

# Energy Efficiency Equipment Case Studies

## *Newton 3000 and Thermo-shutter*

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NH<sub>3</sub>/CO<sub>2</sub> Hybrid Refrigeration System
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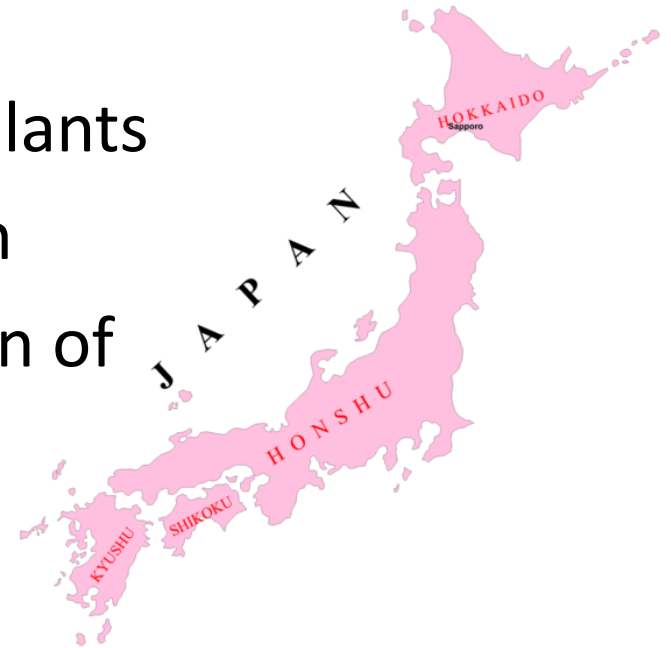
## Mayekawa Australia

- One of 140 offices globally
- Over 3000 staff world wide
- 2 compressor factories, 8 packaging plants
- Established in Australia 1984 (Sydney)
- Parts warehouse and workshop
- Same day parts dispatch



# R22 Challenge in Japan's Coldstores

- Phase out of new R22 refrigeration plants by 2010
- Phase out of existing R22 by 2020
- Approx. 13,000 R22 refrigeration plants
- Added risk of earthquakes in Japan
- Case study looks at implementation of NewTon 3000 in existing and new refrigeration plants



## Newton 3000 Key Features

- Hybrid low energy solution
- Ideal for coldstore transition to Natural Refrigerants
- Package includes NH<sub>3</sub> refrigeration cycle, CO<sub>2</sub> liquefaction, receiver and CO<sub>2</sub> pump.
- NH<sub>3</sub> + CO<sub>2</sub> Hybrid System = Reduced refrigerant charge
- 20% Energy Efficiency Gain from:
  - Purpose designed canned IPM motor
  - Two stage screw compressor
  - Built-in VFD
  - Double economizer



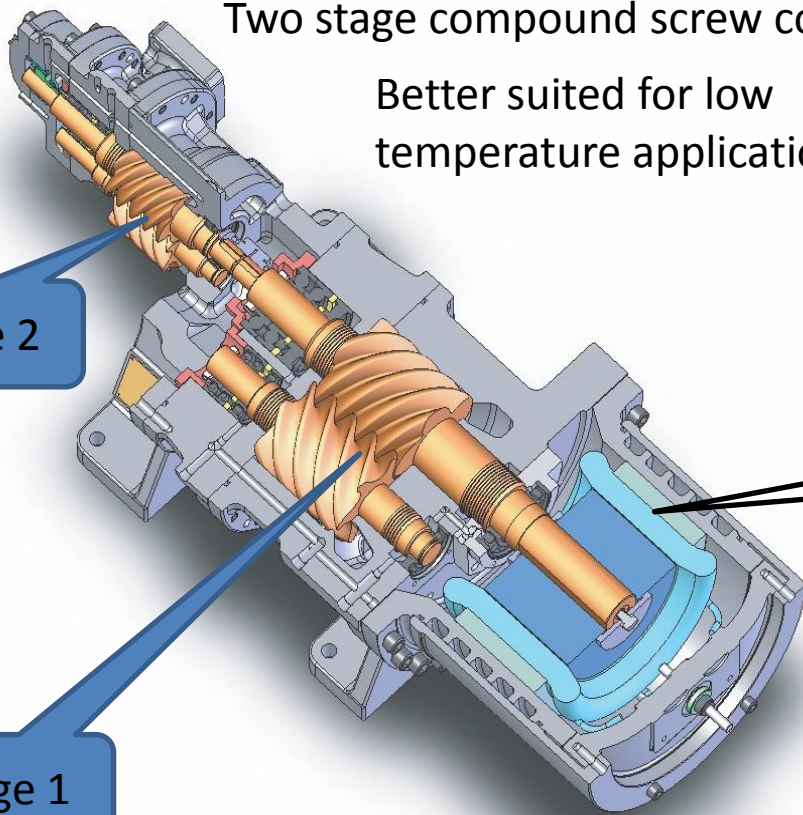
## Indirect Cooling NH<sub>3</sub>/CO<sub>2</sub>

- Indirect cooling takes ammonia out of the cooling or process area.
- CO<sub>2</sub> selected for superior secondary refrigerant qualities

Refrigerant type	Viscosity	Heat density	Flow	Pump power
Calcium chloride	1.00	1.00	1.00	1.00
Formic acid	0.44	1.05	0.96	0.68
CO <sub>2</sub>	0.01	113.5	0.033	0.10

- NH<sub>3</sub> charge reduced to 100kg and confined to the compression package.

# Innovations for 20% Efficiency Gains

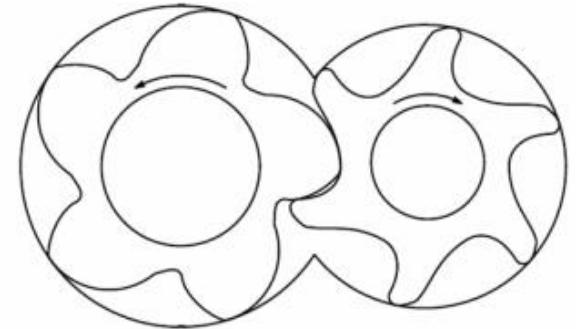


Two stage compound screw compressor

Better suited for low temperature applications -25°C

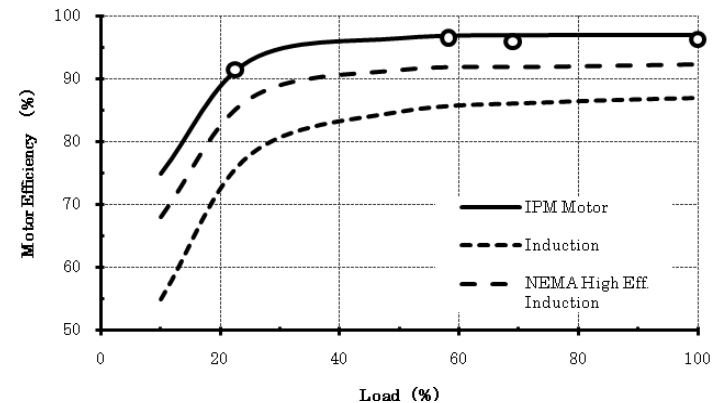
Stage 2

Stage 1



New high efficiency rotor profile

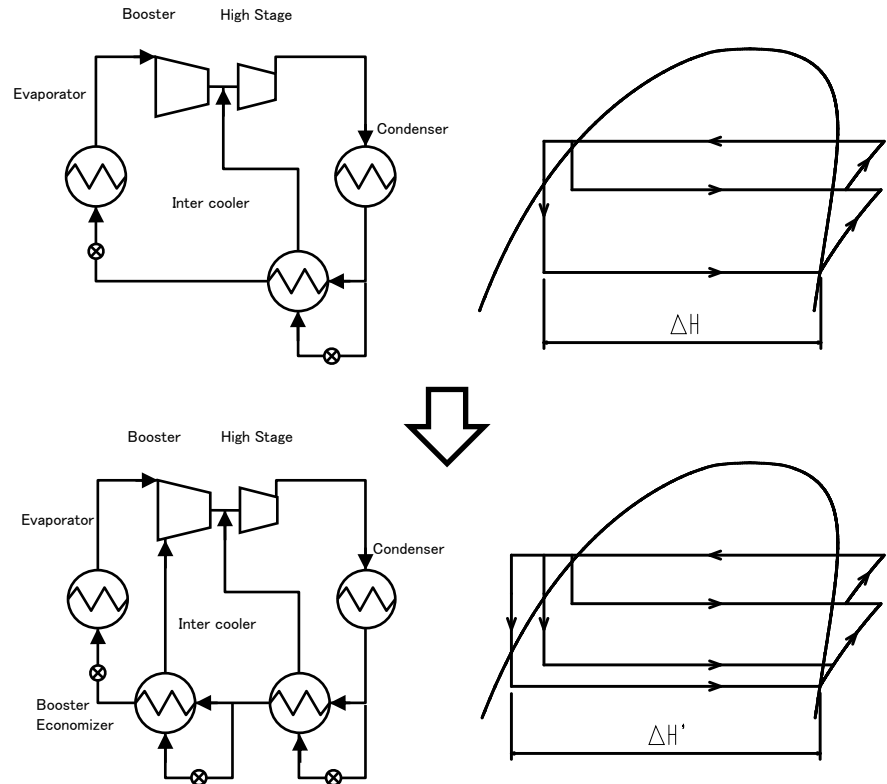
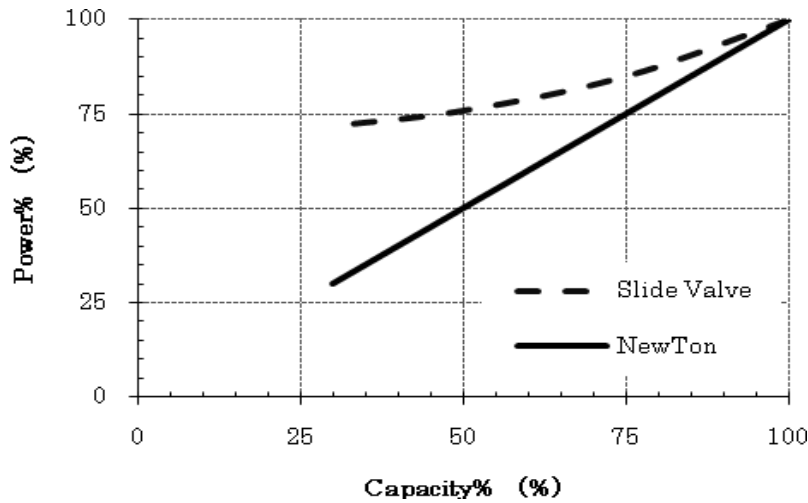
Built-in canned IPM motor  
Internal Permanent Magnet



# Innovations for 20% Efficiency Gains

VFD speed control  
higher efficiency part  
load

Double economizer

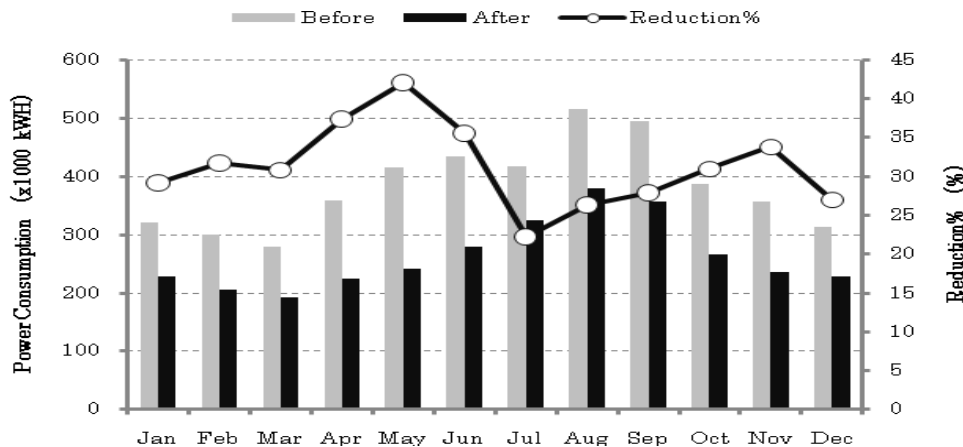


## NewTon 3000 Installations 2008-2010

- 200 units delivered to cold stores and freezers
- 880,000m<sup>3</sup> of cold stores
- 40,000 ton/year freezing
- Replacement of R22 and new coldstore construction
- Some installations have been Japanese Govt. subsidised

# R22 Replacement Case Study

CASE	Volume	Age of plant	Existing equipment		Efficiency gain
	Ton	yrs	Refrigerant	Comp. type	(%)
A	45,000	29	HCFC-22	screw	31.1
B	10,000	33	HCFC-22	recips	41.2
C	16,250	27	HCFC-22	recips	24.9
D	6,125	38	HCFC-22	screw	29.3



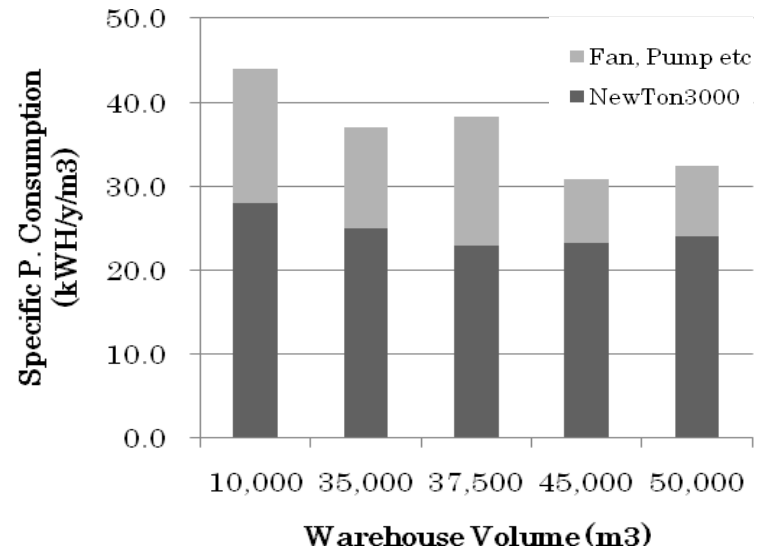
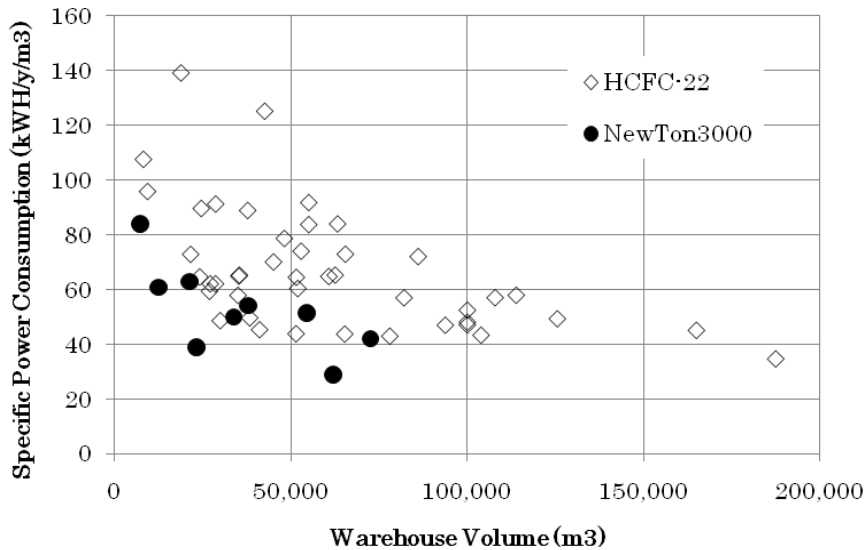
## Case A

- 31.1% plant power reduction
- 50% refrigeration equipment power reduction
- Reduction for replacement projects 44-52%
- Refrigeration equipment accounts for 60-70% of plant power consumption

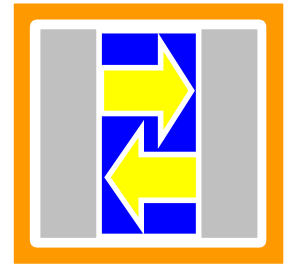
# NewTon 3000 in New Facilities



# NewTon 3000 in New Facilities



- 53 new cold stores measured
- 44 R22 sites using avg. 66.8kWH/yr/m<sup>3</sup>
- 9 NewTon 3000 sites using avg. 52.5KWH/yr/m<sup>3</sup>
- Overall avg. efficiency gain 22% new facilities
- Overall avg. efficiency gain 30% existing facilities



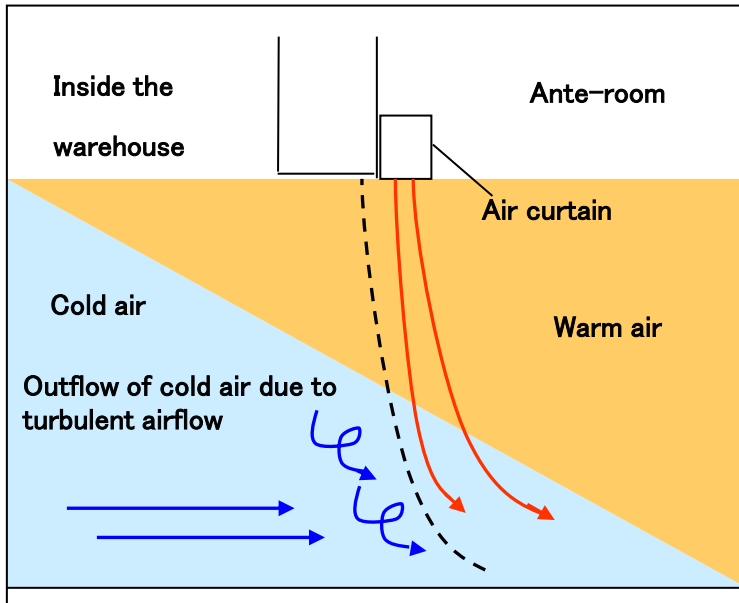
## Thermoshutter Air Curtain

- Avg. annual power efficiency improvement 30% (up to 50% in Summer)
- Reduce refrigeration load - heat infiltration down by 1/2
- Reduce frequency of defrosting
- Lateral airflow – 75% insulation rate

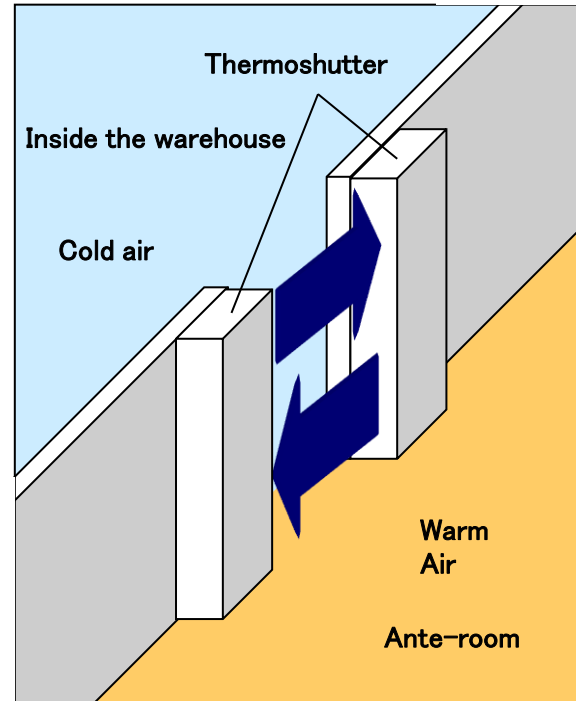


# Thermoshutter vs Conventional Air Curtains

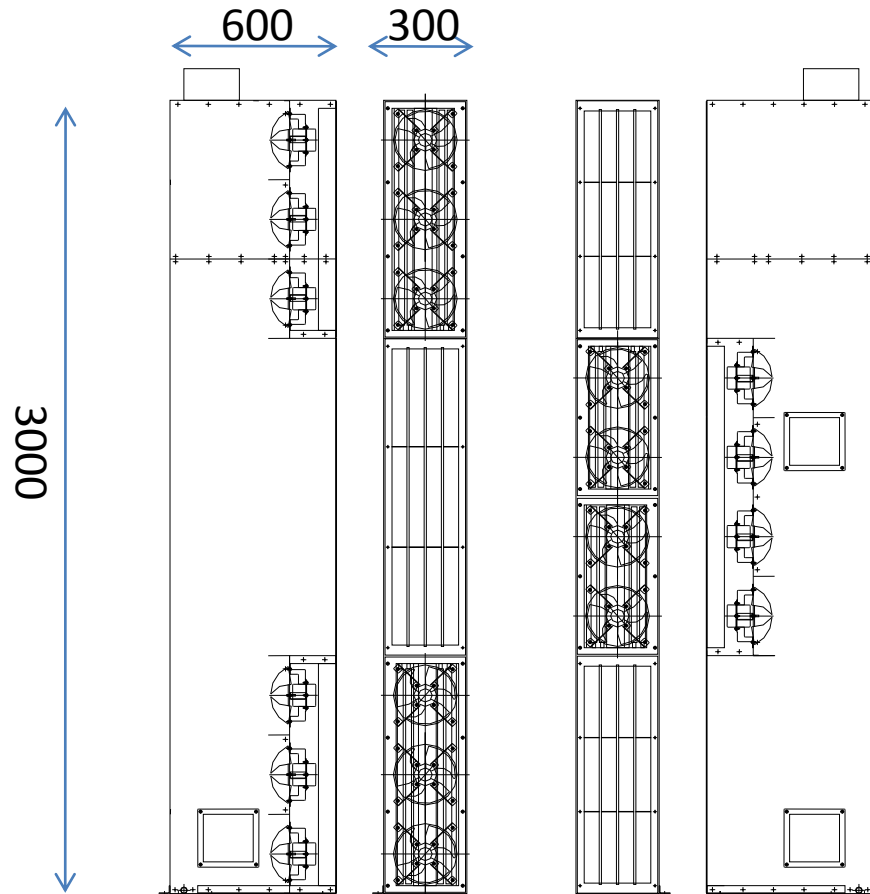
Conventional approach



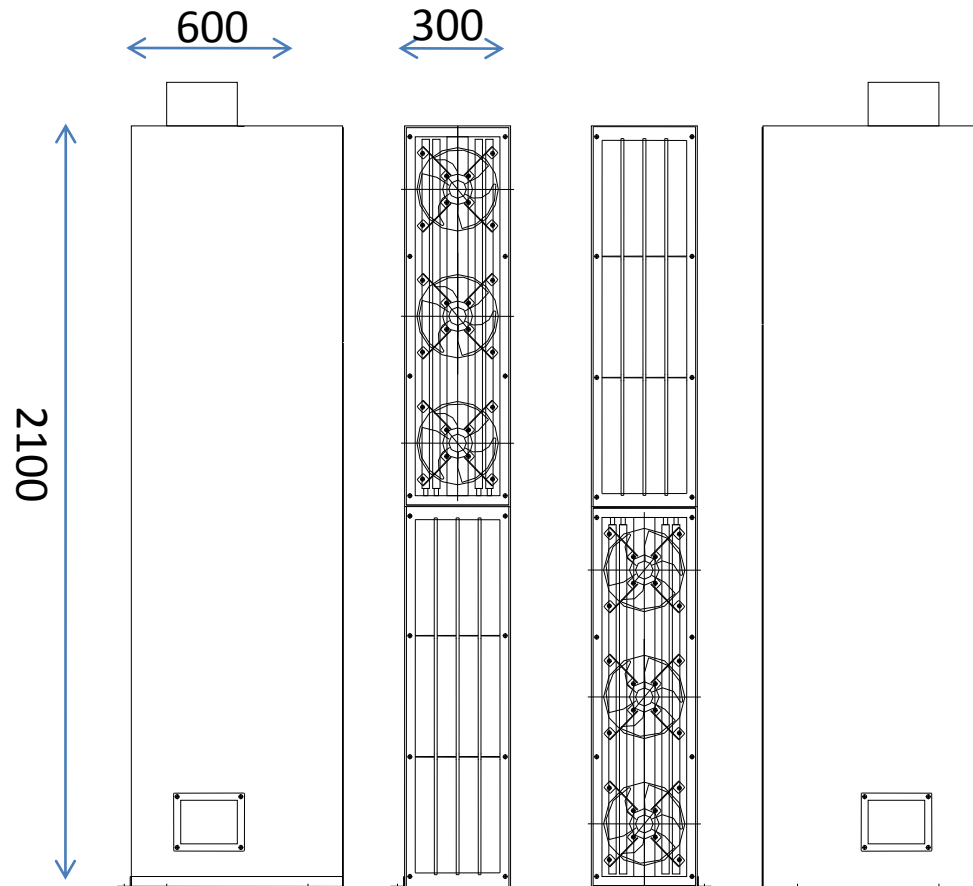
Thermoshutter



# Thermoshutter 3000 Model



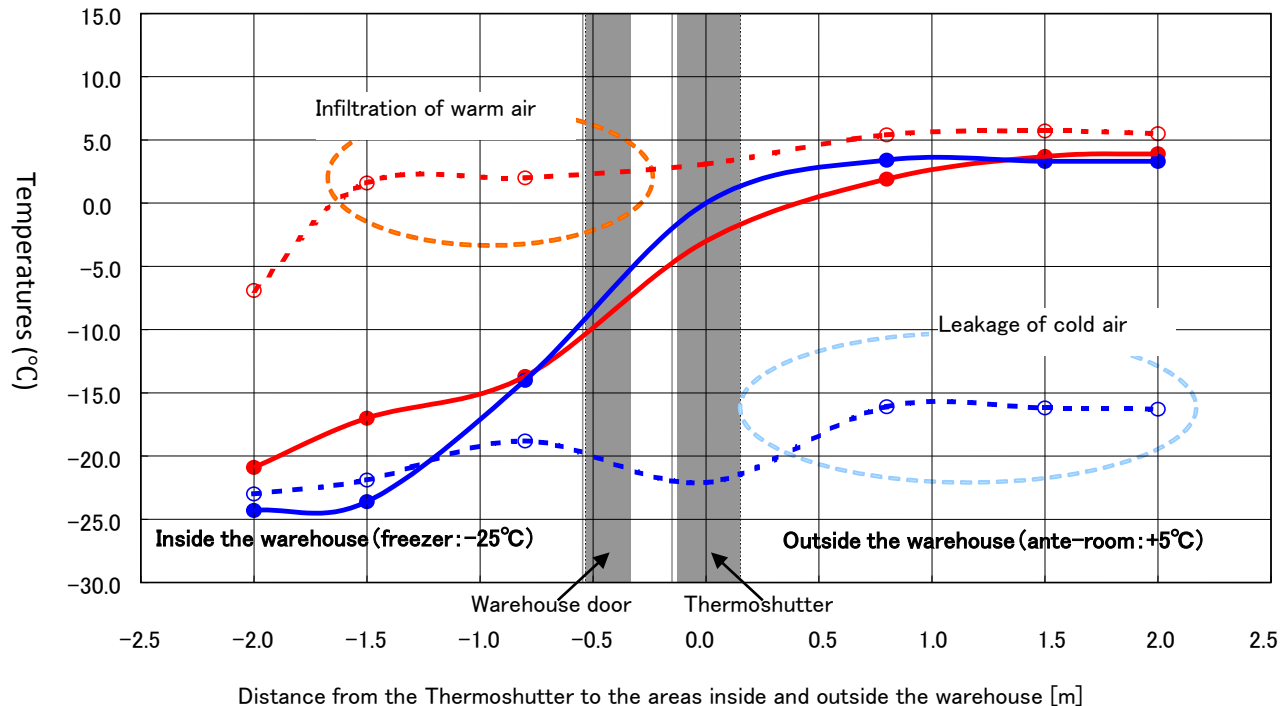
# Thermoshutter 2100 Model



# Company K Tokyo

Inside cool room -25°C  
Ante-room +5°C

- Thermoshutter in operation (near the ceiling)
- Thermoshutter in operation (near the floor)
- -○- - Thermoshutter not in operation (near the ceiling)
- -○- - Thermoshutter not in operation (near the floor)



Thank you.

Mayekawa is your partner in Energy  
Efficiency and Natural Refrigerants