

Solutions of ASHP for Industrial Heating Application

Market Prospect of Industrial Heating

To be the most popular new drying device in recent years, heat pump dryer has below advantages compared with the traditional coal-fired drying devices:

- **Energy Saving**: The energy consumption of heat pump drying device can be reduced by more than 40% compared with the ordinary drying devices.
- **Safe**: It is convenient to use inert drying medium to realize the closing circulation and safely dry the inflammable and explosive products as well as the products which is easy to be oxidized and deteriorated.
- **Eco-friendly**: It won't discharge the dust and peculiar smell to the air during drying, and the aroma components and solvents in the product can be recovered.



In some major drying markets, heat pump has great potential for substitution:

- Tobacco: There are 1.2 million intensive curing houses in China, including 1.19 million coal-fired baking houses and 2000 heat pump baking houses, **which covering 0.167% of the market share.**
- Grain: More than 80% grain are still dried by coal at present. Low energy efficiency, high drying cost, heavy environmental load, and inaccurate temperature and humidity control caused the **unstable drying quality of agricultural products.**

To the government subsidies, not only have the agricultural machinery subsidy from State, every provinces and cities also launched additional preferential policy to encourage the construction of grain drying center.

Industrial Heating Device-Application Fields

So far, almost all the production processes need to use drying, including the industries of agriculture, food, chemicals, ceramics, pharmaceutical, mineral processing, pulp and paper, wood processing, etc. The quality of drying materials depends on whether the constant temperature is well controlled or not. The heat pump drying technology is a kind of mild and natural drying method, which is more suitable for the drying of heat sensitive materials such as most of agricultural products and medicinal materials.



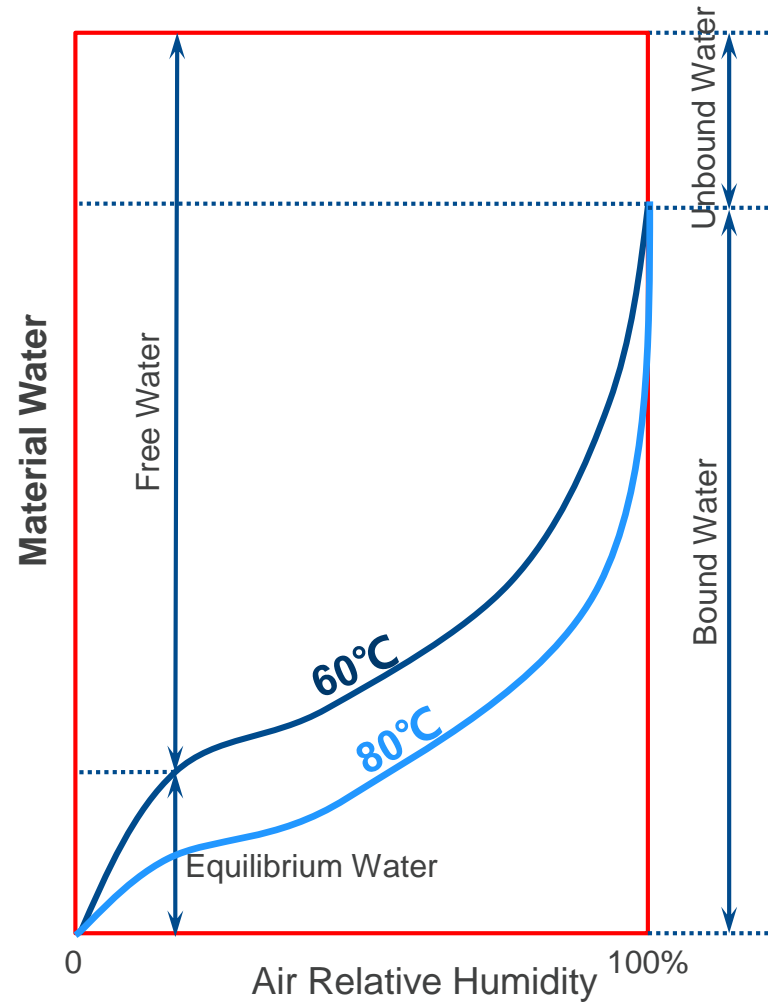
Drying Principle of Heat Pump

- The state of water in materials
 - Unbound water and bound water
 - equilibrium water and free water

Unbound water is the water that **can be easily removed** during drying
Free water is the water that **can be removed** during drying



Increase material temperature
Decrease air relative humidity



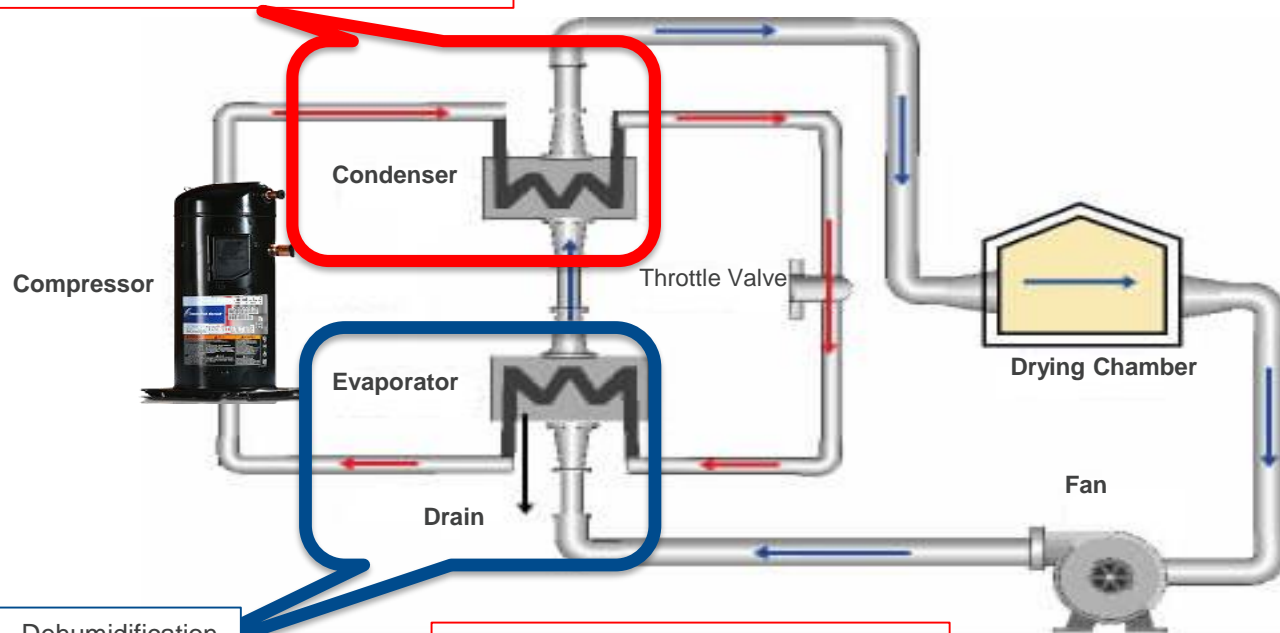
Drying Principle of Heat Pump

- **Increase the temperature of the material to be dried**
 - Providing heat
- **Reduce the relative humidity of drying medium, such as air, etc.**
 - Increase the temperature of drying medium: providing heat
 - Remove water from drying medium: dehumidification

- **Refrigerant selection principle**

- High critical temperature: The condensation temperature required by the working condition shall be lower than the critical temperature
- Low discharge temperature : The temperature should be low at the end the compression
- Environment protection: 0 ODP, low GWP

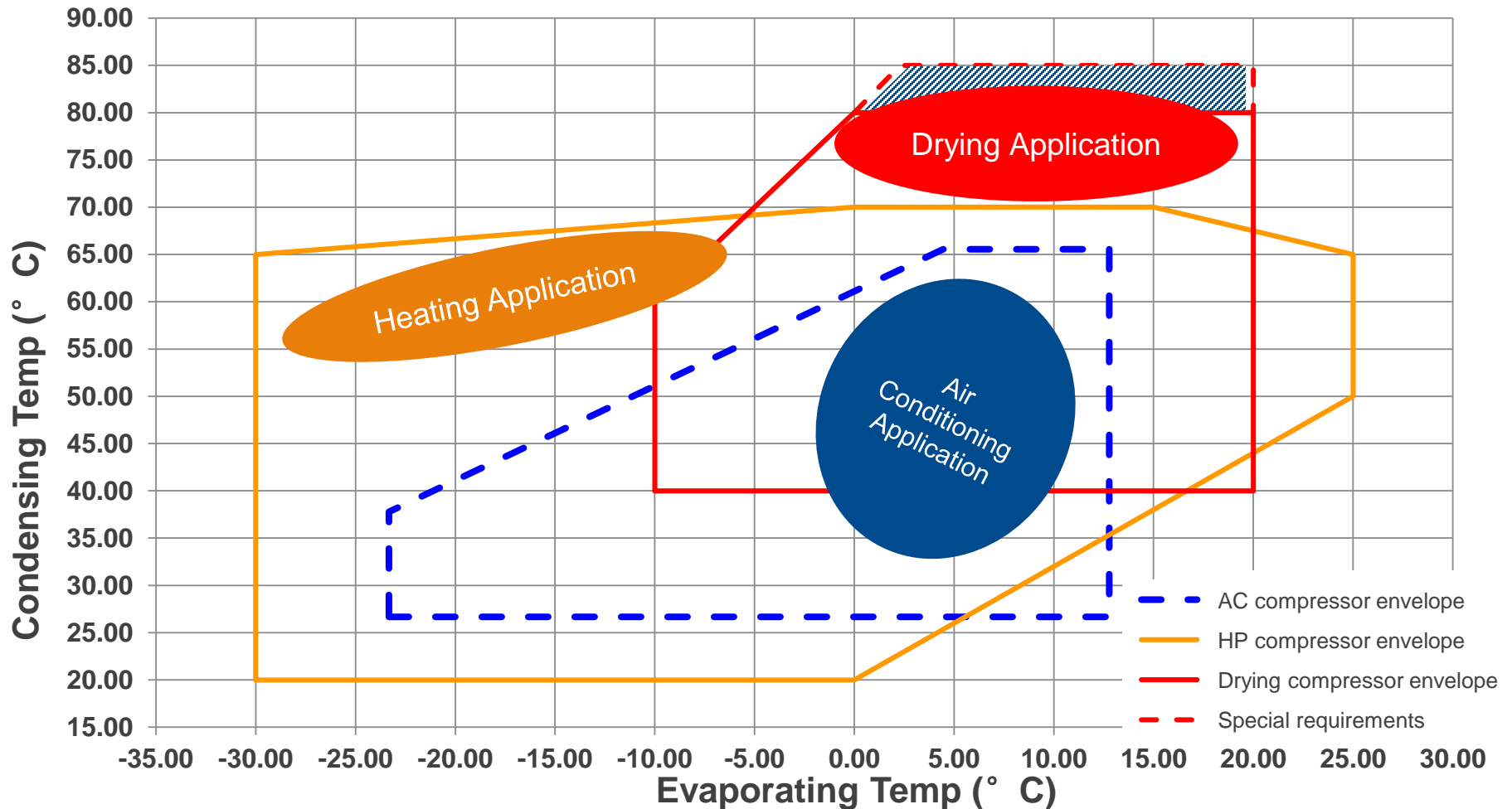
Condenser: Providing heat



Evaporator: Dehumidification

Closed Loop System

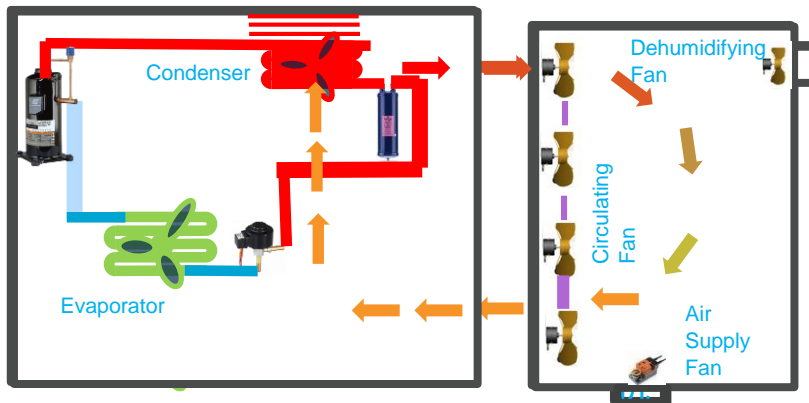
Industrial Heating Compressor-Application Range



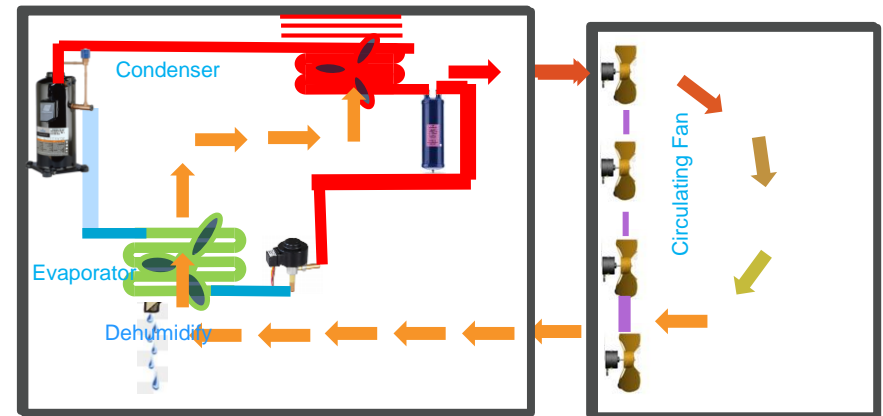
Since the application range of drying is completely different from other applications, a special designed compressor is required.

Industrial Heating System Classification

- Open Loop System
 - The forced exhausting fan discharge the humidity to the ambient directly, and the air supply valve is used together
- Closed Loop System
 - Remove humidity by evaporator
- Compound System
 - Open close integrated system



Open Loop System



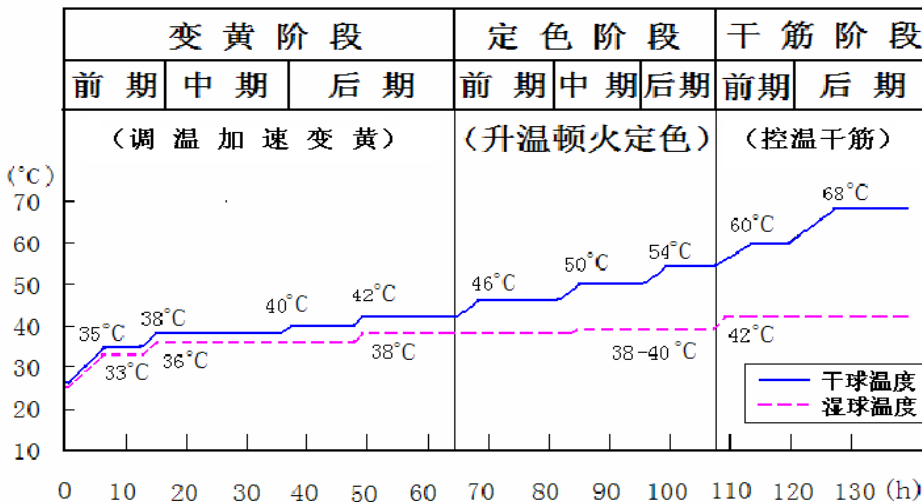
Closed Loop System

Selection of Industrial Heating Compressor

- **Capacity Modulation**

- The output capacity of the compressor needs to be adjusted to stabilize the temperature control
- Need to adjust and control the humidity of drying room (system related)

- **Temperature difference / capacity adjustment and application environment also require high compressor reliability.**

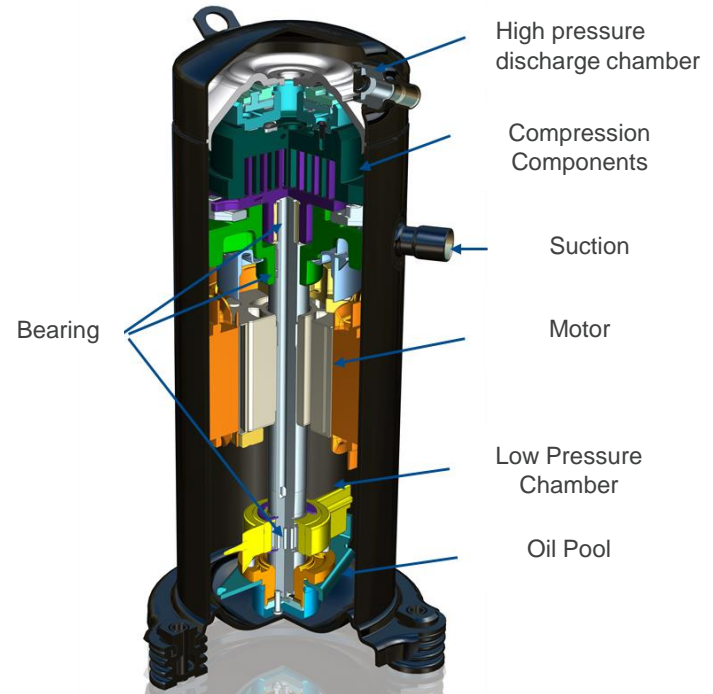


Example: Diagram for temperature and humidity requirement of tobacco baking, dry and wet bulbs must be stable during the whole process

- **Reliability of compressor**

- (1) compression components strength, (2) lubrication (Bearing / compression components) , (3) Motor protection;

- **Proper temperature is the key point (ensure lubrication and insulation of motor parts)**



Key components of low pressure chamber compressor (Vortex as an example) in low pressure chamber (low temperature)

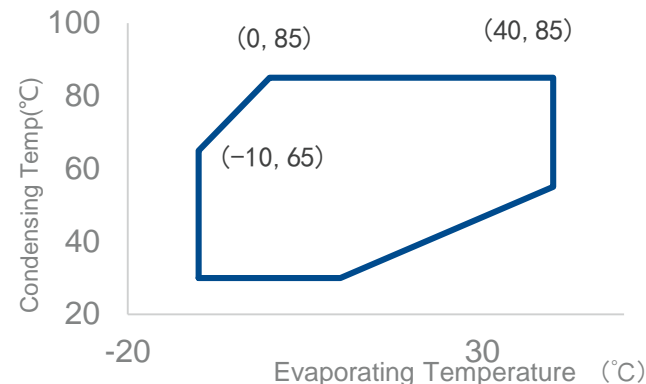
Constant Temperature & Humidity Dryer -Profile & Specification

HP	5	6	7	8	9	10	11	12
380V-50HZ Fixed Speed	●	●	●			●		●
Digital	●	●	●					

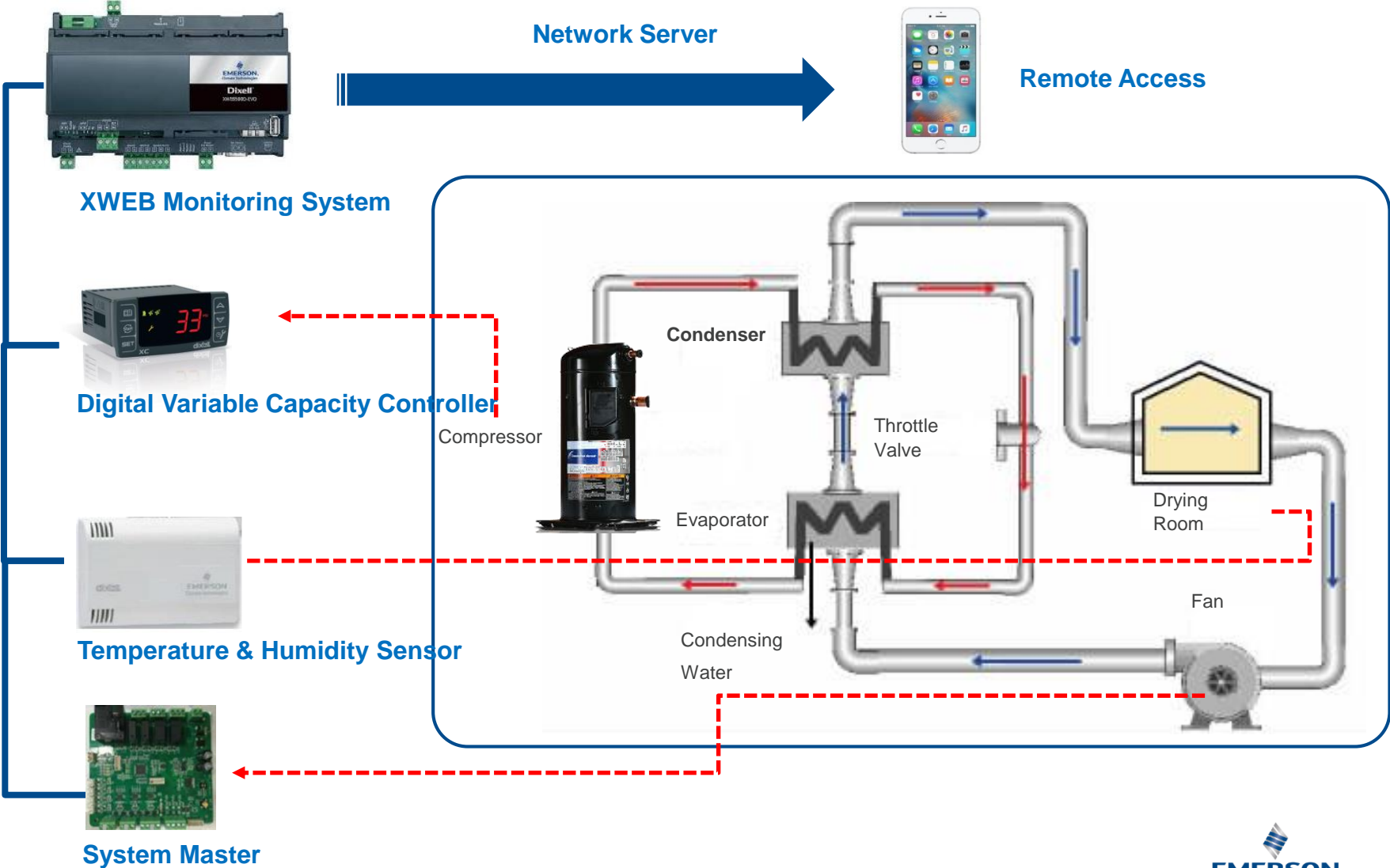
R134a Dedicated Compressor (ZW KB Series)

Compressor Specification

- The condensation temperature can reach to 85 °C and satisfy the needs of most drying materials.
- The evaporating temperature can reach to 40 °C, shall fully consider the application of high return air temperature of closed loop and compound system.
- Designed for R134a high temperature application, passed rigorous reliability test and field test, it is stable and reliable.
- The digital scroll compressor can adjust the capacity according to the load demand to realize the accurate temperature control of the baking room.



Industrial Heating Device- Control System Diagram

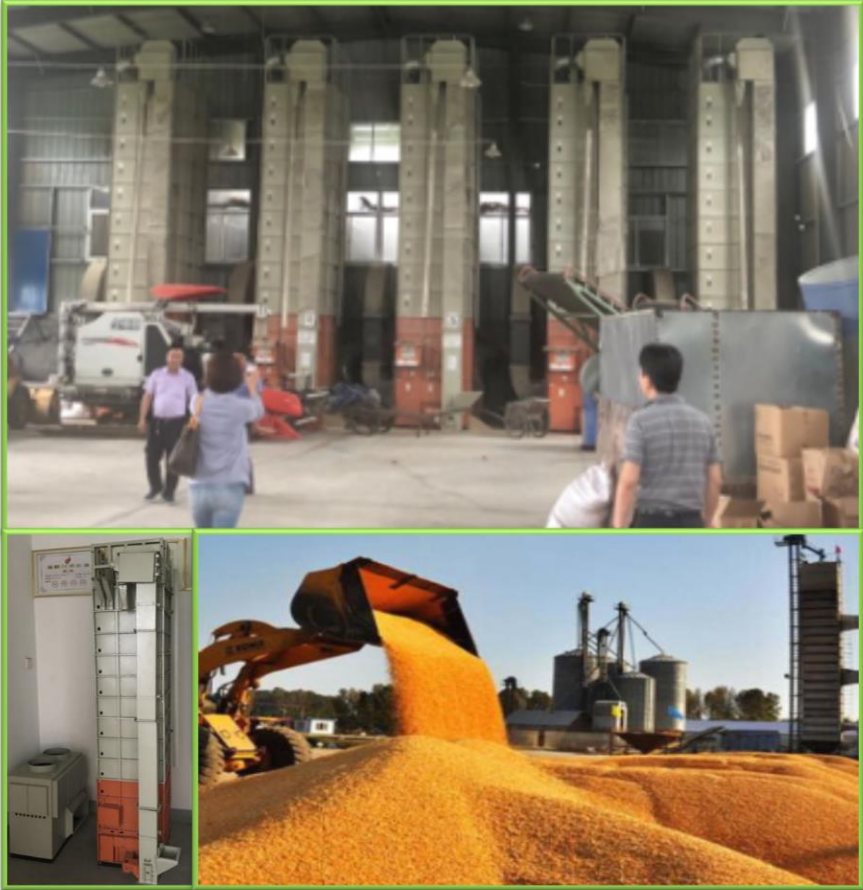


Industrial Heating Projects

Yunnan Tobacco Drying



Ningbo Drying Center



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