVERVIEW
3. ABSORPTION CHILLER WORKING PRINCIPLES
4. ABSORPTION CHILLER CYCLE
5. VARIOUS PARTS OF THE CYCLE
6. SUMMARY - FUNCTIONAL LOGIC OF THE CYCLE
7. ABSORPTION CHILLER SET UP PICTURES

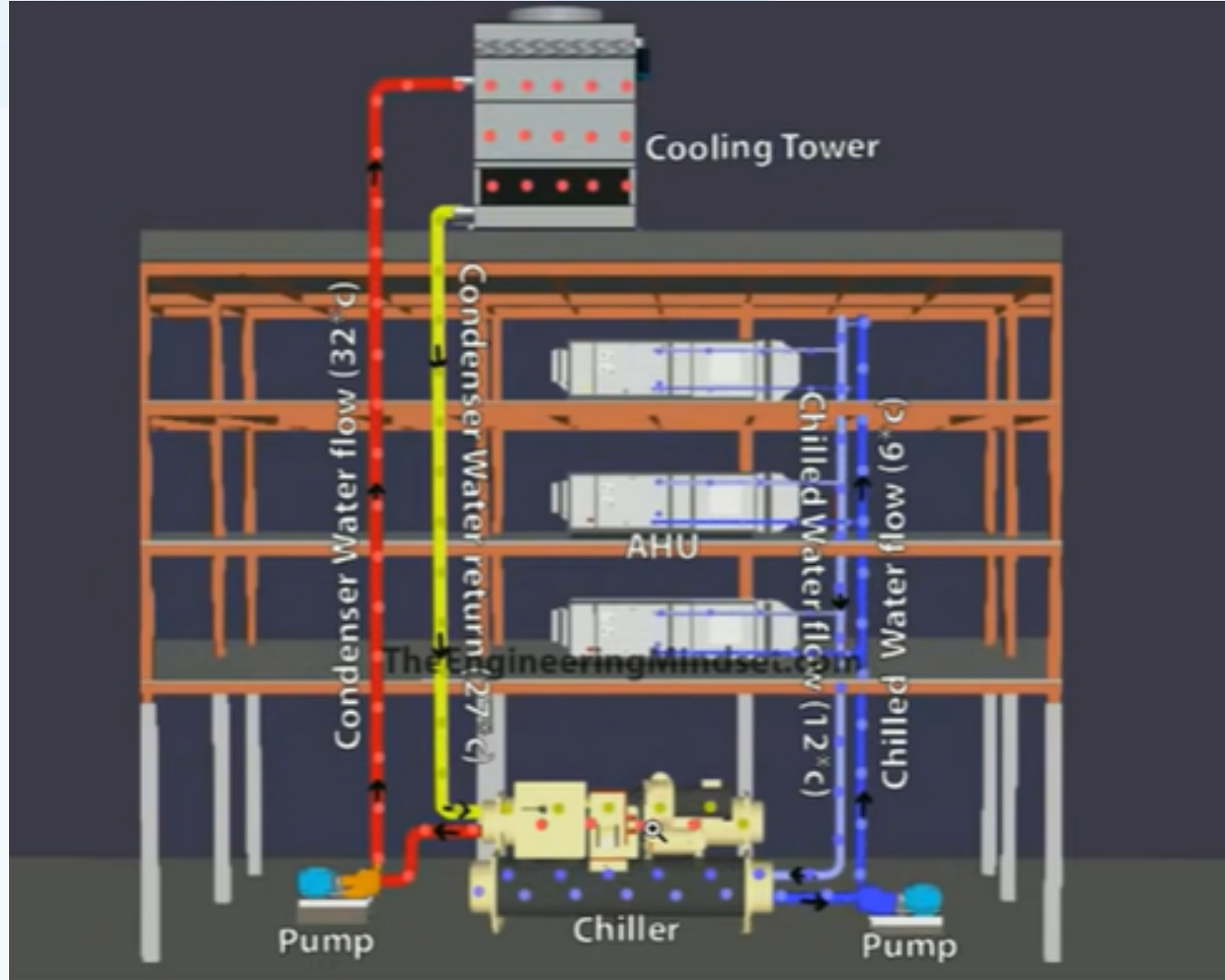
Vapour Compression Refrigeration System



4 BASIC CHILLER COMPONENTS – 3 GENERAL CIRCUITS



CHILLER SYSTEM BRIEF – GENERAL SETUP





ABSORPTION CHILLER WORKING PRINCIPLES/CONCEPTS

- PRESSURE CHANGE
- WATER MISCIBILITY WITH OTHER LIQUIDS/SOLUTIONS HAVING DIFFERENT HEAT ABSORPTION/REJECTION PROPERTIES FROM WATER
- AMMONIA OR LITHIUM BROMIDE

TEMPERATURE CHANGE WITH PRESSURE



How Absorption Chillers Works

Boiling Point
Temperature: 100°C / 212°F
Pressure: 101kPa / 14.7psi



Sea Level

Boiling Point
Temperature: 70°C / 158°F
Pressure: 34kPa / 4.9psi



High Altitude

Boiling Point
Temperature: 4.5°C / 40°F
Pressure: 0.84kPa / 0.12psia



Vacuum

LITHIUM BROMIDE & WATER MISCIBILITY



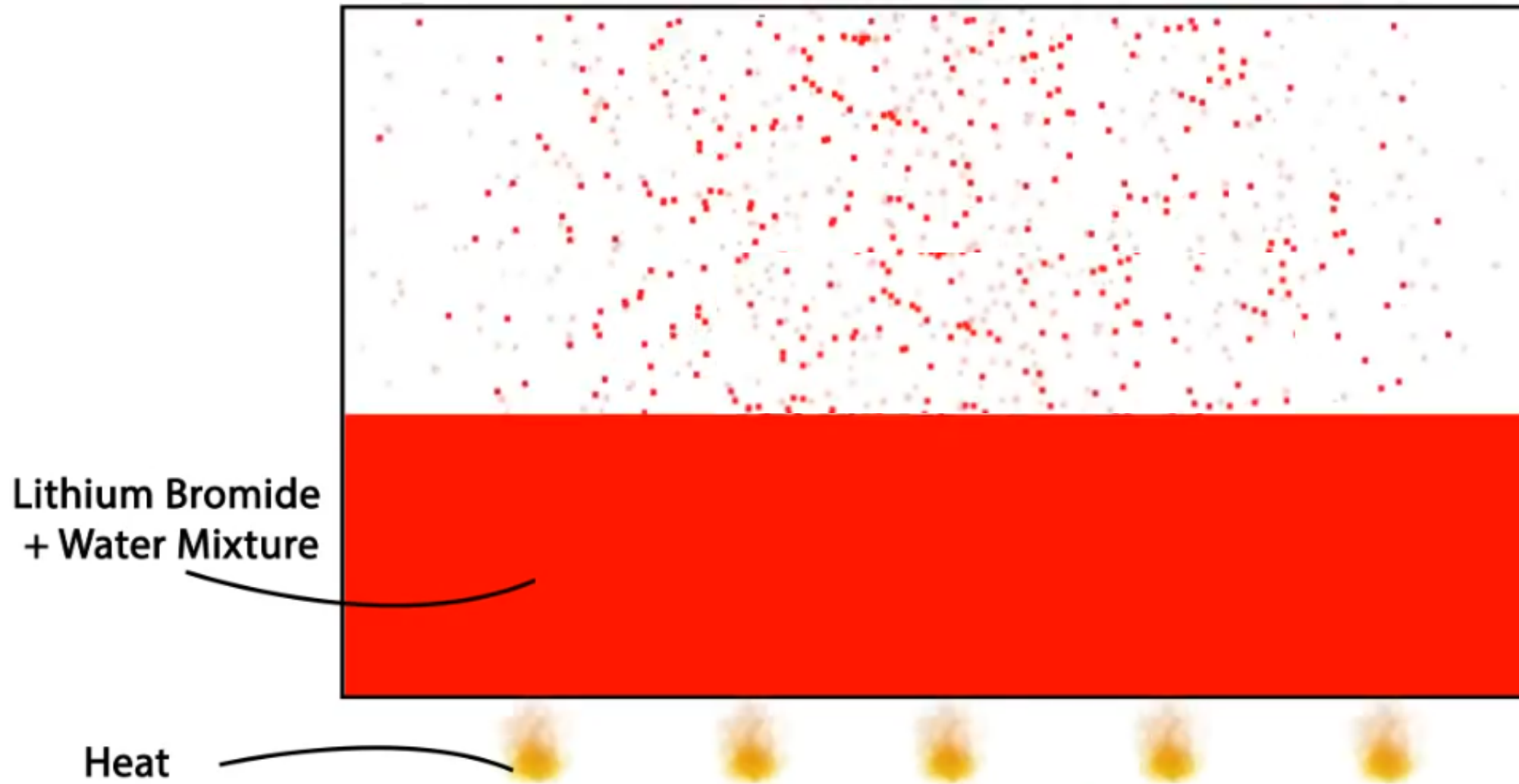
How Absorption Chillers Works

Water Vapour



Lithium Bromide
(Salt)

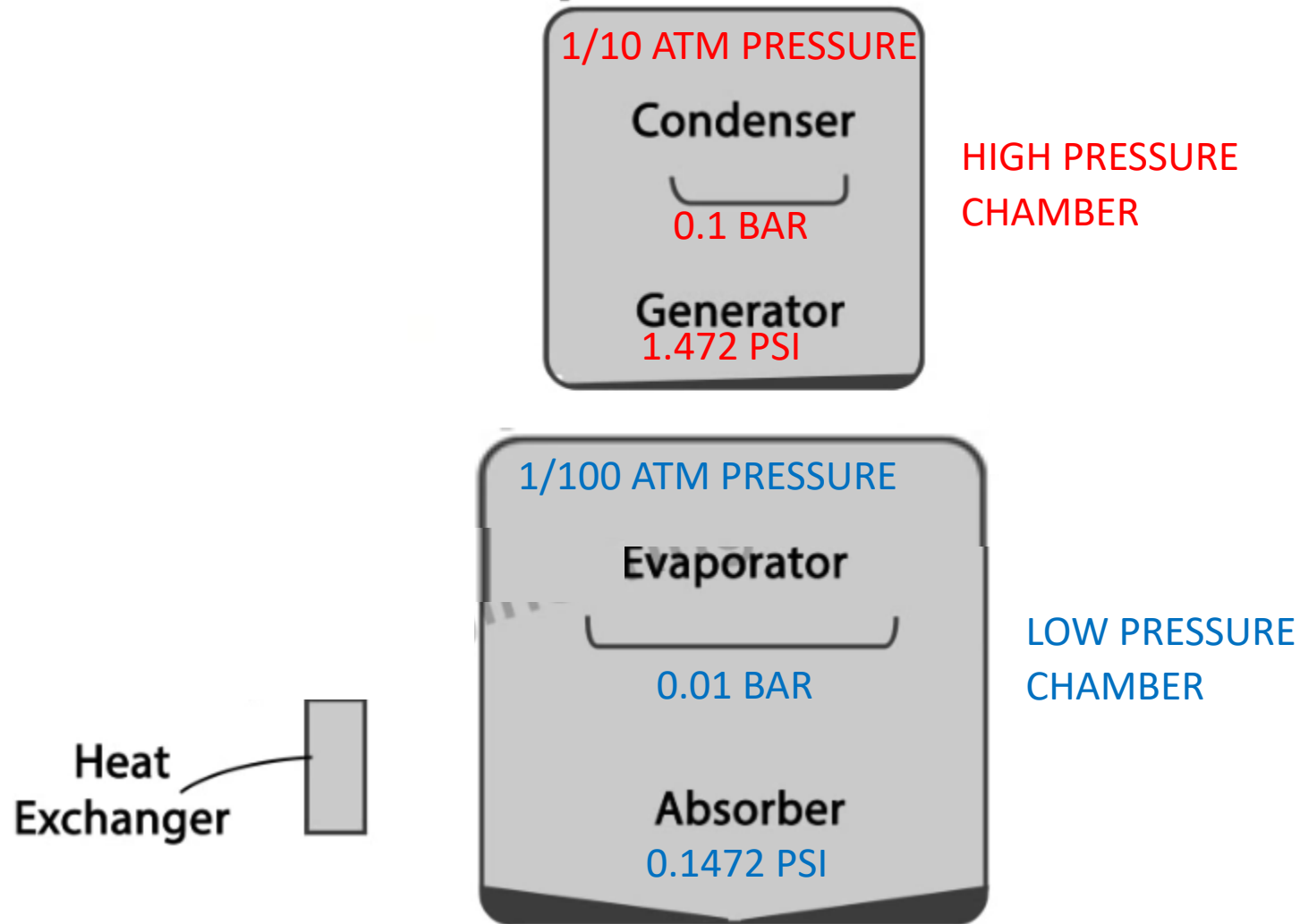
HEATING LITHIUM BROMIDE-WATER MIXTURE



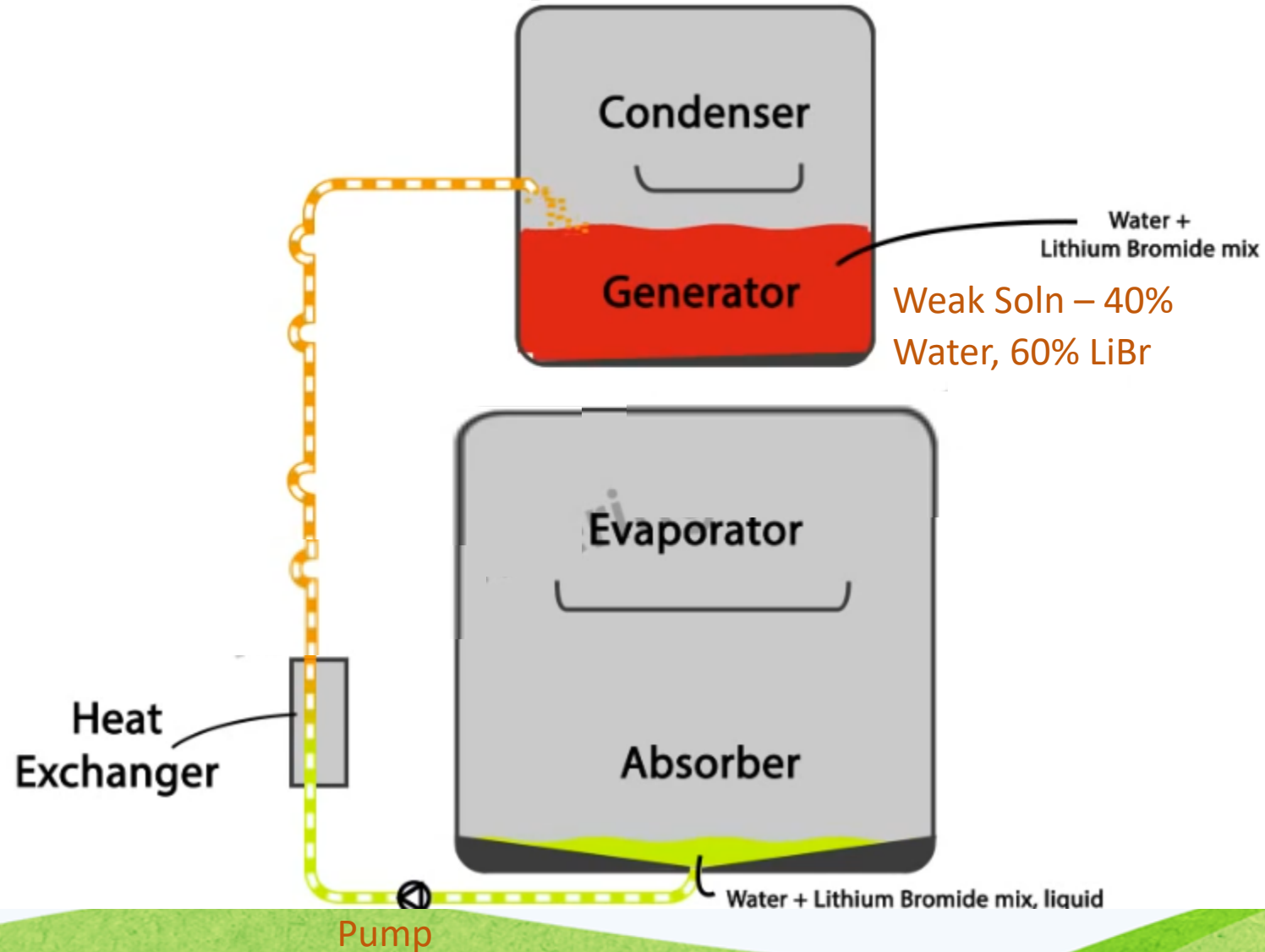
ABSORPTION CHILLER BLOCK DIAGRAM



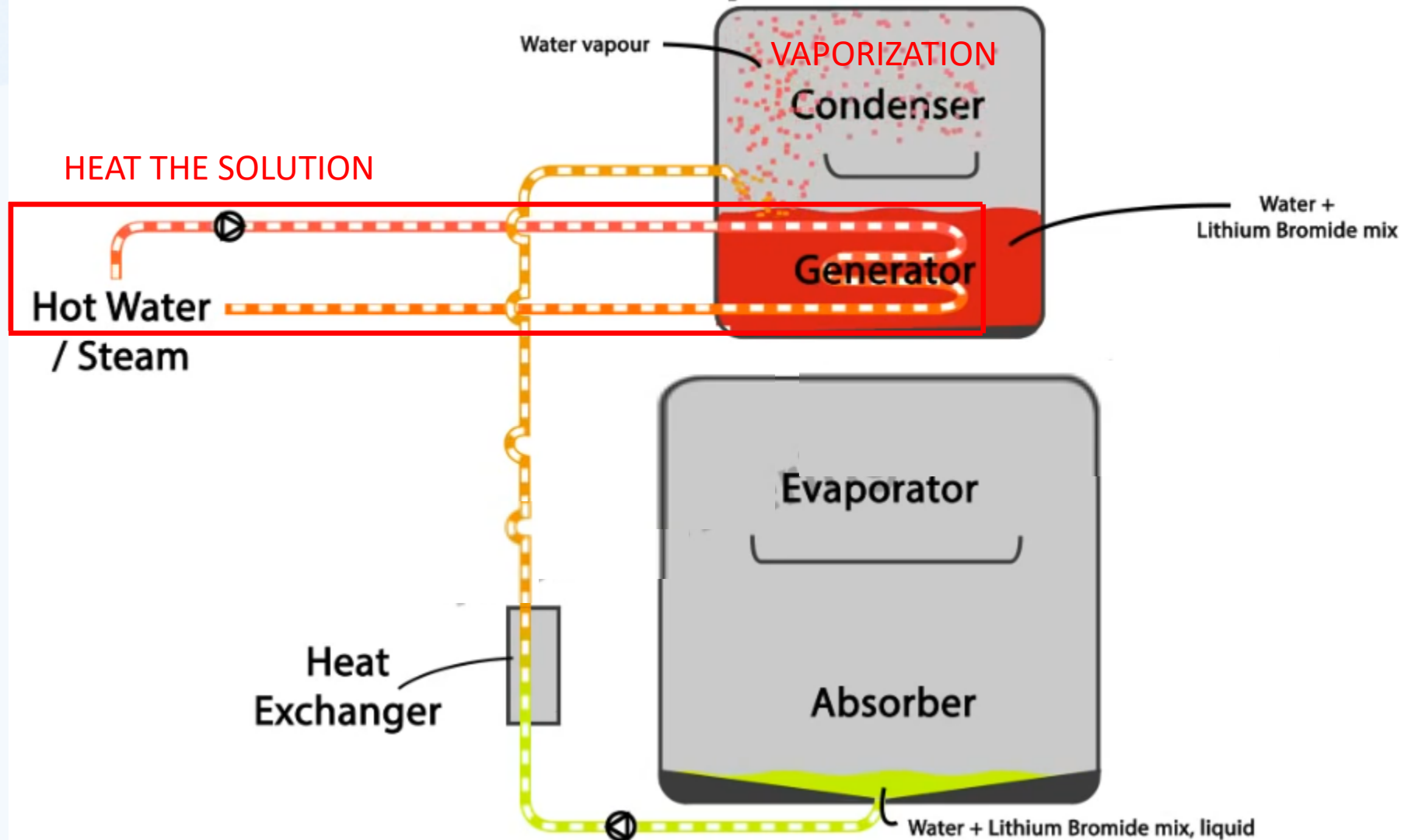
How Absorption Chillers Works



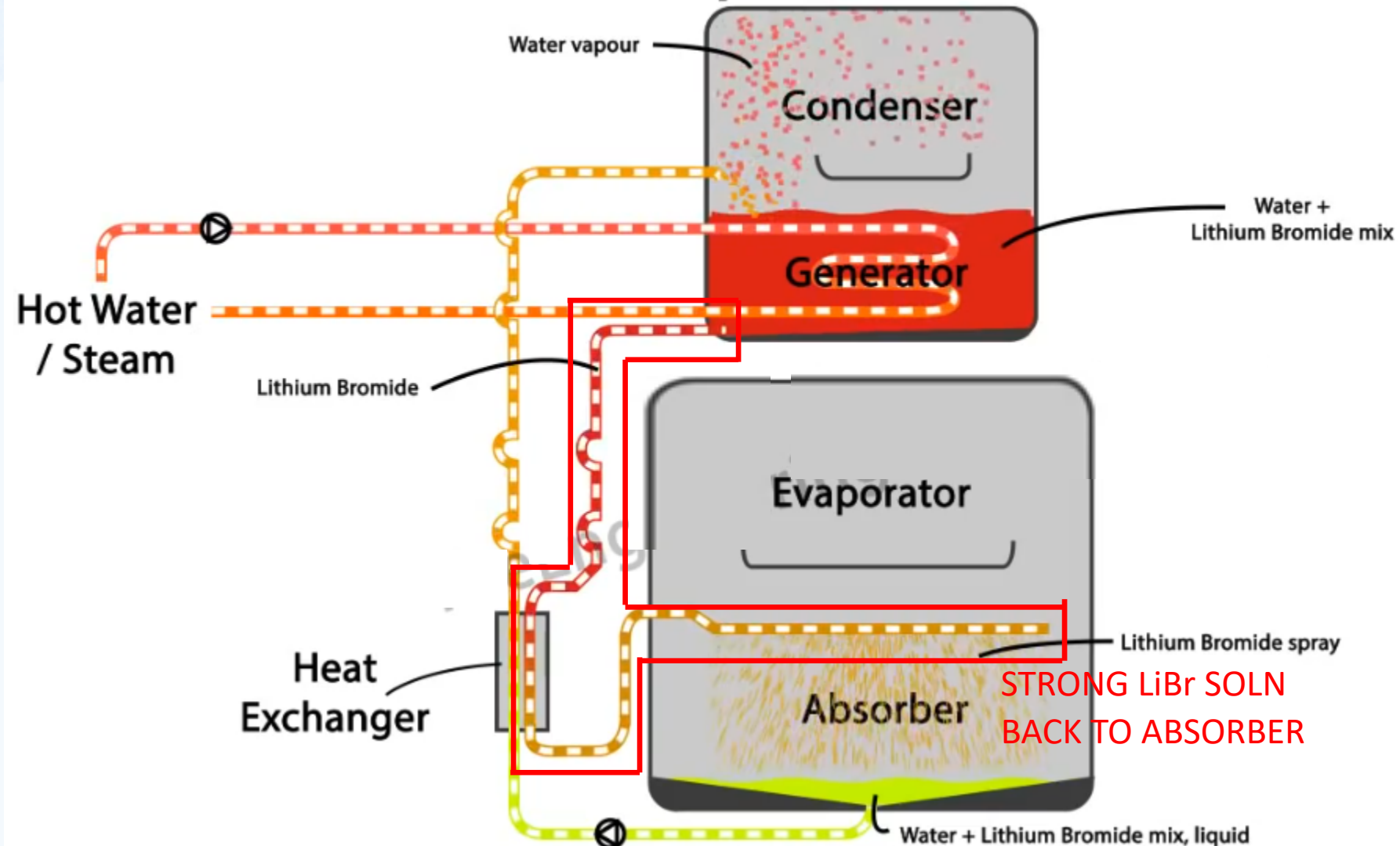
How Absorption Chillers Works



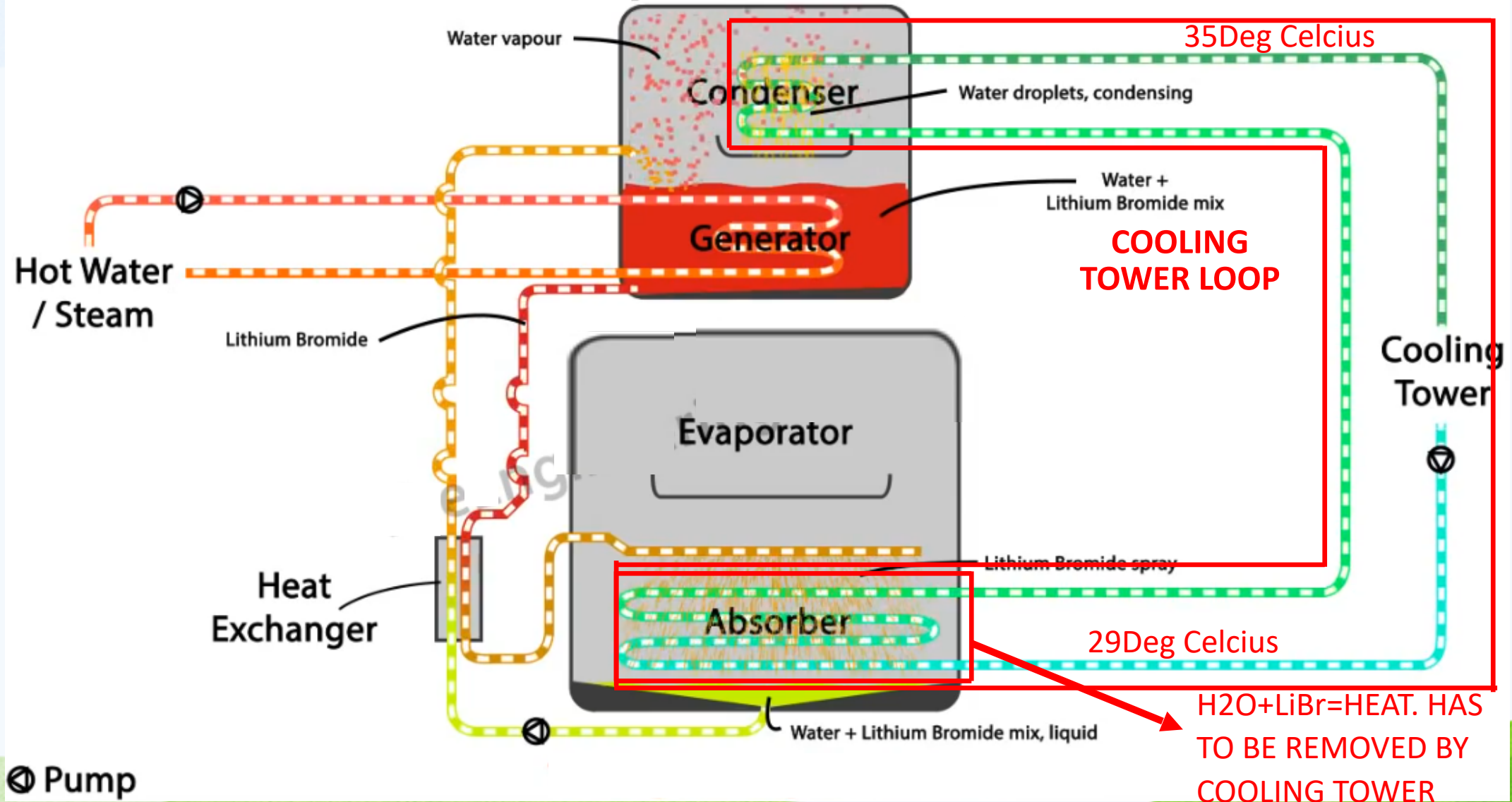
How Absorption Chillers Works



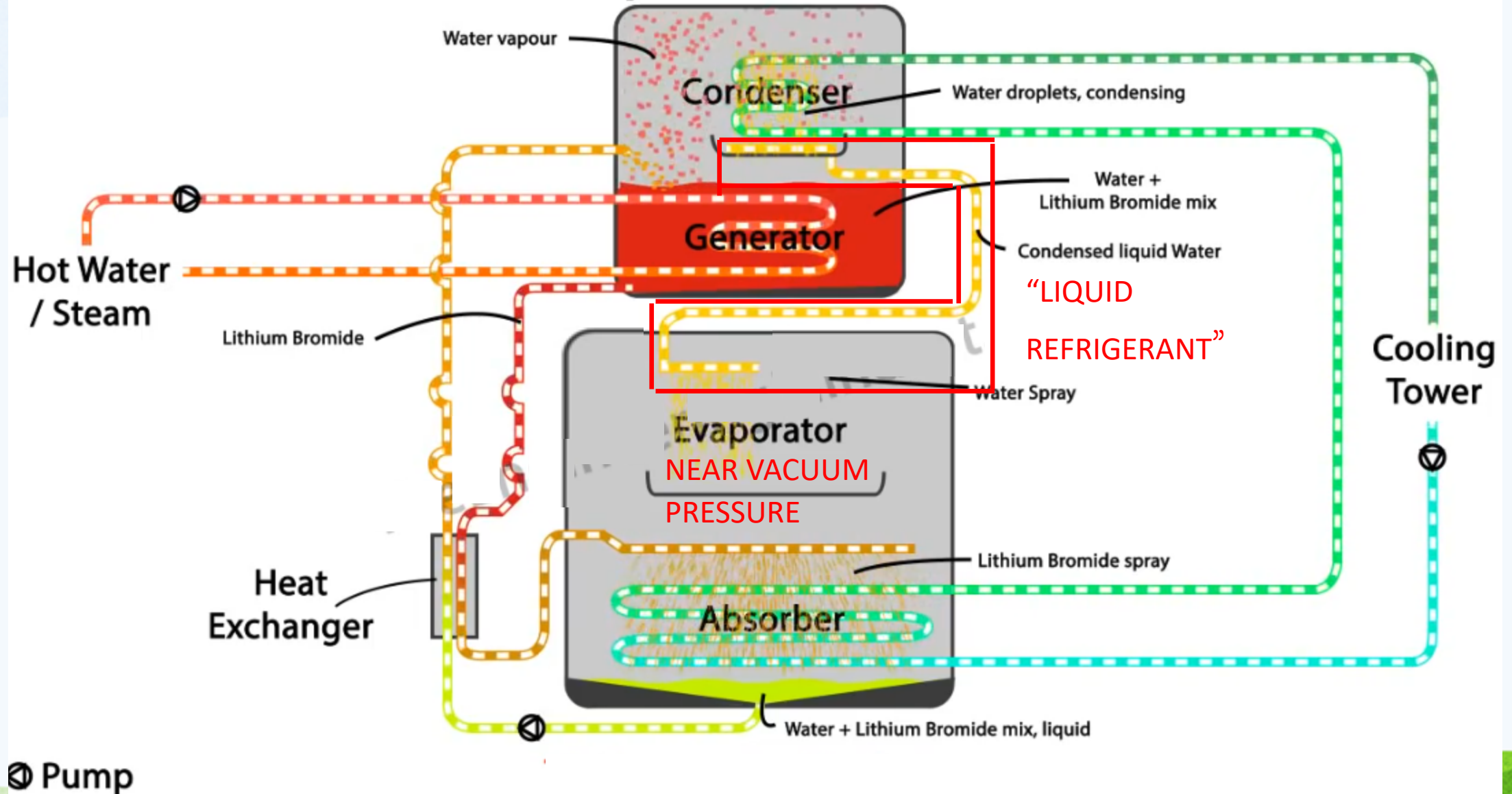
How Absorption Chillers Works



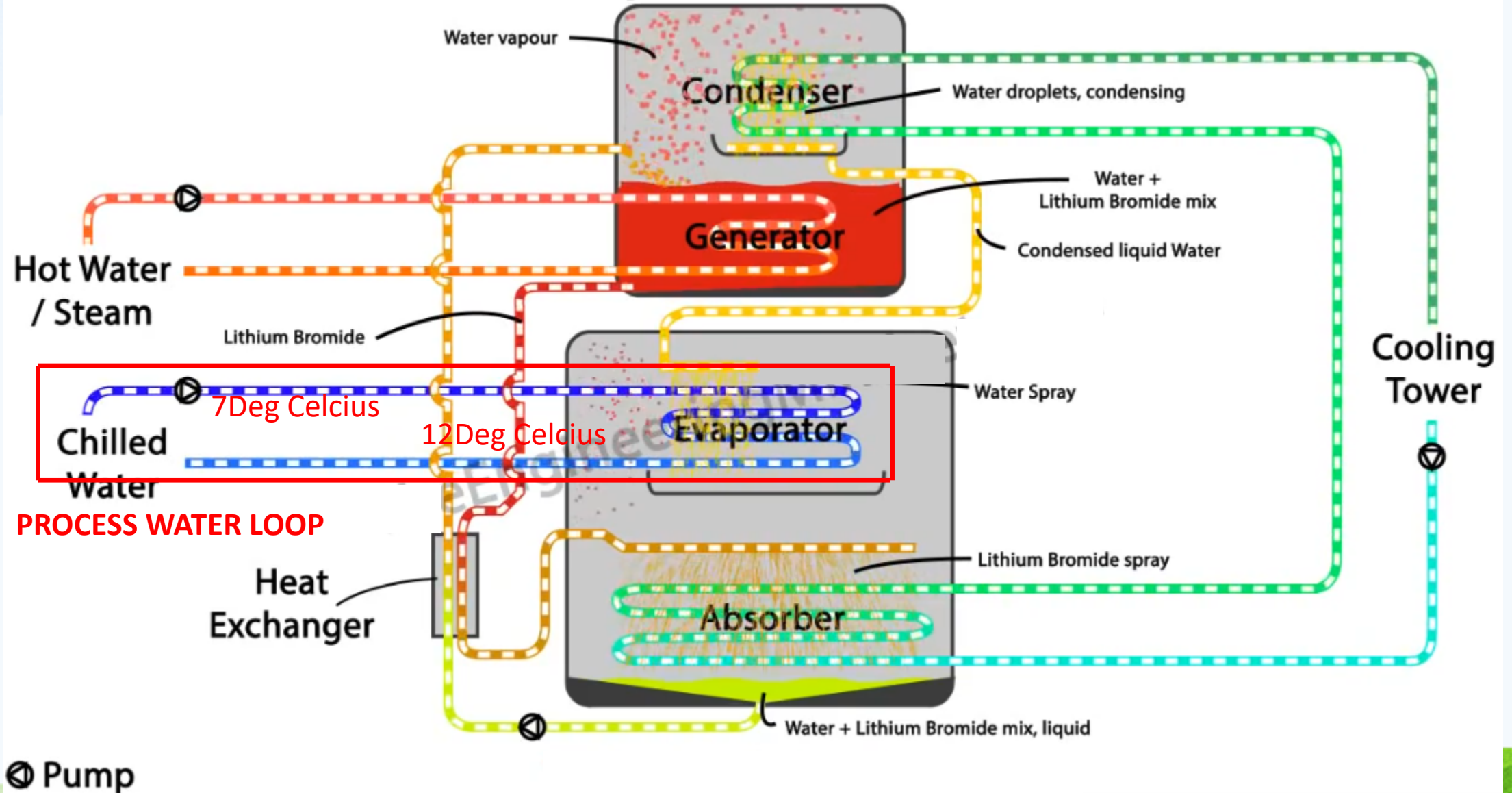
How Absorption Chillers Works



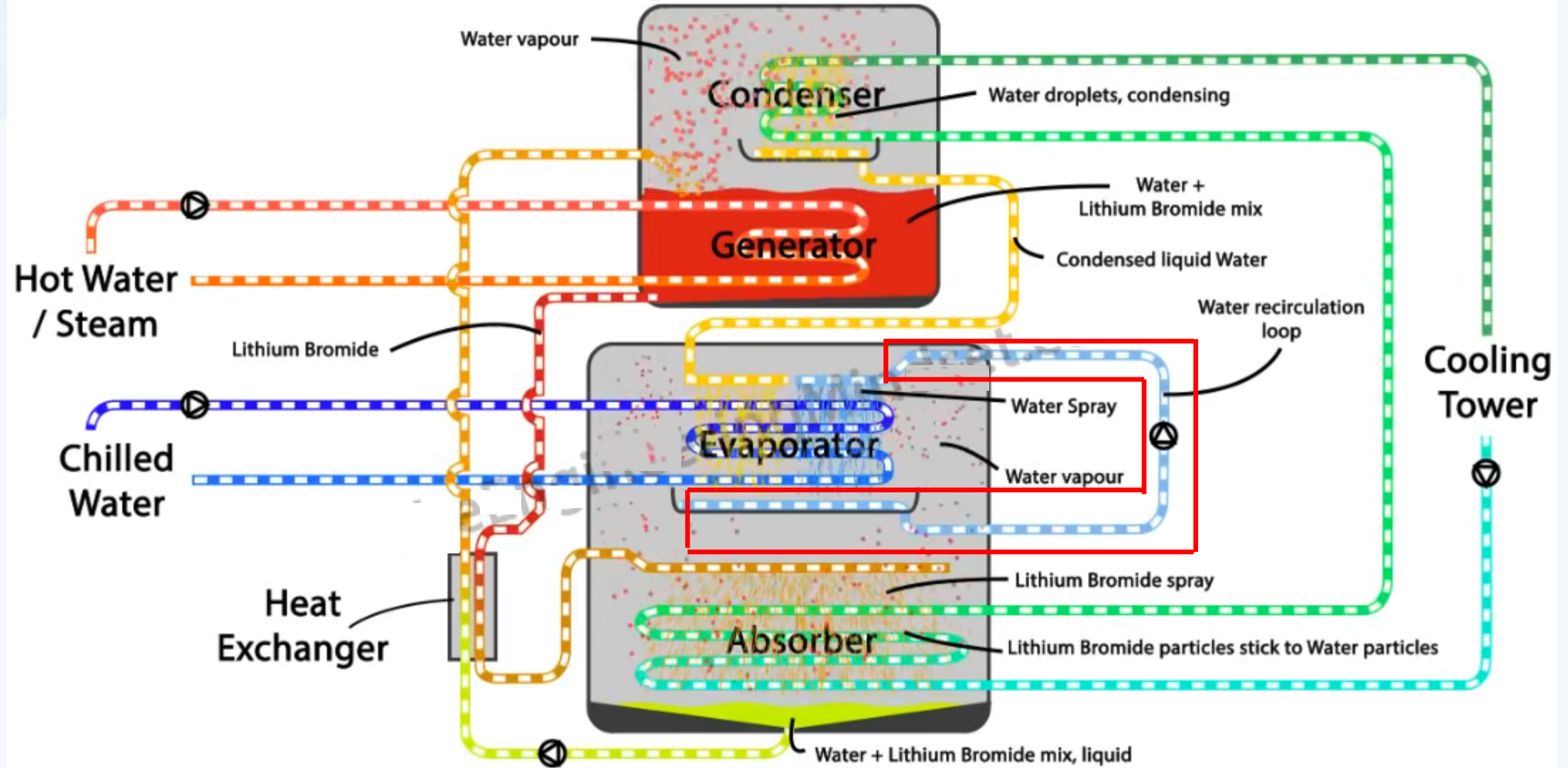
How Absorption Chillers Works



How Absorption Chillers Works



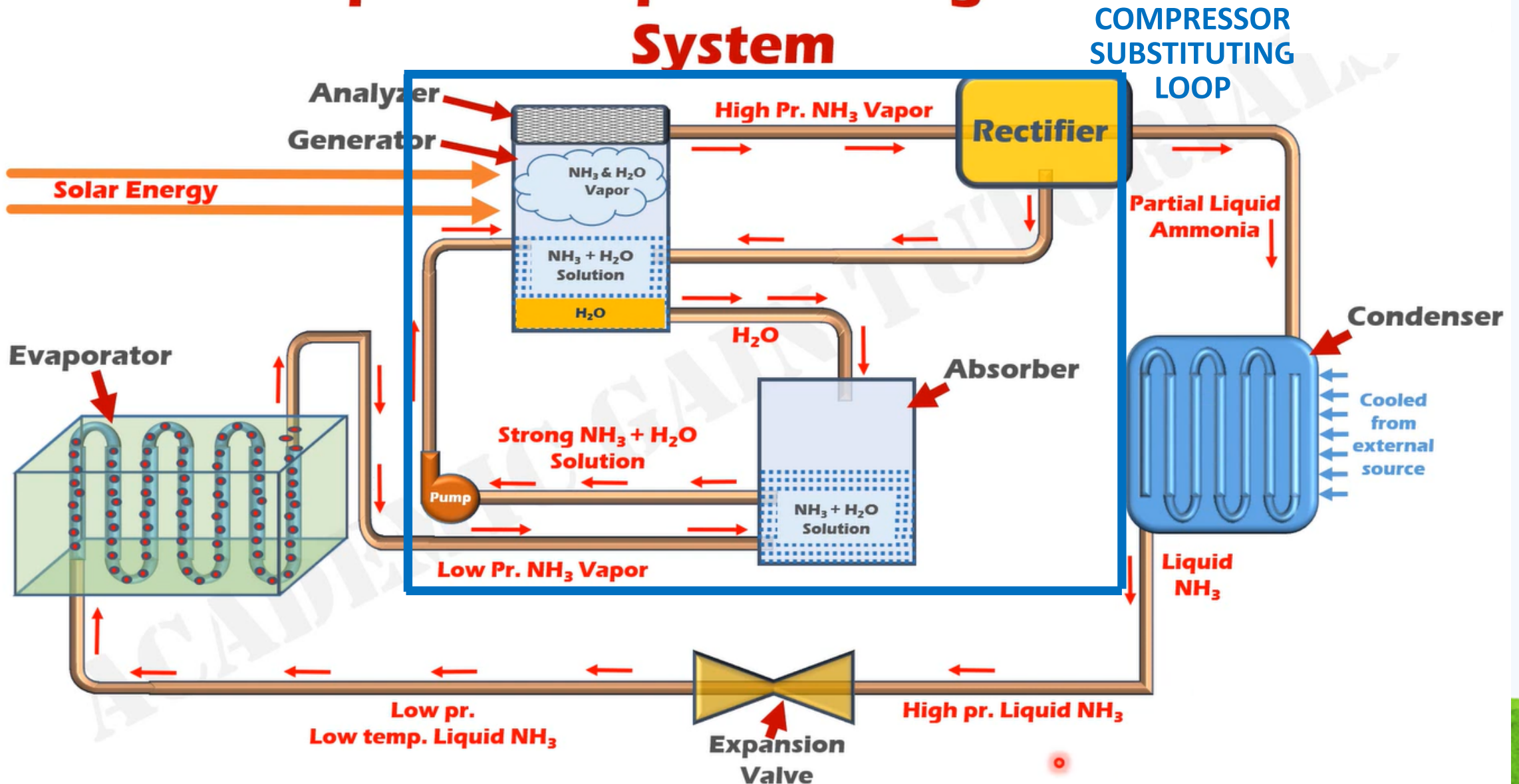
How Absorption Chillers Works



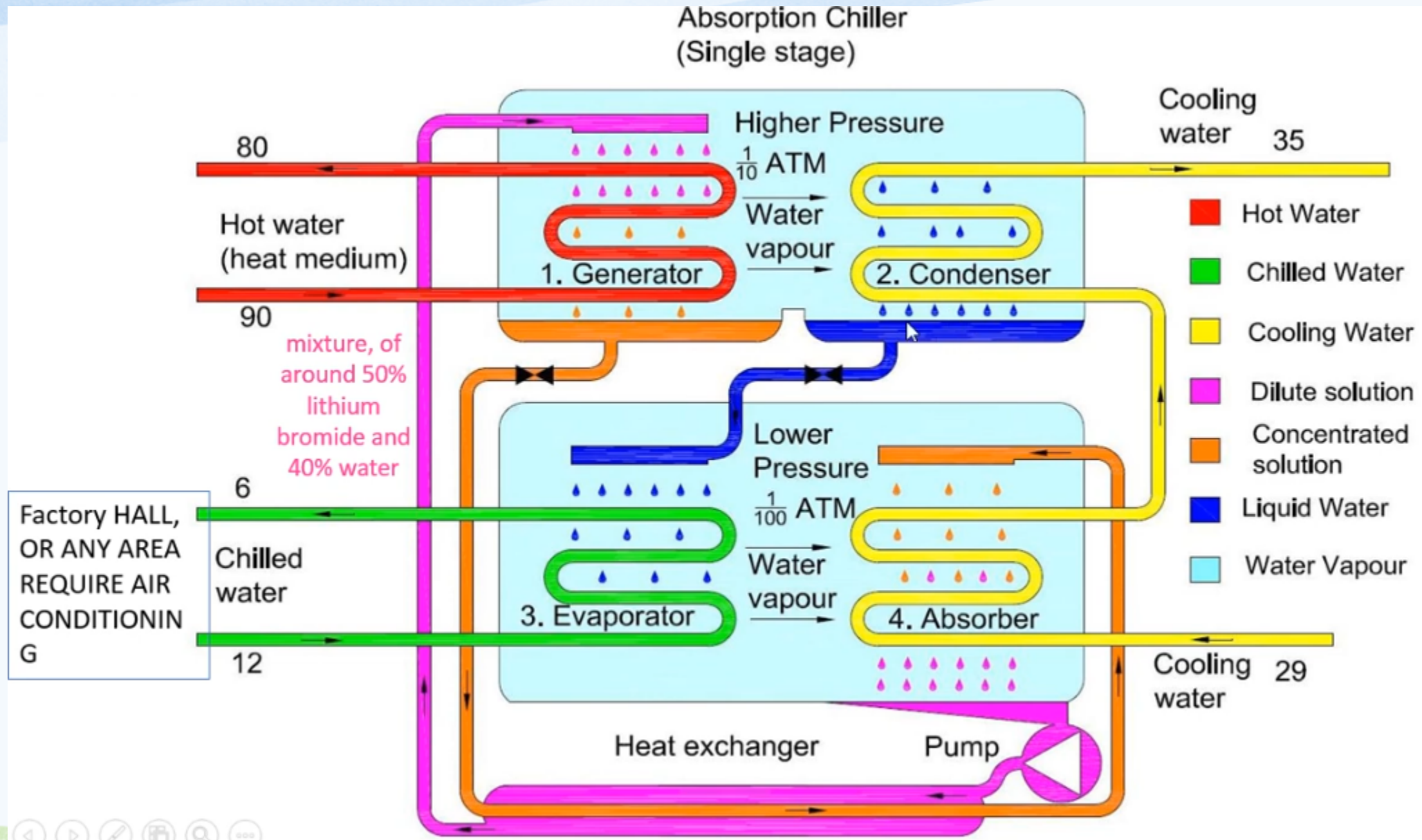
AMMONIA CYCLE



Vapor Absorption Refrigeration System



IN SUMMARY – COMPACT CYCLE DIAGRAM





Comparison between the Water–Ammonia and Lithium Bromide–Water systems

Criterion	Water–ammonia	Lithium bromide–water
Saturation temperatures difference	Relatively low	Very large
Refrigerant vapor purity	Poor	Very high
	The vapor released in the generator is a mixture of water and ammonia vapor and therefore a rectifier is required.	The vapor in the generator is pure water vapor. No rectifier is required.
Absorption rate	High	Low
	No recirculation is needed.	LiBr slowly absorbs water and therefore a recirculation of the weak solution in the absorber is necessary.
Toxicity	High	Relatively low
Corrosion	Noncorrosive toward ferrous metals	Corrodes nonferrous metals
	Ammonia corrodes copper and its alloys.	
Heat supply shutoff	Accepted	Not accepted
	The cooling of the solution due to the lack of heat input does not result in crystallization, which occurs at temperatures far below the ambient temperature.	The strong solution crystallizes at ambient temperature. In such situations, the installation has to be emptied and the solution is stored in heated reservoirs.

ABSORPTION CHILLER VARIATIONS IN PRODUCTION AROUND THE WORLD



Double Effect Exhaust Gas Driven Absorption Chiller



Engine/Turbine flue gas recovery

Driving temp. 250 ~ 700°C (Outlet : ~115°C)

Direct cooling & heating

COP 1.21 or 1.36

Invert controlled solution flow
PID control by microprocessor

Standard cooling capacity

50 - 1,500 ton (176 - 5,272kW)

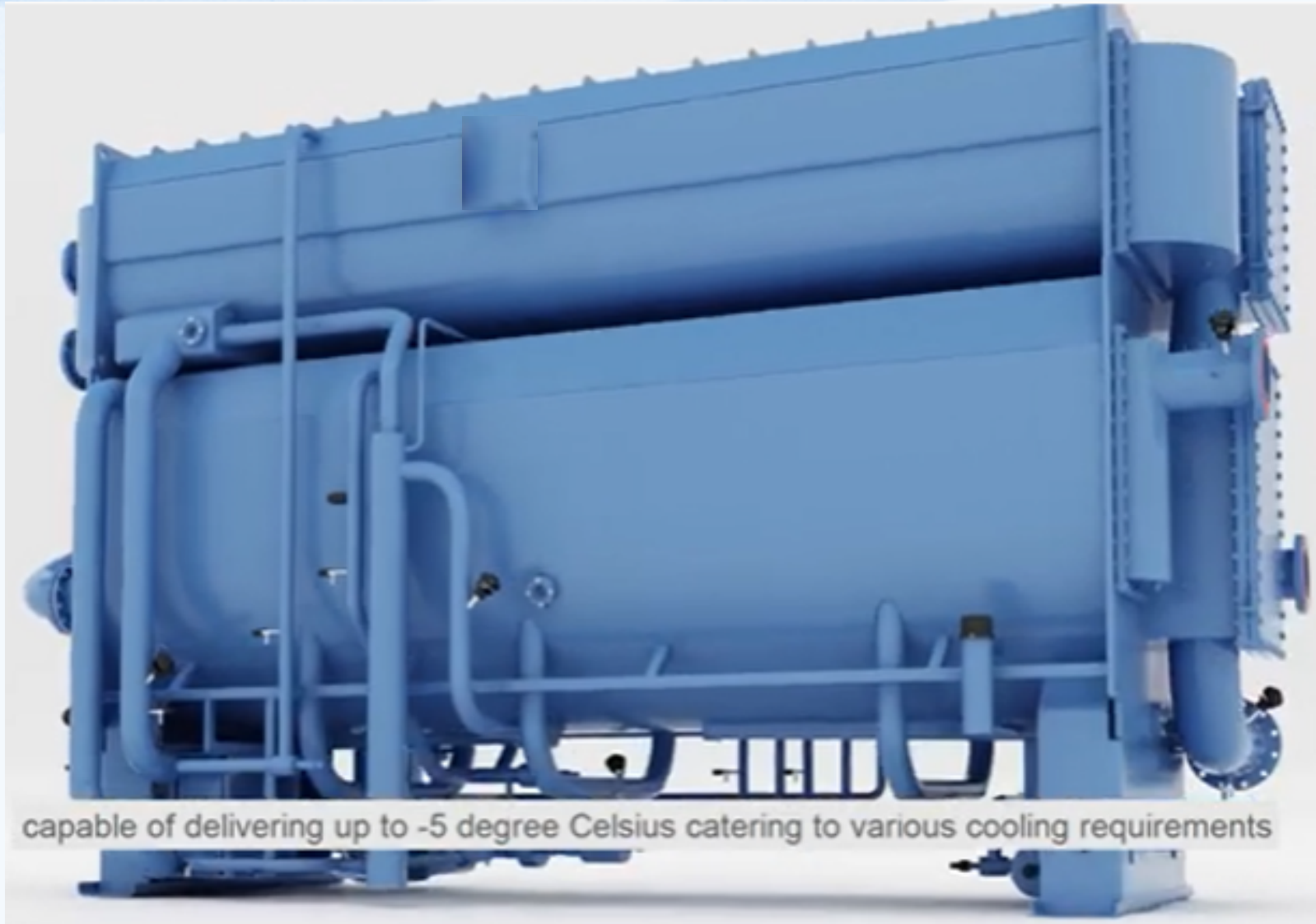


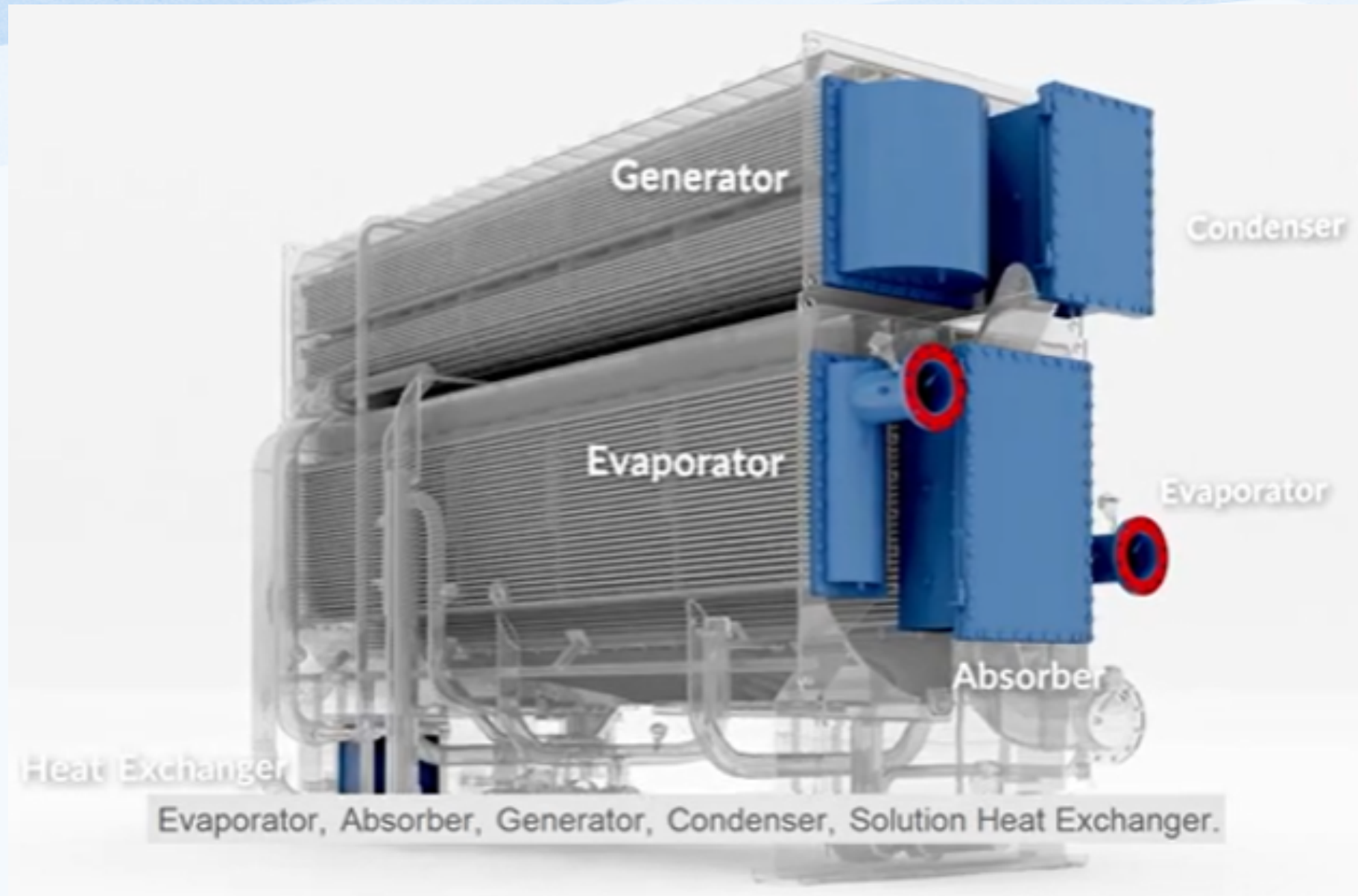
6,300+
installation

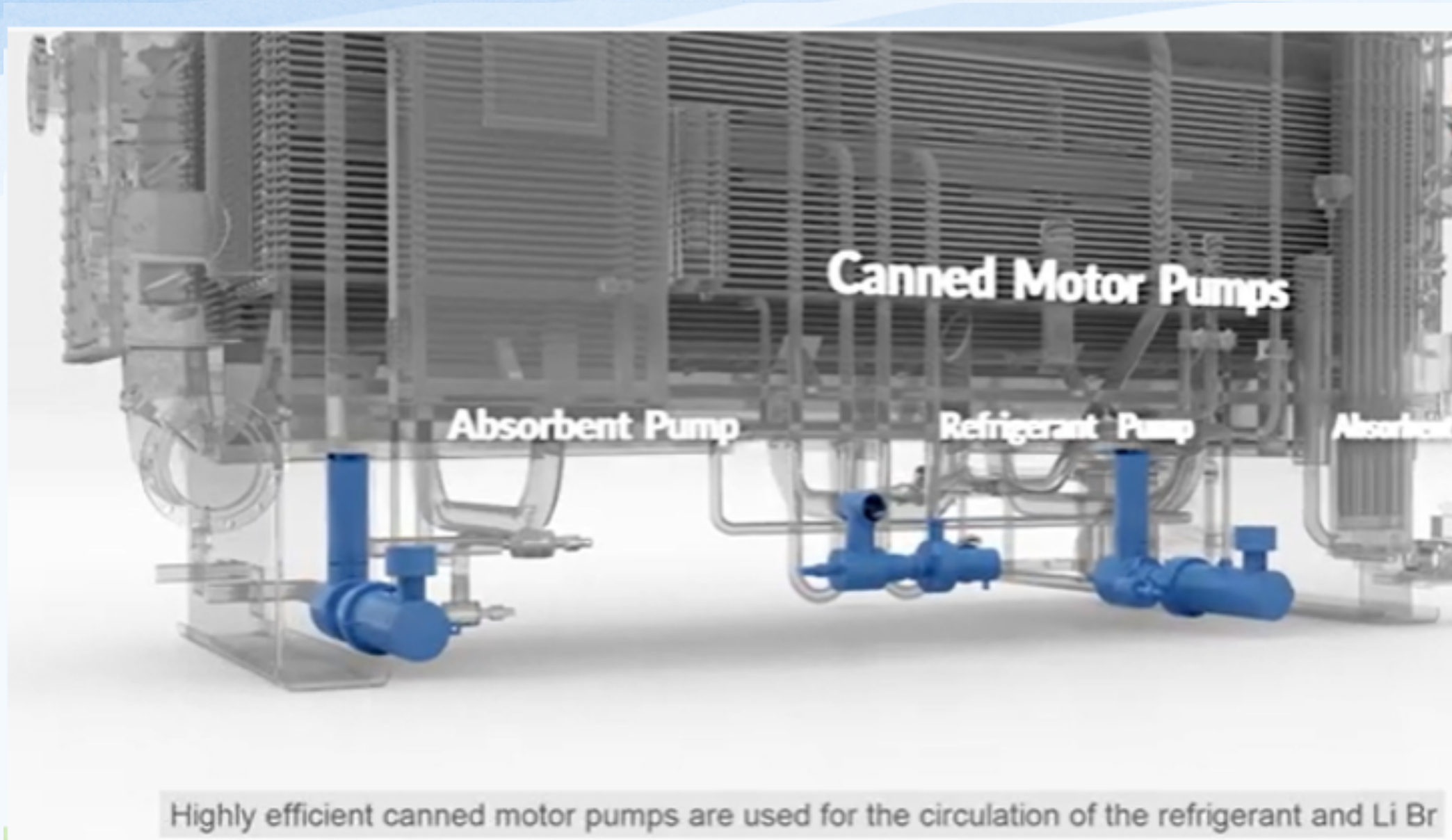


with 6,300 plus installation across the globe over the last 30 years









Canned Motor Pumps

Absorbent Pump

Refrigerant Pump

Absorbent Pump

Which can operate maintenance free for over 60,000 hours



Applications & Uses

- **Manufacturing:** The manufacturing industry, especially plastics, use industrial grade process chillers to remove heat from processed materials. Without chillers, many forms of production would need to grind to a halt for air cooling.
- **Food and Beverage:** Federal law sets strict guidelines for any product intended for human consumption. Secure chillers provide even, reliable cooling systems for products and ingredients which need to be kept cold. Process chillers can flash-freeze tons of product at a time by surrounding products with sudden cold, without affecting moisture or ingredients.
- **Power Generation:** The modern world would not be possible without power plants generating electricity for towns and cities around the world. The power supply industry uses process chillers to reduce heat caused by power generation. Without chillers, power plants would not be able to supply the amount of power they do using the amount of space they have.
- **Medicine:** Medical equipment and supplies sometimes need low temperatures in order to function. MRI machines and other large medical equipment generate large amounts of heat while they scan patients, and process chillers help to keep these machines from overloading. Liquid chillers are also used for storing medical supplies at low temperatures.





The Absorption Chiller Industry

Absorption chillers are quiet, vibration free, reliable, low maintenance and don't use any CFC gases. Because they are driven primarily by heat energy instead of mechanical energy, they are used in industrial manufacturing plants that use boilers or have access to wasted heat from different machinery and processes.





THANK YOU

ANY QUESTIONS

UNION OF ASSOCIATION OF AFRICAN ACTORS IN REFRIGERATION & AIR-CONDITIONING

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COOLING: THE KEY TO SUSTAINABLE DEVELOPMENT