



Market Trends – Industrial Refrigeration

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Market Trends

- R717 – widely used and historically, the most common refrigerant used in HCFC/HFC conversions
- CO2 – setting the standard in commercial refrigeration applications
 - application range is widening
- Air - very low temperature applications

Technology Trends - Efficiency

- VSD control
- Permanent magnet motors
- Electronic valve control systems
- Multi stage systems

Technology Trends – Heat Recovery

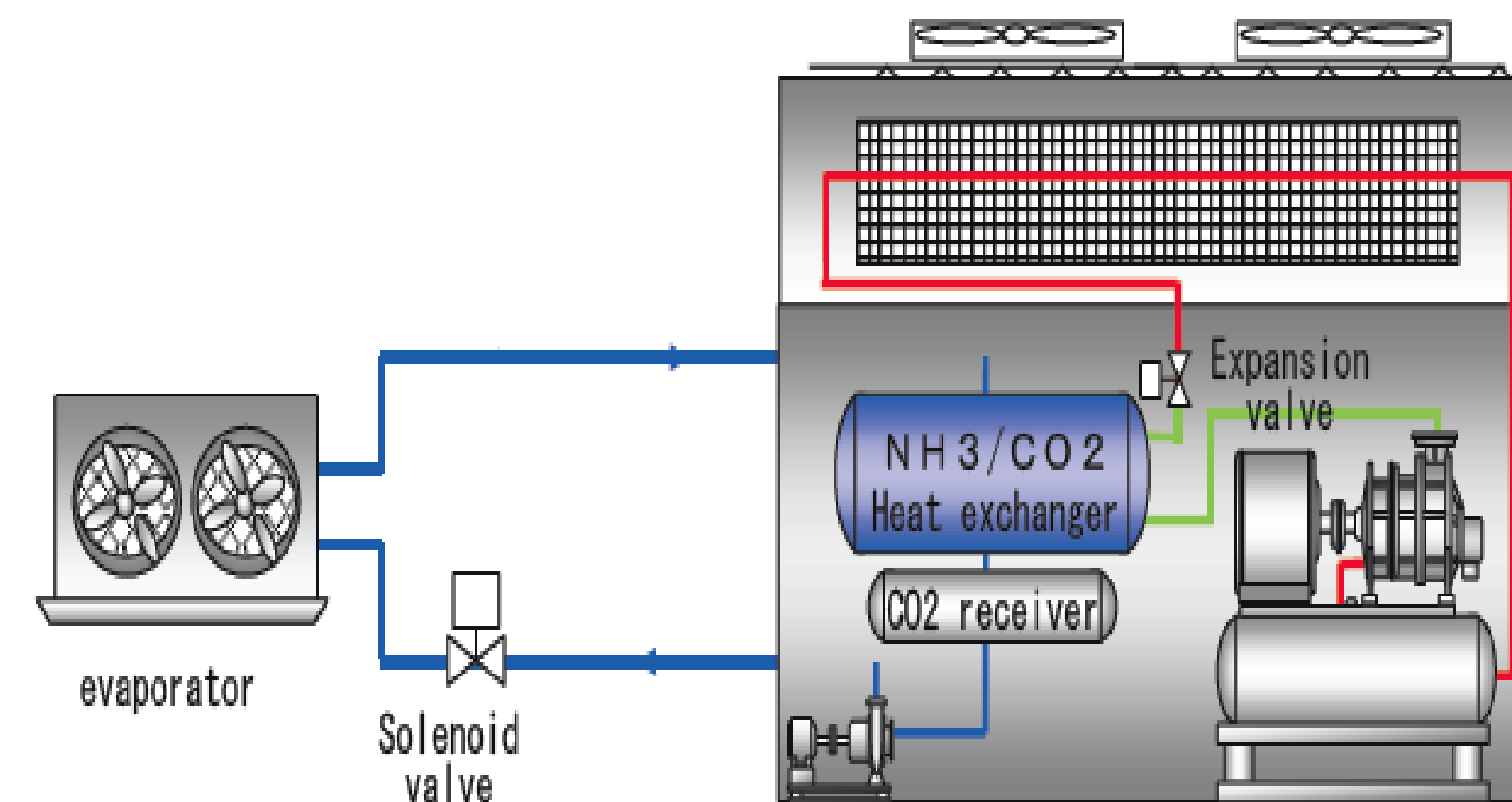
- Hot gas usage vs Low Tc
- Heat pump applications (waste heat, stable thermal heat sources)

System Safety

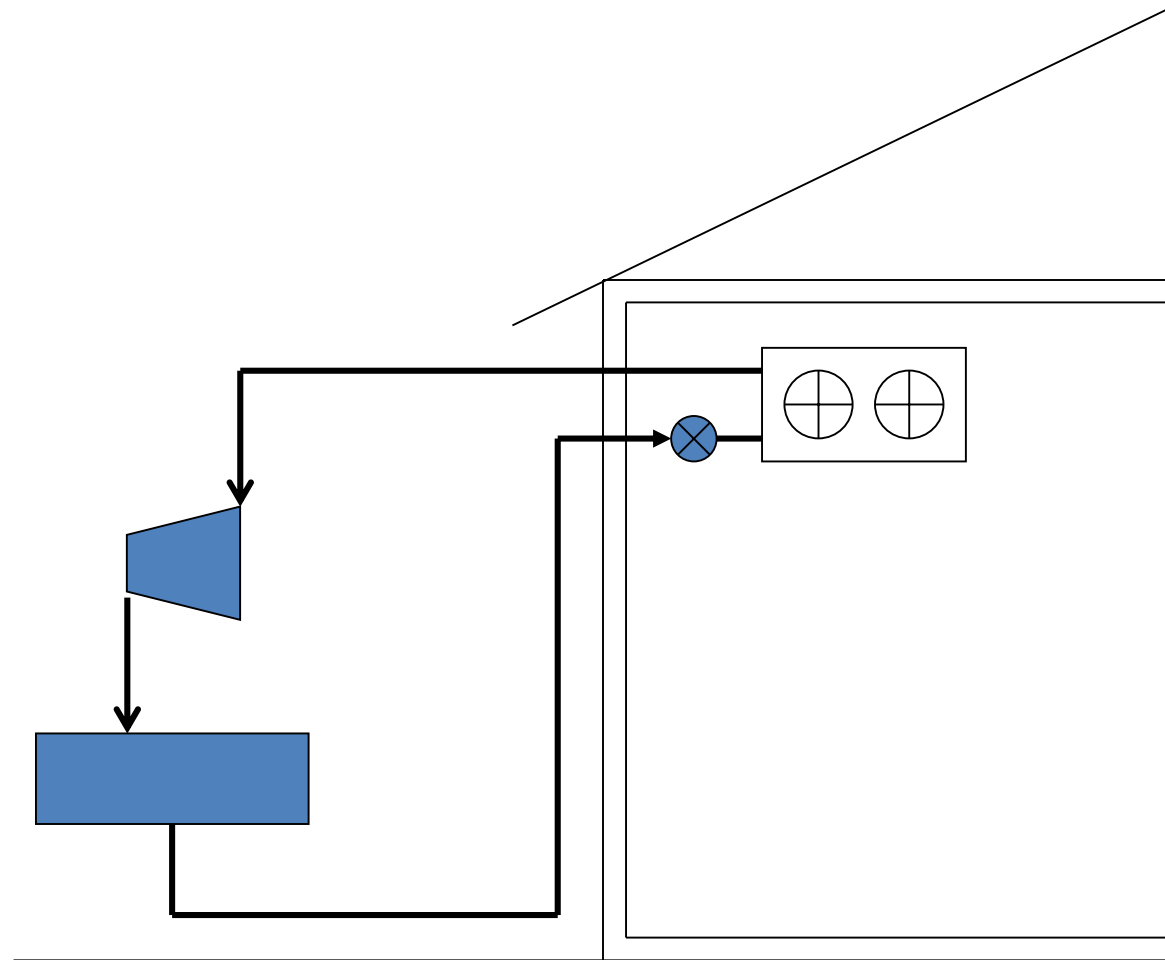
- Low charge systems
- Use of semi-hermetic compressors/motors to eliminate potential leaks
- Motor alignment advantages using semi-hermetic compressors
- Adhering to legislative compliances

- NH₃ is used as the primary refrigerant and CO₂ refrigerant is used as the secondary refrigerant
- Liquid CO₂ is pumped from NH₃ / CO₂ package to evaporator fan coils, display cases or spiral/tunnel freezers
- Liquid CO₂ extracts heat and returns as a two phase flow to package NH₃ / CO₂ heat exchanger (CO₂ condenser)
- No CO₂ compressors are needed, only CO₂ circulation pump(s) utilized. Some applications can also be gravity fed requiring no CO₂ pump

NH₃ / CO₂ Chillers are typically the least complex system type using Natural Refrigerants which allows for wide adoption in applications previously using HCFC and HFC refrigerants

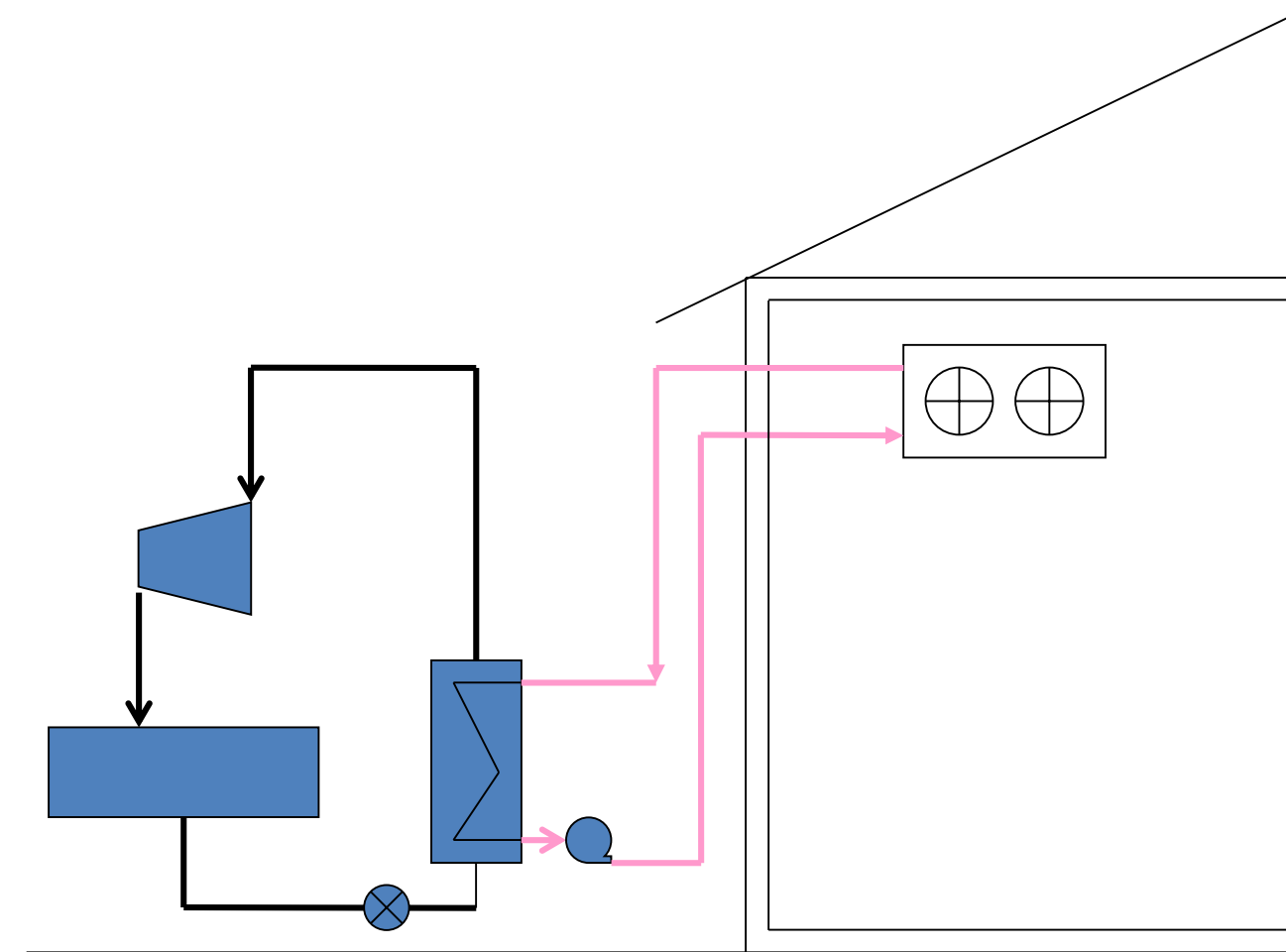


Comparison of NH₃ System Types



Direct Method

- Potential for leaks in occupied spaces
- Requires large amount of ammonia



Indirect Method

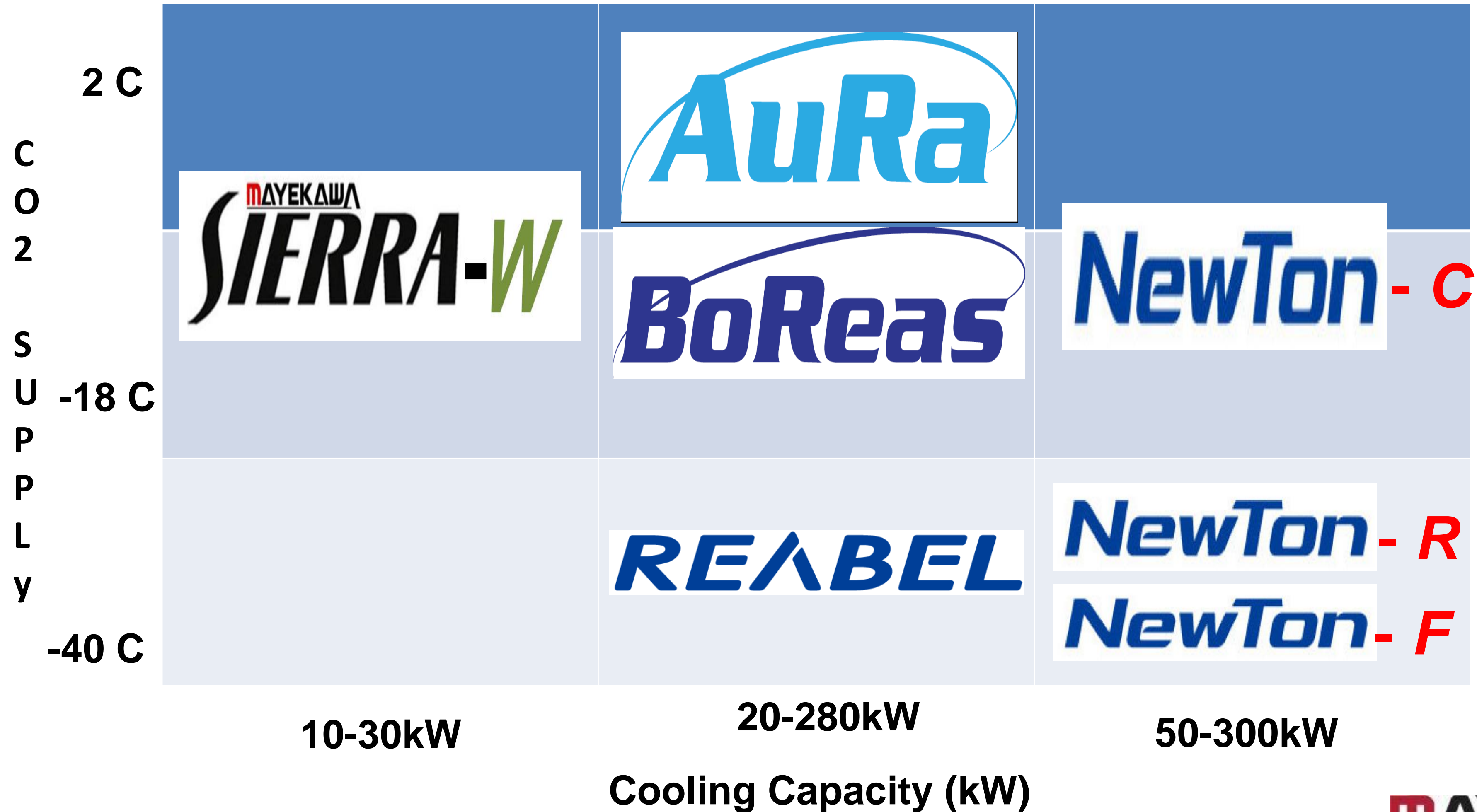
- Least potential of leakage in occupied spaces
- Utilizes very small amount of ammonia

Safest Approach of NH₃ Refrigeration Systems

The Indirect Method

- Eliminates CO₂ sub critical compressors in system, requires only CO₂ pump. In addition, the volumetric performance of CO₂ is 4 to 12 times better than even NH₃ which translates to lower pump energy required
- No oil fouling of evaporator coils, no oil draining maintenance is required
- Smaller system piping required for CO₂ field piping results in lower piping installation cost
- Ammonia is contained in an isolated location, large reduction in total charge
- Better heat transfer co-efficient means smaller size evaporator and low air to refrigerant approaches for precise temperature control
- In the event of a leak, CO₂ in the secondary system will not damage product
- Higher CO₂ operating pressures on the secondary loop prevent air contamination of system in the event of a minor leak.

Mayekawa NH₃ / CO₂ Secondary Chiller Package Product Overview



NewTon

Shaping Refrigeration Systems for Tomorrow

Low Temperature Semi Hermetic Screw Package

- -25C to -42C CO₂ Supply Temperature range
- 50kW to 300kW Capacity range – single compressor
- Internally Compounded Twin Screw Design
- IPM Motor with Integrated VFD
- High Performance Plate and Shell Heat Exchangers
- Low NH₃ Charge with optimized flooded control



Medium Temperature Semi Hermetic Screw Package

- -10C to 2C CO₂ Supply Temperature range
- 140kW to 240kW Capacity range – single compressor
- Single Stage Twin Screw Design
- IPM Motor with Integrated VFD
- High Performance Plate and Shell Heat Exchangers



Over 1,000 NewTon Packages Installed Worldwide!

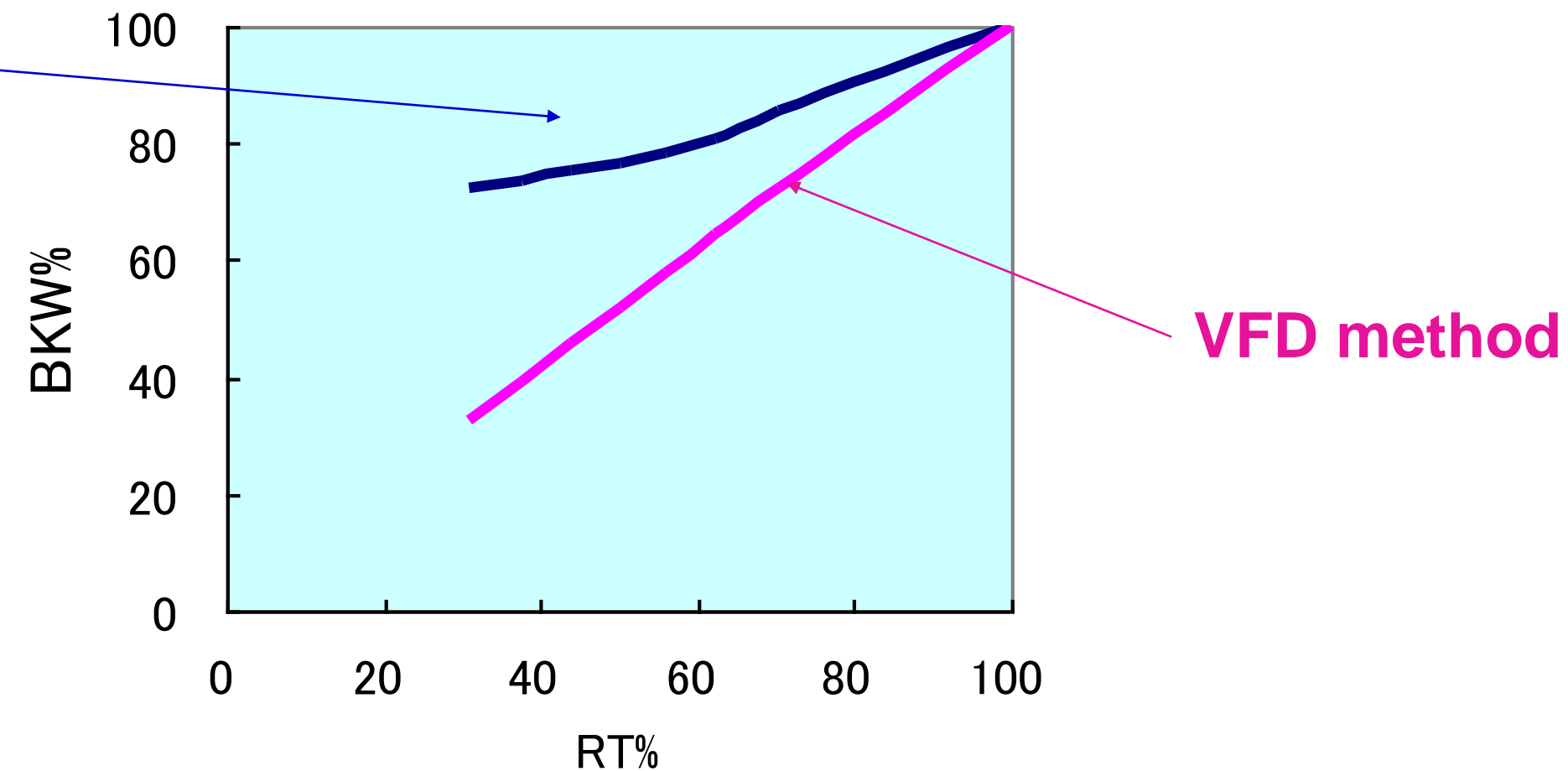
NewTon NH₃ / CO₂ Secondary Chiller Package Features

NH₃ Low Temperature Screw Compressor Package

IPM Motor • Internally Compounded • VFD Controlled

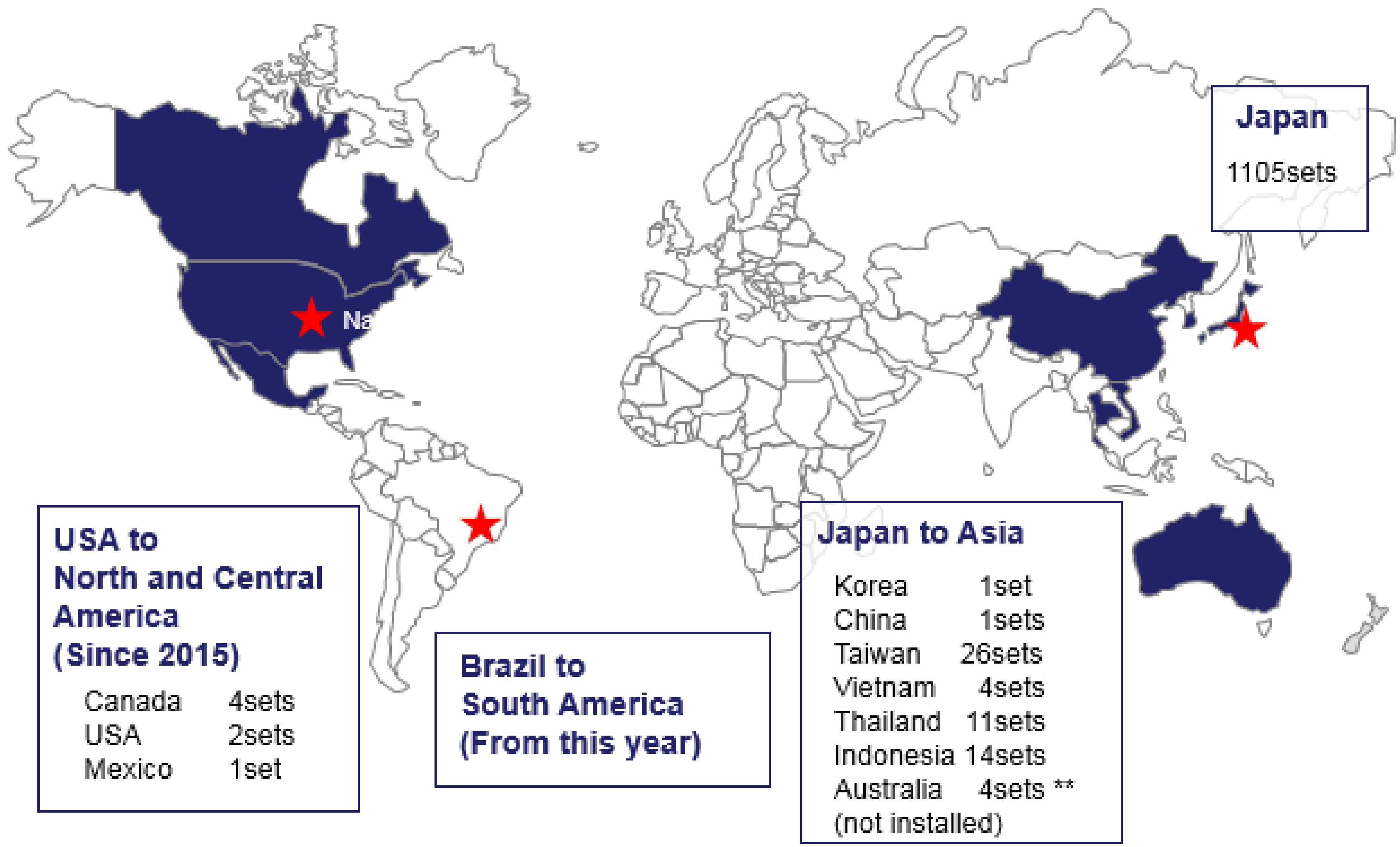
- Semi hermetic COMPOUND screw compressor with integral IPM motor. High speed rotation possible up to 5,600 RPM, and when combined with precise rotation speed to match required capacity, higher part load efficiencies are achieved versus a conventional slide valve
- IPM Motor results in 5-10% increased motor efficiency and 40% smaller size
- Double Economizer feature allows for more efficient liquid sub cooling

Slide valve method



Energy consumption under low demand load

"NewTon" Installations



Air Cooled NH₃ Semi Hermetic Reciprocating Compressor Package

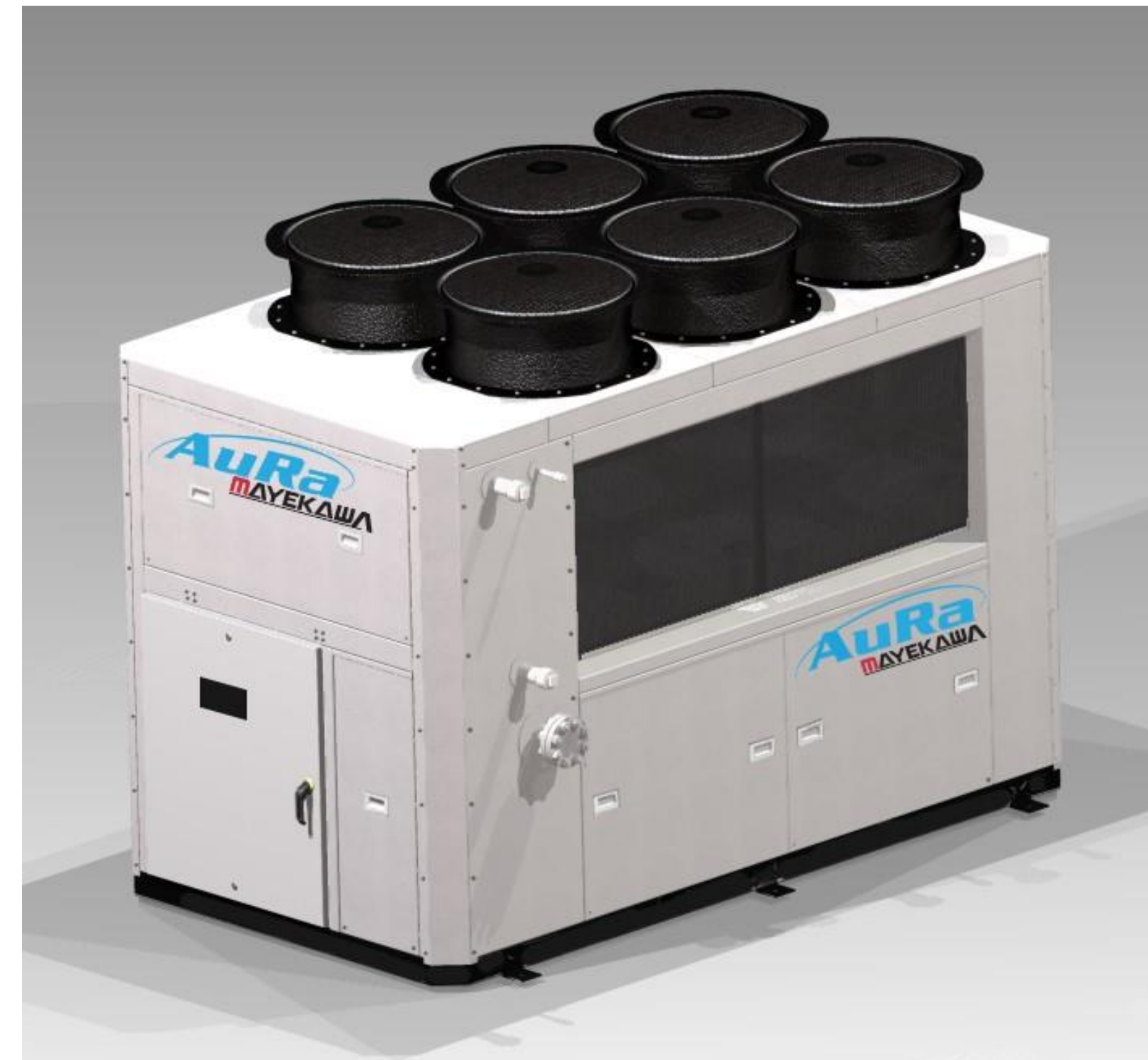


BoReas

MAYEKAWA
MYCOM



- Outdoor rated packages available in 140, 200 & 280kW models at 7C water outlet temperature and 35C ambient temperature
- Micro Channel Condensers utilized to maintain low NH₃ refrigerant charge, yet maintain high package efficiencies
- Optimized water or glycol heat exchangers
- Reliable MYCOM semi hermetic reciprocating compressors with VFD control allow for precise temperature control
- Integrated digital controller with EC condenser fan operation capable of connection to existing BMS automation system



Air Conditioning • Process Cooling • Ice Rinks • Cold Storage

Challenges

- Longer term view required by end users
- Training requirements
- Legislation
- Investment by end users
- Government support/funding of energy efficient and natural refrigerant projects



ATMO
sphere

Thank you very much!



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