

# Air refrigeration system "Pascal Air"

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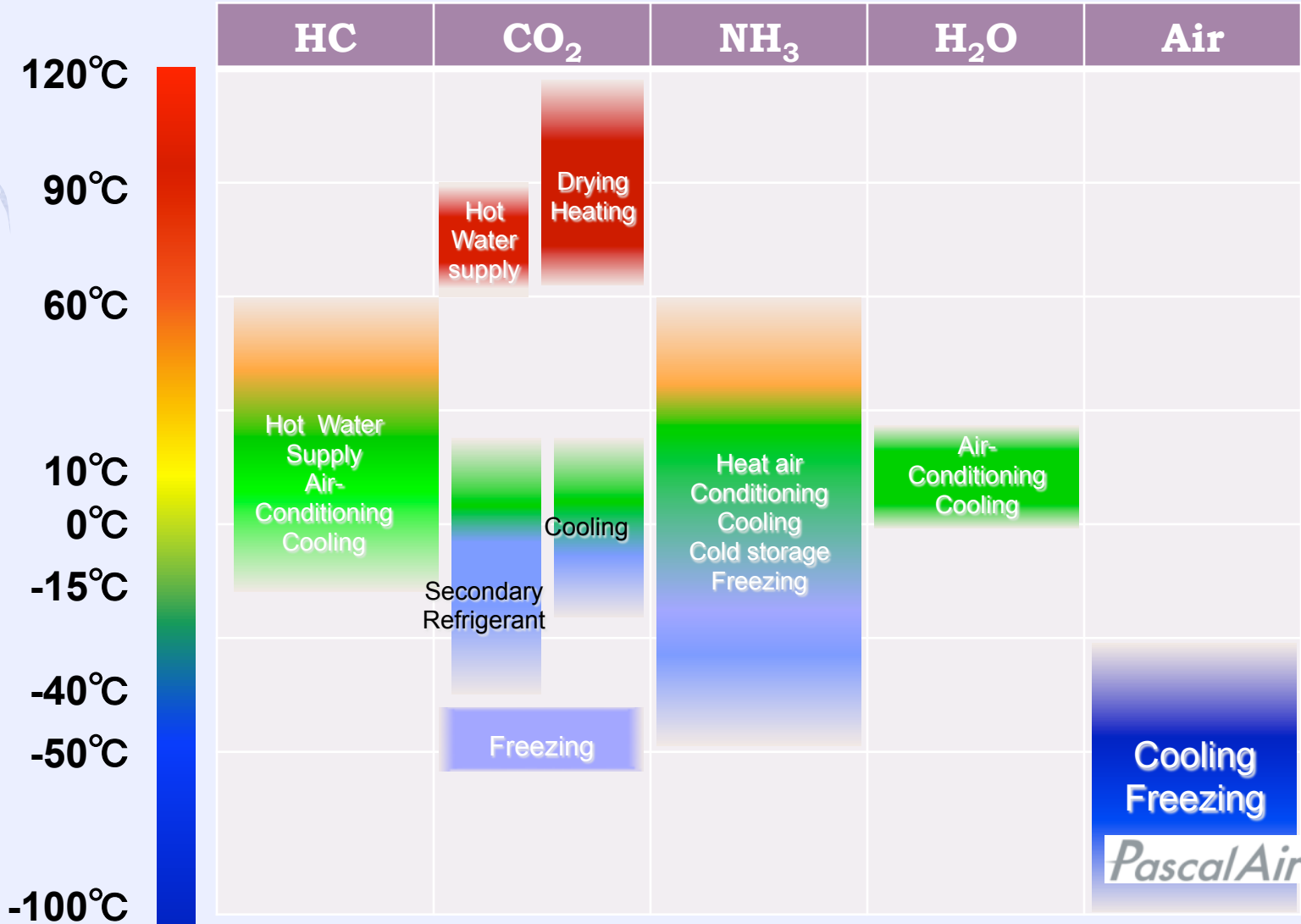
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# Mayekawa "Natural Five" Refrigerants and Product Solutions.



Temperature Ranges for "Natural Five" Applications

# Features of Pascal Air



## Safety

Low working pressures.  
Not Toxic or flammable  
No safety regulations  
required



## Nature

No environmental load  
GWP=ODP=0  
Environment friendly

### ◆ Flexibility

Wide range of temperature control – No need to have different machines for each temperature range

### ◆ No Special Regulations

Low pressure system (below 0.2MPa), does not require high pressure equipments.

### ◆ Natural refrigerant(Air)

Extremely safe and easy to operate.

### ◆ Substitute for Cascade Refrigeration Systems

No environmental load when compared to R23 cascade refrigeration system in ultra low temperature. R23 has a very high GWP (12000) , therefore, high environmental load from the view of green conservation.

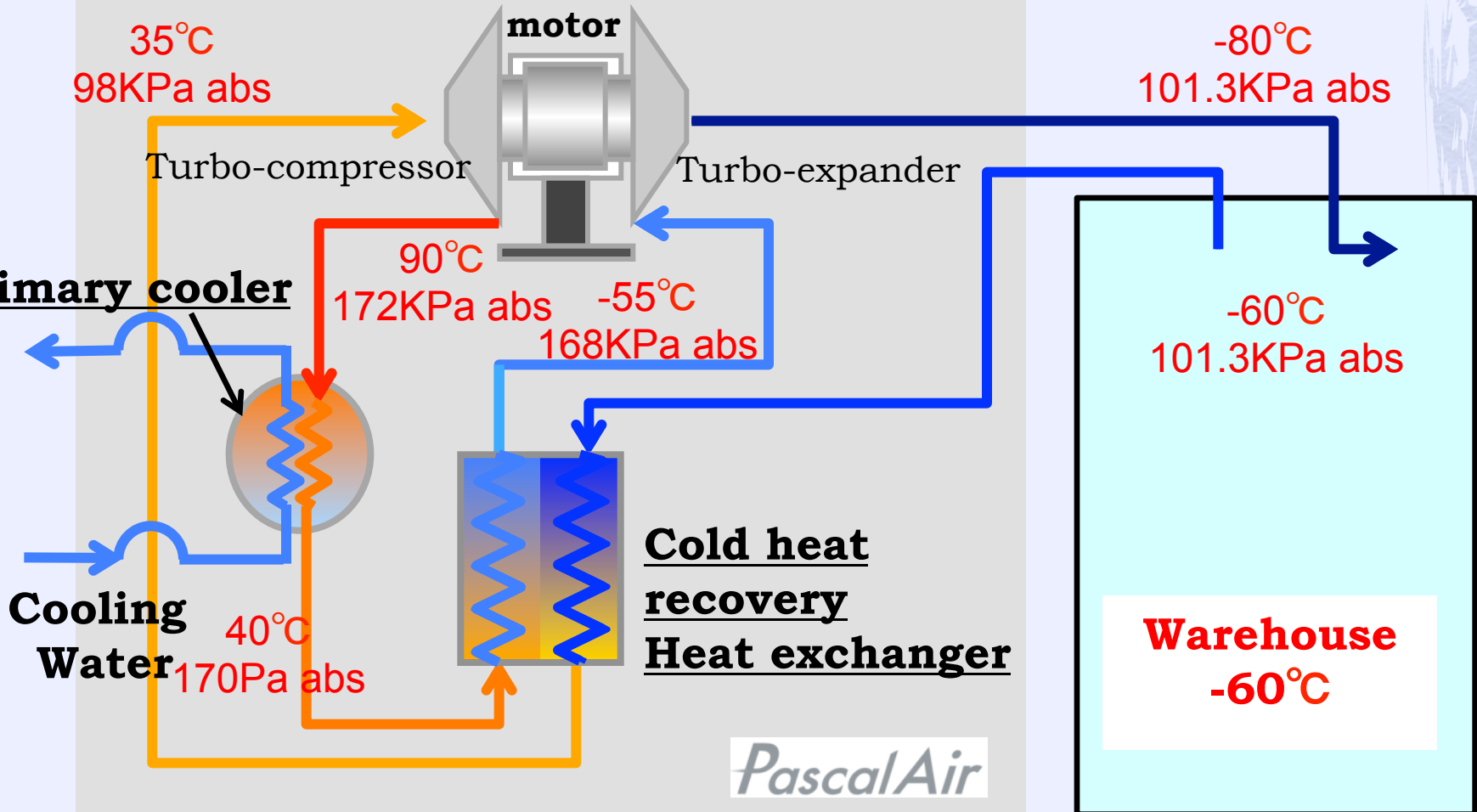
### ◆ No Air Coolers required

Storage space increased

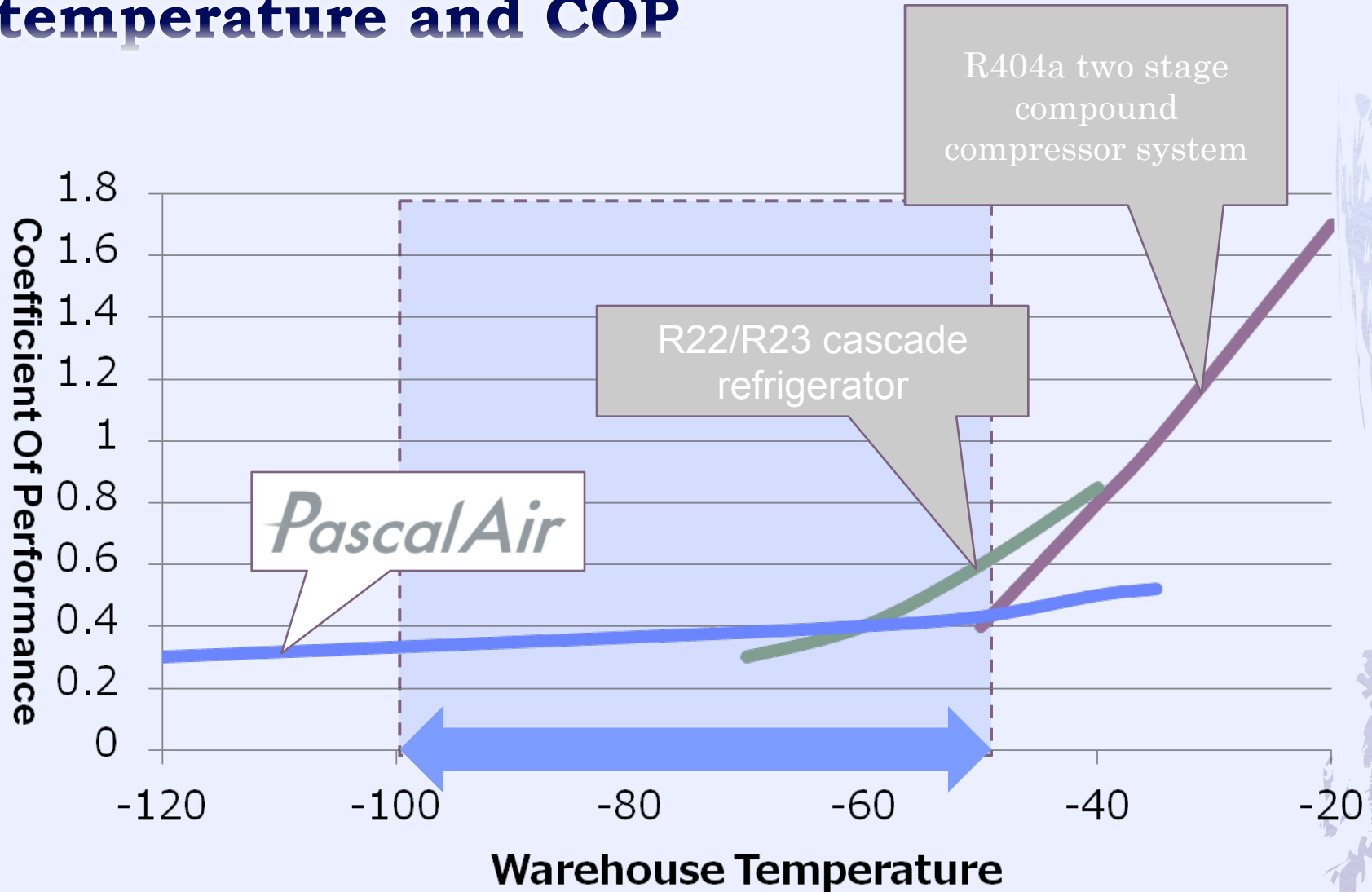


# Direct Air circulation

## The integrated turbo-compressor-expander



# Relationship between warehouse temperature and COP

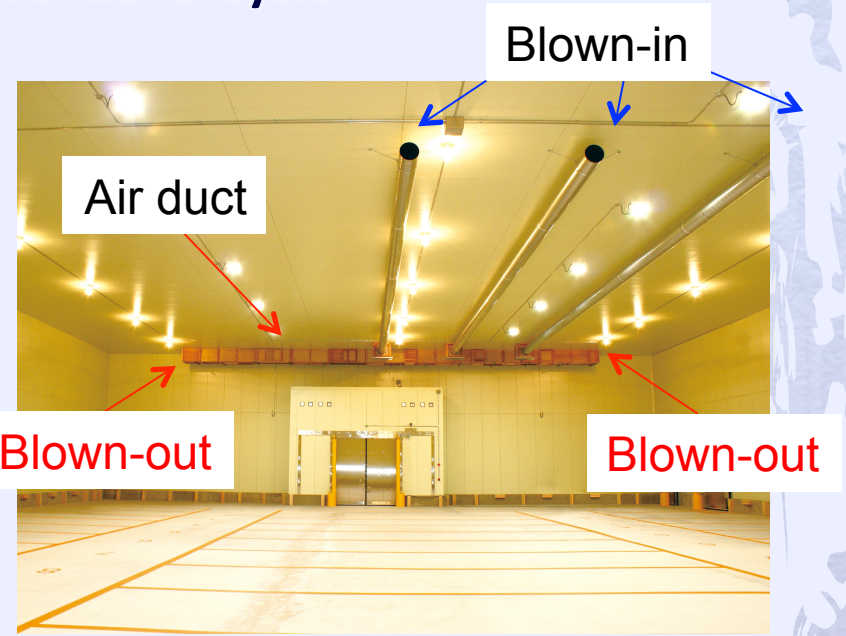


# Comparison of systems

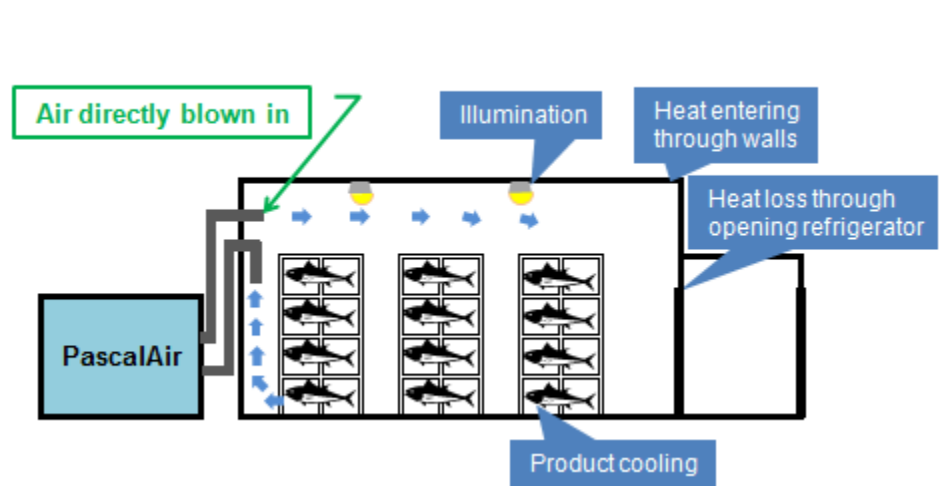
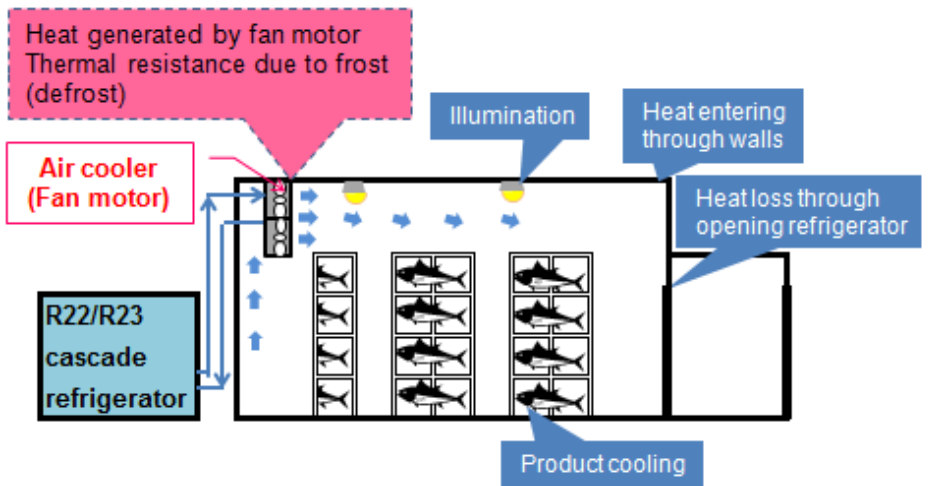
:Pascal Air and the conventional system



**Conventional system**



**PascalAir system**



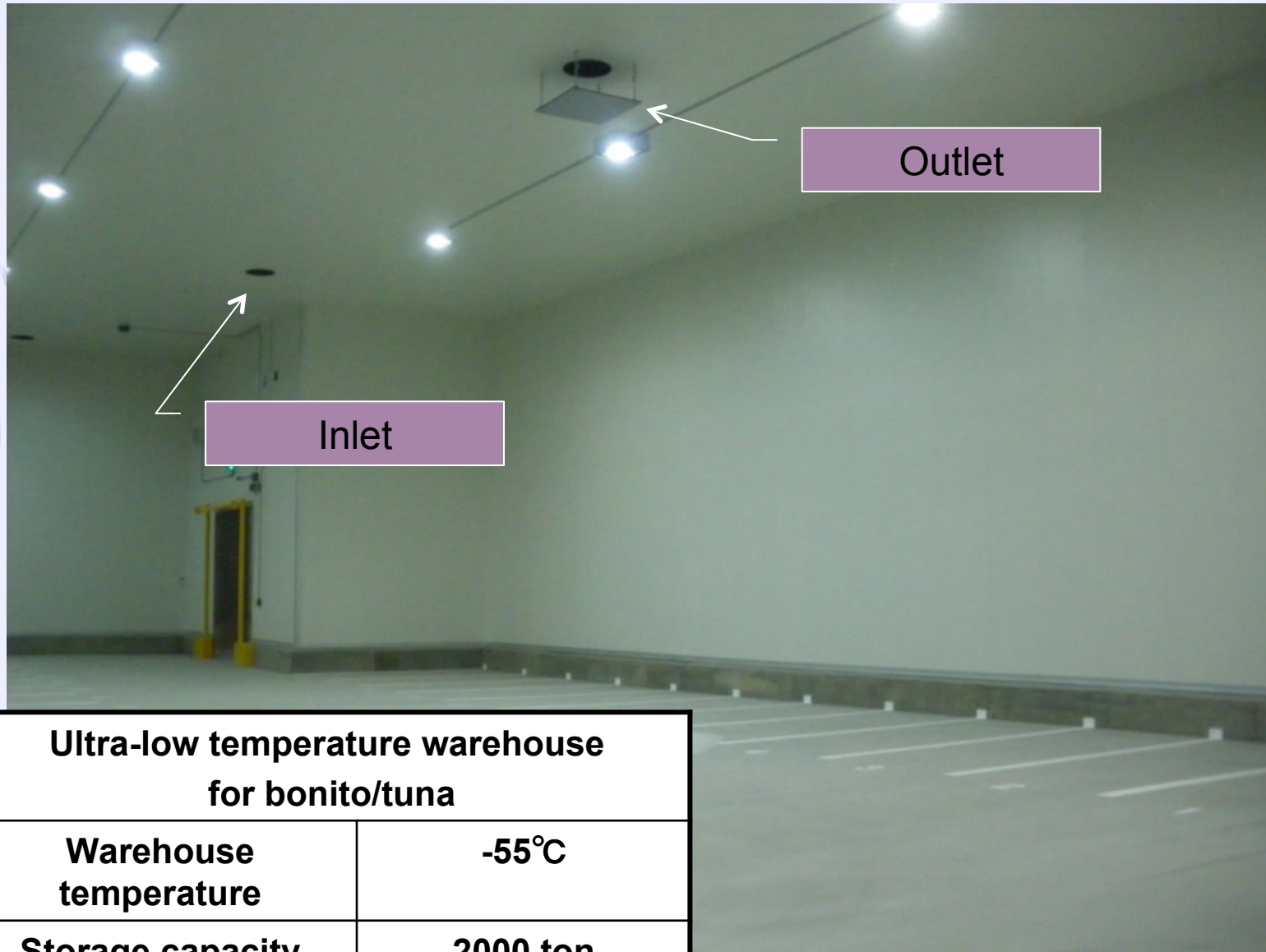
# Comparison of systems

## :Pascal Air and the conventional system

	Conventional system	Pascal Air
Heat entering through walls	30%	30%
Heat loss through opening refrigerator doors	5%	5%
Product cooling	25%	25%
Illumination	10%	10%
Heat generated by fan motor	20%	–
Thermal resistance due to frost(defrost)	5%	–
<b>Total</b>	<b>100%</b>	<b>75%</b>

The PascalAir saves more than 25% of energy compared to convention system because it does not require defrost.

# Installation example



<b>Ultra-low temperature warehouse for bonito/tuna</b>	
<b>Warehouse temperature</b>	<b>-55°C</b>
<b>Storage capacity</b>	<b>2000 ton</b>
<b>PascalAir x 2 sets : 30kW</b>	

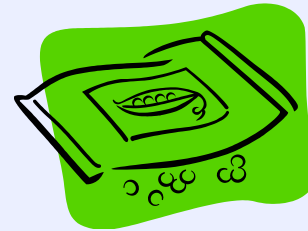


# Installed and other applicable areas



## (1) Installed areas

- Ultra-low temperature warehouse for bonito/tuna (49 units already installed  $-50\sim-60^{\circ}\text{C}$ )
- Food rapid freezing system (3 units- freezers  $-50^{\circ}\text{C}$ )
- Chemical process cooling (2 units –pharmaceutical  $-70\sim-80^{\circ}\text{C}$ )



## (2) Other applicable areas

- Vacuum Freeze-dry
- Semiconductor manufacturing
- Low temperature Milling etc.





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**natural refrigerants**

3-5 February 2015 in Tokyo

**Thank you very much!**