MAYEKAWA MYCOM

Advantage of "Natural Five"
- Components & Applications-

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(Tokyo, JAPAN)
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株式会社 前川製作所

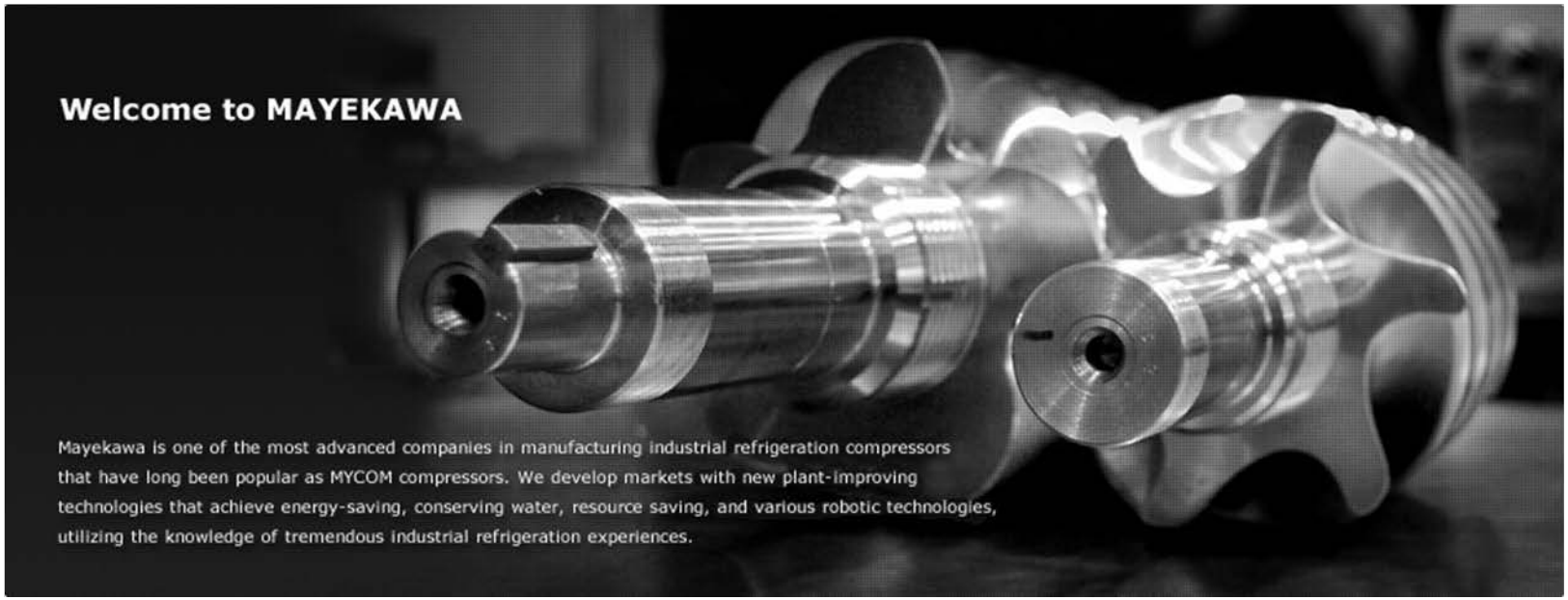
MYCOM GREEN

Corporate Profile of Mayekawa

MAYEKAWA MFG. CO., LTD.

Established in:	1924
Capital:	1 billion yen
Sales:	130 billion yen (group)
President:	Shin Mayekawa
Employees:	2,479 in Japan
	2,084 overseas
Offices:	60 in Japan, 104 overseas (45 countries)
Plants:	3 in Japan, 7 overseas

Tokyo Head Office



Corporate Profile of Mayekawa

MAYEKAWA Global Network

Head office, Tokyo

Moriya plant

Higashihiroshima plant

Saku plant

Belgium

Europe

North America

Los Angeles

Nashville (U.S.)

Mexico

Korea

Japan

Japan/Asia

Chennai, India

Latin America

São Paulo

Brazil Plant

★ Mayekawa plants

■ Mayekawa branch offices

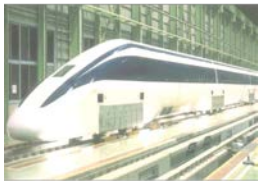
Corporate Profile of Mayekawa

1924
Vertical low speed reciprocating refrigeration compressor

1964
Screw compressor

1978
Ultra low temperature accelerator

Refrigerated cargo vessel



Maglev train

Rocket fuel

1998
Nagano Olympics, Winter Games

1958
Multi-cylinder reciprocating compressor

Offshore platform

Freezer

Chicken whole leg deboning robot

Comprehensive food production system

1924 1960 1970 1980 1985 1990 2000

- Established in 1924, Capital 1,000,000,000 yen, Number of employees (2,479 domestic employees and 2,084 overseas employees), 60 Domestic offices and 104 overseas offices
- Manufacturing and sales of various gas compressors based on industrial compressors (More than 40% share of the international market)
- Plant engineering and consulting engineering services for agricultural and livestock industries, food and energy industries
- Manufacturer of made-to-order industrial refrigeration goods (capital goods)

Applications using Natural Refrigerants

Applicable temperature of "*Natural Five*"

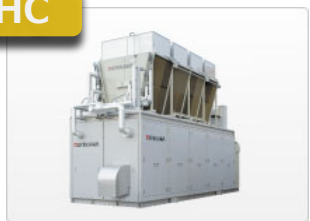
Air

Air Cycle refrigerator
"PascalAir"

H2O

Adsorption Refrigerator
"AdRef-Noa"

HC



Heat Pump
with high efficiency

Five environmentally friendly natural refrigerants applied to refrigeration, air conditioning, heating and hot water supply

Concept of ‘NewTon’ system

NewTon

- ◆ Energy Saving
  - High efficiency screw rotor profile for NH_3
  - Semi-hermetic IPM motor for NH_3
  - Rotational speed control by matrix converter
  - High efficiency shell & plate heat exchanger
- ◆ Safety
  - Indirect cooling system with natural refrigerant [NH_3/CO_2]
  - Reduction of possible leakage points of NH_3
  - Low charge of NH_3
- ◆ Support
  - Remote Monitoring with prediction diagnosis

Product Line-up of ‘NewTon’ system

Application	Model	Refrigeration capacity [kW]	CO_2 supply temperature [°C]
Cargo platform	CH	130	0
	C	237	-5
Refrigerated warehouses	R-3000	95	-32
	R-6000	189	
	R-8000	270	
Freezers	F-300	70	-42
	F-600	140	
	F-800	170	

***NewTon* R-3000, *NewTon* F-300**

***NewTon* C, CH**

Features of the cooling system

- Indirect cooling system with natural refrigerant

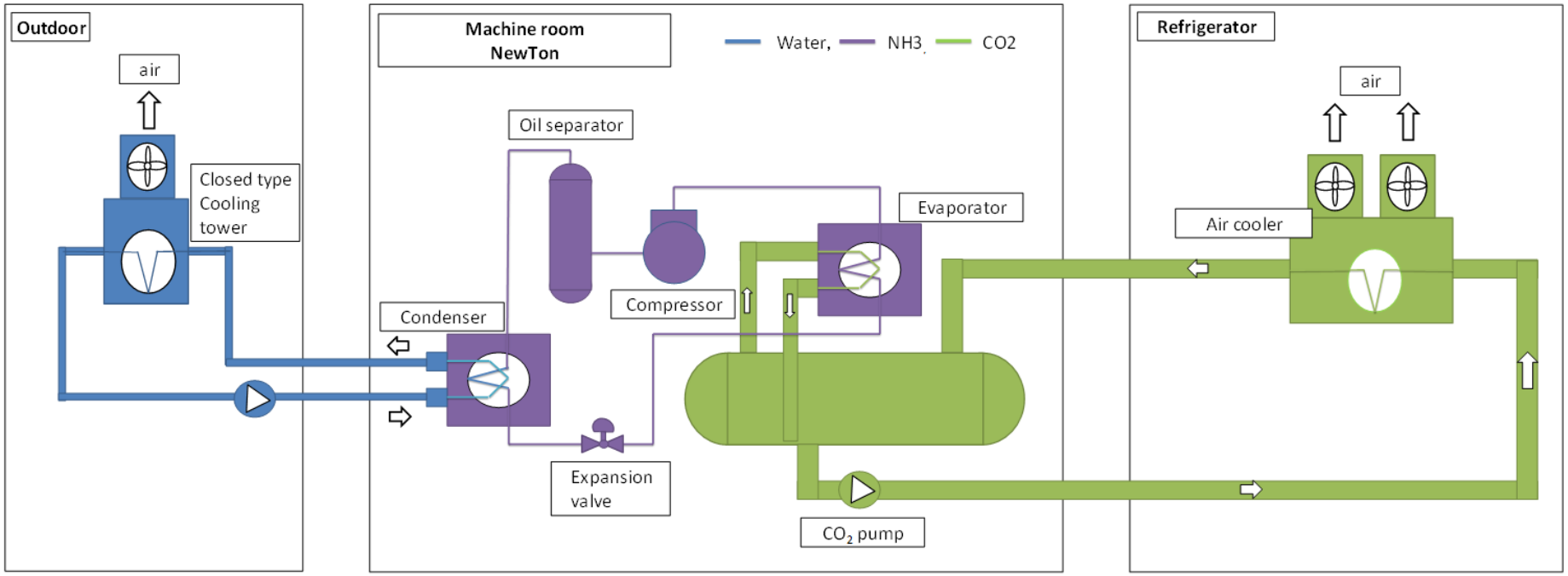


Fig. **Flow of the cooling system**

- Reduction of possible leakage points of NH_3
  - Adoption of bellows valves
  - Semi-hermetic motor

Table. **Refrigerant characteristics**

		NH3	CO2	R22	R404A
Molecular weight	[g/mol]	17.03	44.01	86.47	97.60
Normal boiling point	[℃]	-33.3	-56.6 [1]	-40.8	-45.5
Heat of evaporation [2]	[kJ/kg]	1345	293	224	186
GWP [3]	[-]	0	1	1870	3922
ODP [4]	[-]	0	0	0.055	0

Features of the cooling system

- High efficient screw compressor for NH3 refrigerant
  - High efficiency screw rotor
    designed to perform at maximum efficiency
    at this suction pressure level

  - Semi-hermetic IPM motor for NH_3
    aluminum wire with Teflon coating,
    a permanent magnet built in the rotor
    of the motor (no excitation energy necessary)
    → the motor efficiency improves by 5 to 10%
    compared with the induction motor

Fig. **Semi-hermetic IPM Motor for ammonia**

  - Rotational speed control by matrix converter
    no generation of harmonic current (EC waveform almost sinusoidal)
    → countermeasures against harmonics not necessary

- Adoption of high efficiency shell & plate heat exchanger
  evaporator size became 1/4
  NH_3 charge quantity reduced to 79% (comparison with the initial 'NewTon' system)

Features of the cooling system

- Maintenance system by remote monitoring system
  - constantly connected to data server, operation data sent to the server every ten minutes
  - prediction diagnosis with operation data

    → preventing machine failures
    keeping the optimum performance

    → diagnosis extracts abnormal symptoms
    emits alerts with a maintenance report
    to the service personnel
    (propose planned maintenance)

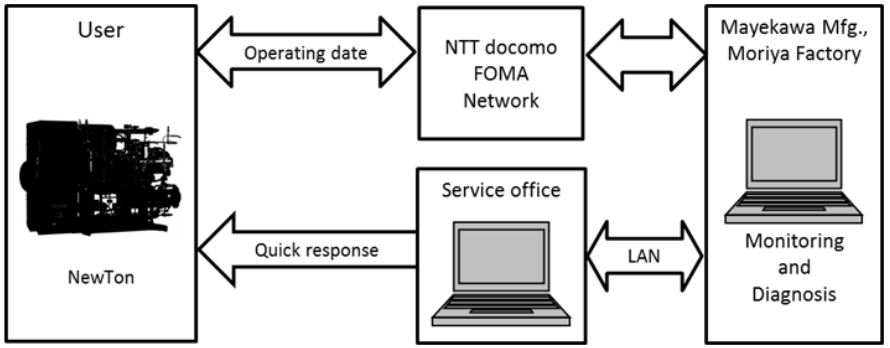


Fig. **Remote Monitoring System**

- function to compare and analyse
  the current operating condition and design value

  → quantitative evaluation report -- optimum operation [yes/no]

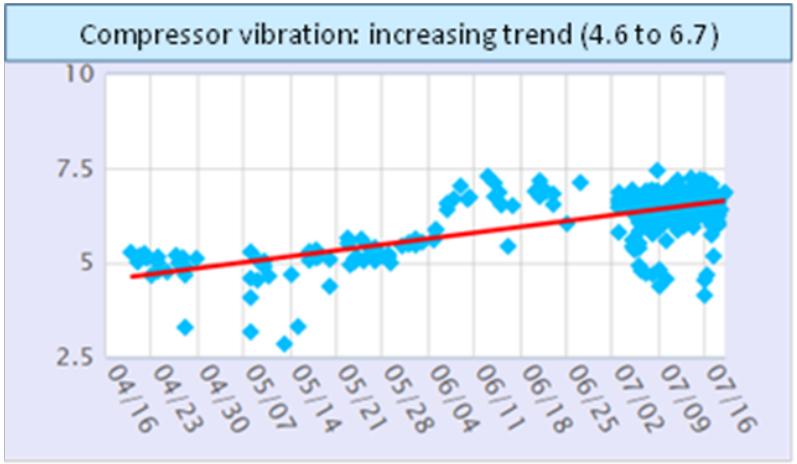


Fig. **Maintenance report of Compressor vibration**

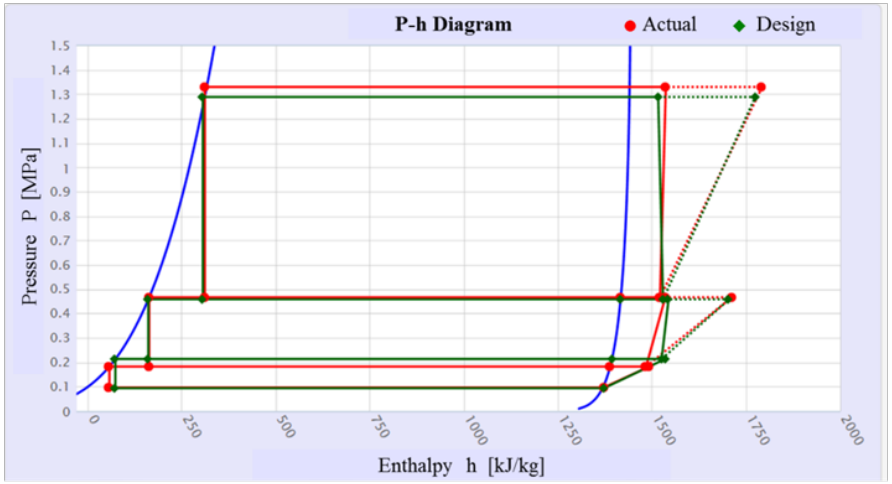


Fig. **Maintenance report example of *P-h* diagram**

Effect of Energy Saving

- Measured energy saving of 8 cold warehouses converted to 'NewTon' systems (internal storage volume from 6,000 to 45,000 m^3, previously in use from 22 to 38 years, mostly equipped with a HCFC-22 refrigeration unit)
- Annual power reduction ratios after the conversion were measured between 20 to 40 %

Table. **Measured energy saving of eight different warehouses, converted towards 'NewTon' systems**

Warehouse No.	Volume	Years in use	Refrigerant & compressors before renewal to 'NewTon'		Power reduction
	[m^3]	[years]	Refrigerant	Compressors	[%]
1	45,000	29	HCFC-22	Screw	31.1
2	10,000	33	HCFC-22	Piston	41.2
3	16,250	27	HCFC-22	Piston	24.9
4	6,125	38	HCFC-22	Screw	29.3
5	7,500	25	HCFC-22	Piston	28.0
6	30,000	30	HCFC-22	Screw	19.8
7	32,500	22	HCFC-22	Piston	28.0
8	30,000	25	NH3/Brine	Piston	34.0

Applications using Natural Refrigerants

Applicable temperature of "*Natural Five*"

Five environmentally friendly natural refrigerants applied to refrigeration, air conditioning, heating and hot water supply

CO_2 Heat Pump "unimo"

Eco-cute unimo for Hot Water production

Environment-conscious and safety

- CO_2 emission reduction up to 70%
- No NOX emission and safety as combustion process is eliminated

Economy

- Running cost reduction up to 50%
- Additional merits when hot water and cooling

(brine or chilled water) are used simultaneously

Heat recovery, simultaneous heating and cooling

- Hot water production by heat recovery

from warm waste water, ground water, cooling water

- Heating and cooling operation

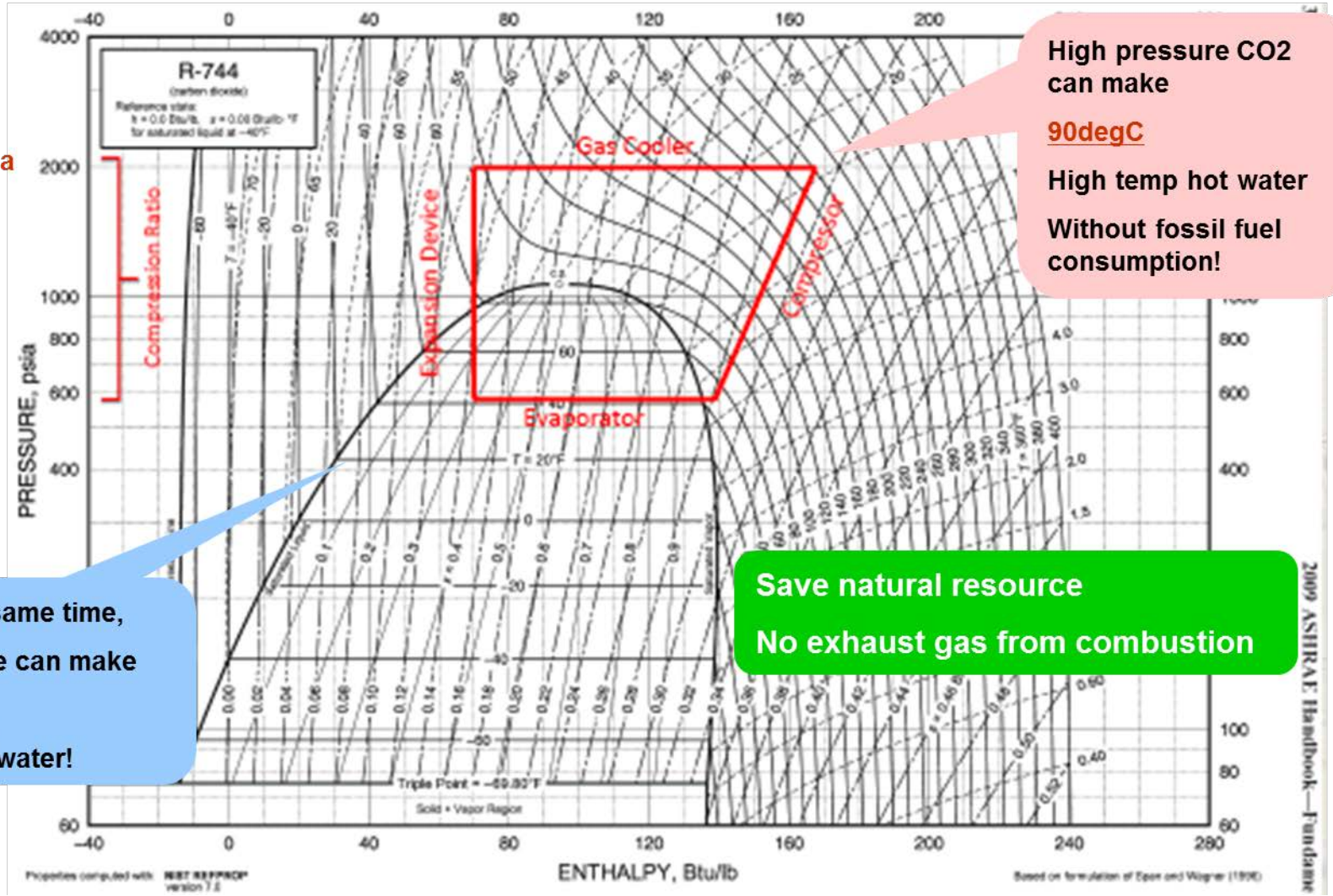
(cooling supply from -10℃ to 32℃)

High hot water supply capacity

- Hot water supply capacity up to 100kW, the largest as Eco Cute.
- Hot water temperature, 65℃ or 90℃
- Re-circulated heating operation is possible

Hot water production with CO_2 heat pump

P-h diagram of CO_2



Specifications of unimo 90℃ Hot water

Model		HWW-2HTC		
Temp. of Cooling Side（Inlet→Outlet）		-5℃→-9℃	12℃→7℃	22℃→17℃
Performance（Hot Water In. 17℃→ Out. 90℃）	Heating Capacity〔kW〕	48.5	76.4	92.6
	Hot Water Amount [L/h]	571	900	1091
	Cooling Capacity〔kW〕	33.4	53.9	69.6
	Input Power〔kW〕	19.6	24.3	26.4
	Total COP※1	4.2	5.4	6.1
Power source		3φ AC200V or AC380V, 50Hz		
Outer Dimensions〔mm〕		W1,140×L1,240×H1,861		
Weight〔kg〕		1,180		
Compressor	Model	Semi-hermetic 2 cylinder Reciprocating mayekawa C2HT		
	Rated Motor Power〔kW〕	25		
Range of Use	Makeup Water Temp.〔℃〕	5～40℃（@65℃ Hot Water Heating） 5～65℃（@90℃Hot Water Heating）		
	Hot Water Temp.〔℃〕	65, 90		
	Cooling Side Inlet〔℃〕	-5～9	9～17	17～37
	Cooling Side Outlet〔℃〕	-9～4	4～12	12～32

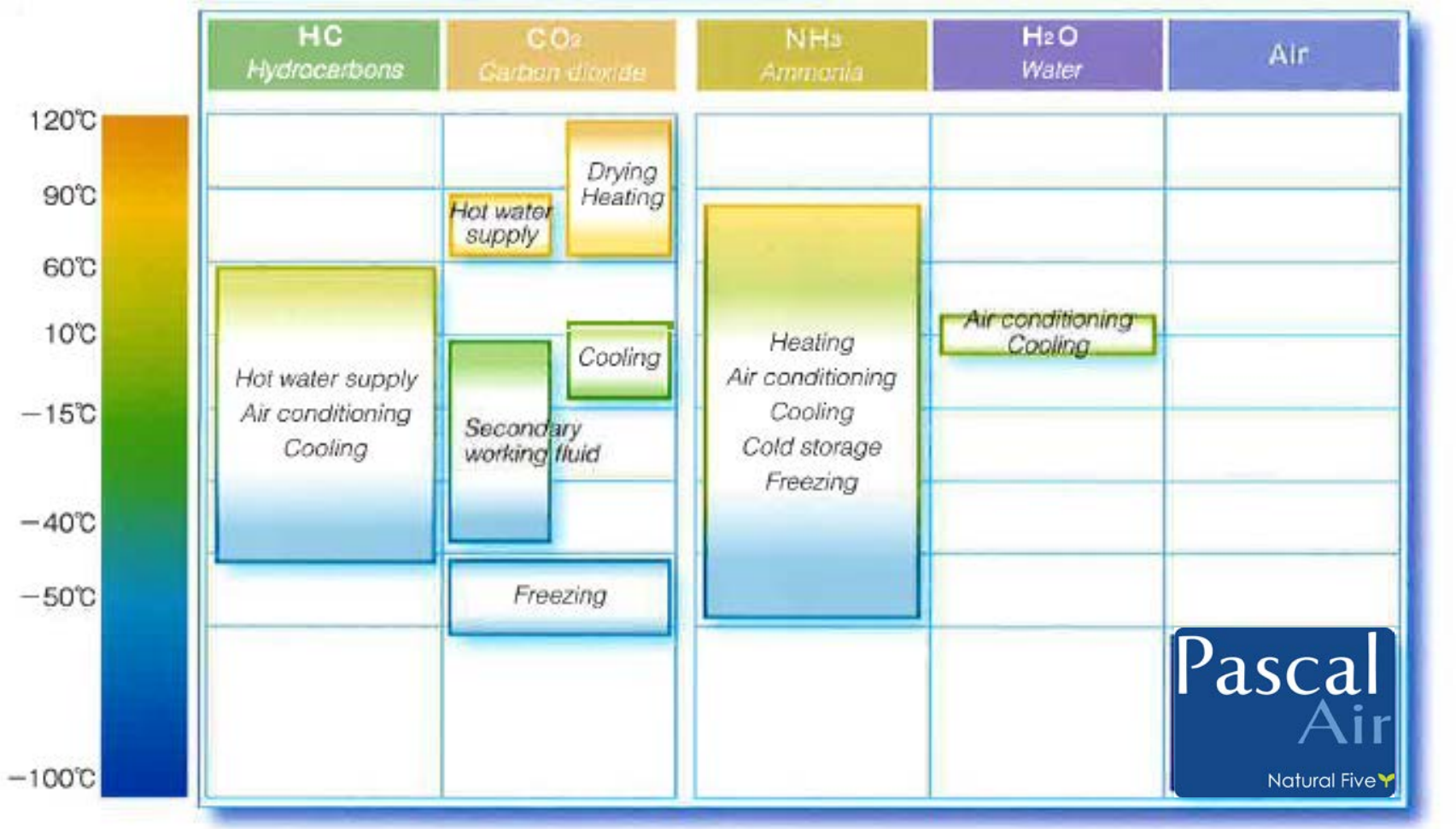
CO_2 Heat Pump “unimo”

unimo Products Line-up

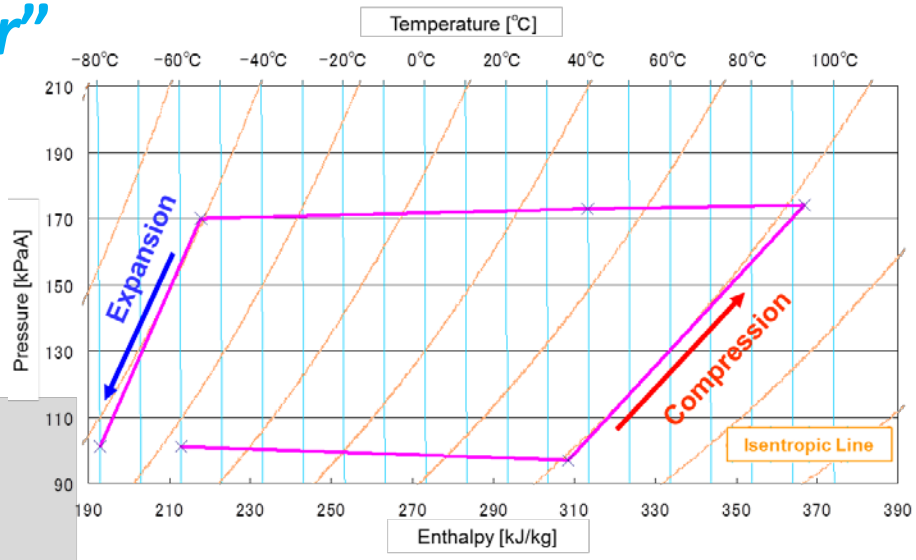
unimo AW	unimo WW	unimo AWW	“Eco Sirocco”
Air-source “Eco Cute”	Water-source “Eco Cute”	Air-source/Water-source “Eco Cute”	Water-source CO_2 Heat Pump supplying Hot Air
			
Supply of Hot water 65℃~90℃	Supply of Hot water 65℃~90℃ And Cold water -9℃~35℃	Supply of Hot water 65℃~90℃ or Supply of Hot water 65℃~90℃ And Cold water -9℃~35℃	Supply of Hot air 80℃~120℃ and Cold water -9℃~35℃

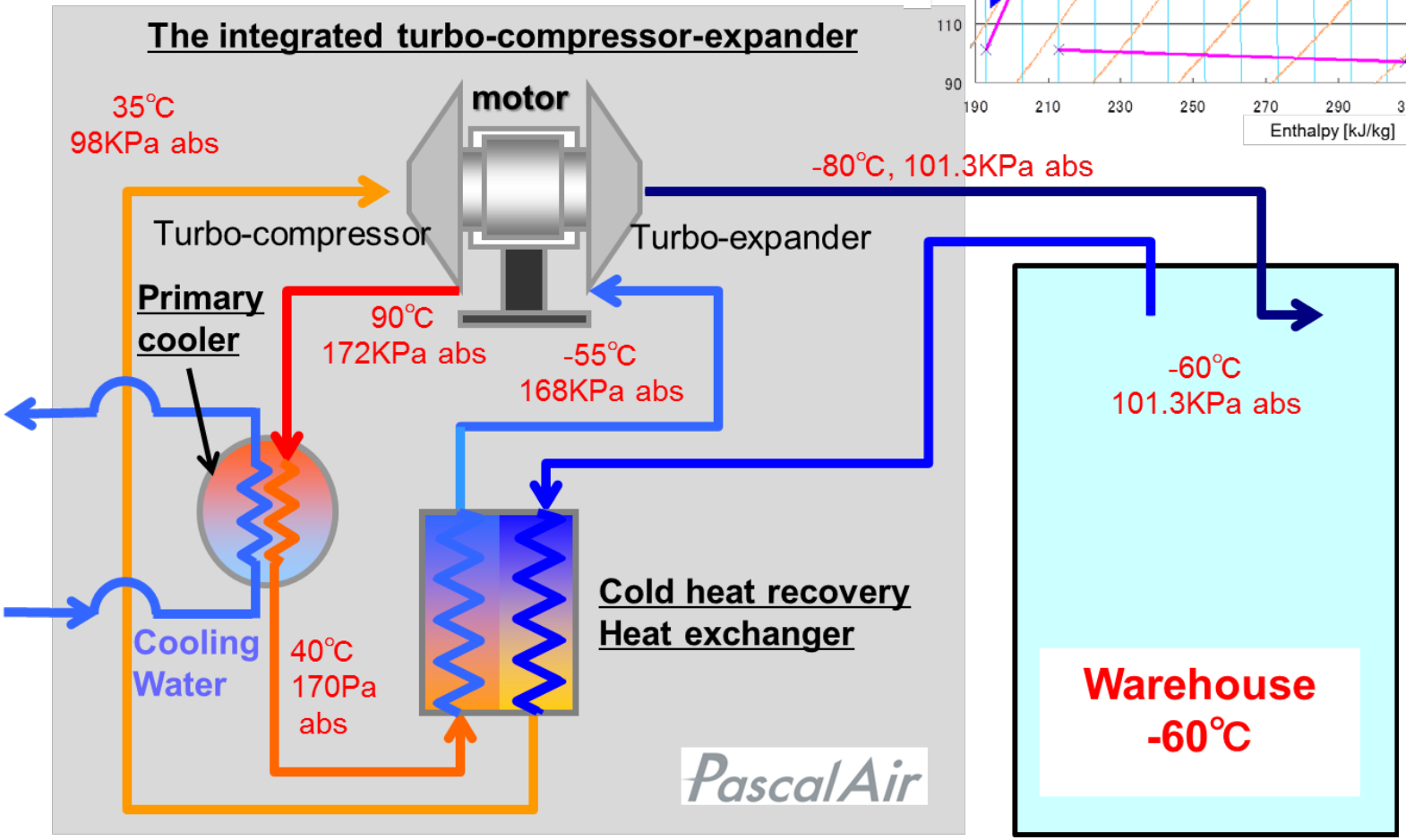
Applications using Natural Refrigerants

Applicable temperature of "*Natural Five*"



Schematic flow of "*Pascal Air*"
: Direct Air Circulation

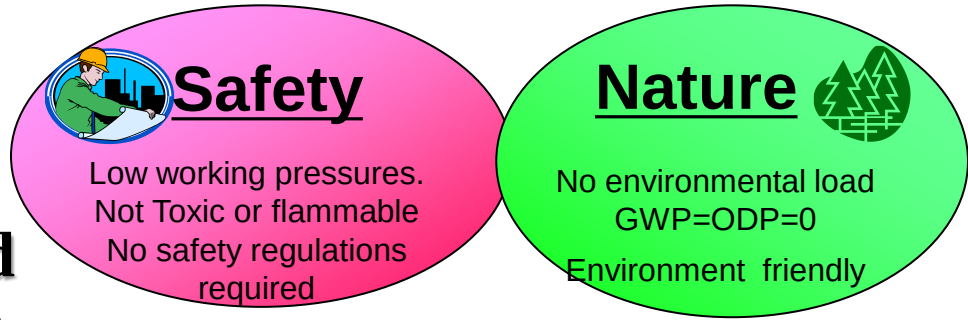




Features

Ultimate natural refrigerants “Air”

Air, a natural refrigerant, has no global impact on the environment as opposed to the conventional fluorocarbon refrigerants.



Safety

Neither toxic nor flammable.

No safety regulations required

against High Pressure Gas Safety Act in Japan.

Space-saving of warehouse

Since there are no air coolers and connecting piping ,warehouse can be used widely.

Easy construction

It can operate only by connecting water, electricity, and ducts.

Renewal construction is possible in a short period.

Energy saving

In the extremely low temperature region (below -50° C), Pascal Air offers better brake power based COP than the conventional system. Therefore, energy is saved by more than 30%.

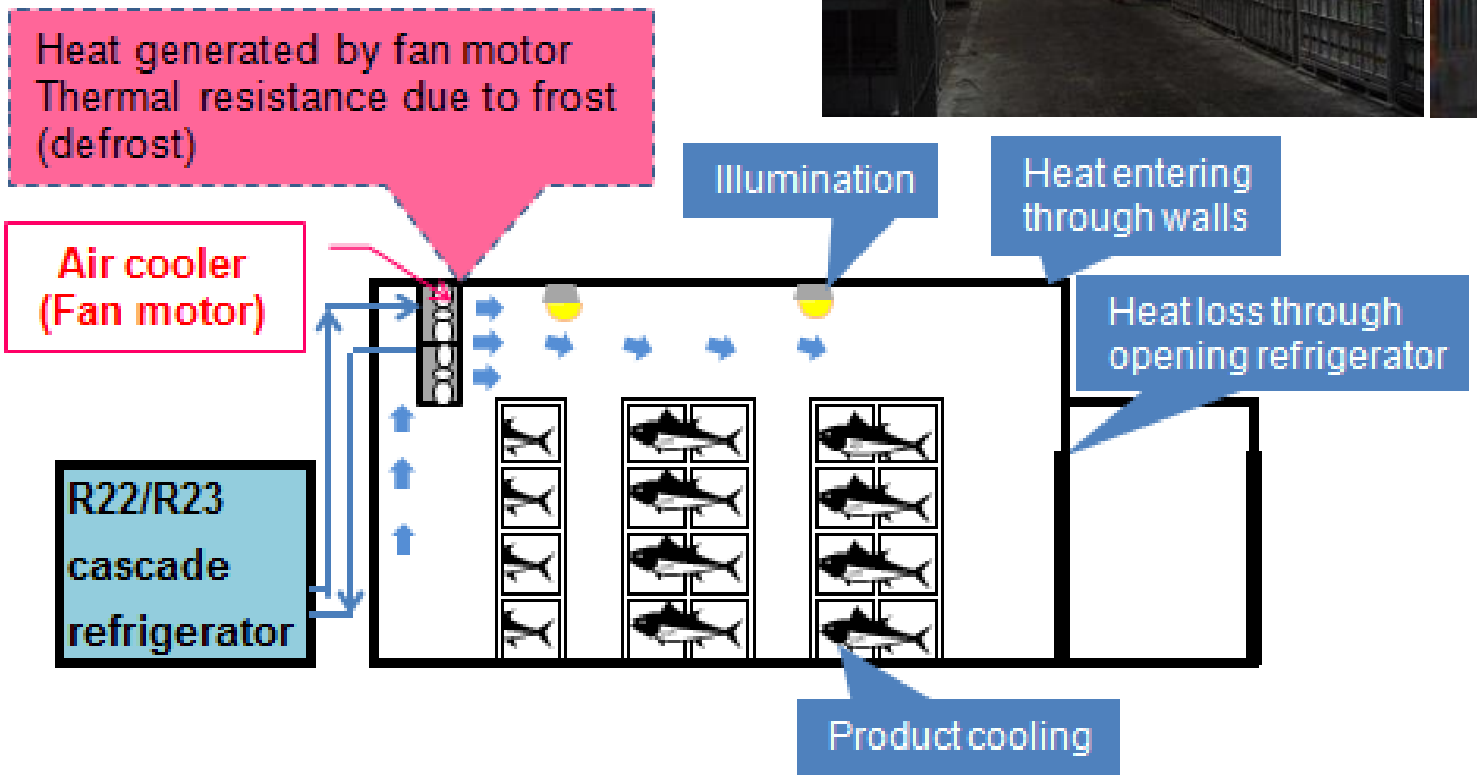
Specifications

Model	-	PAS15-R	PAS30-R
Cooling capacity	kW	15	30
Motor Power	kW	30	60
Temperature(in the warehouse /blow in from the expander)		-60/-80 ° C	
Dimensions	mm	L5,000xW2,200 xH2,800	L5,000xW2,300 xH2,800
Weight	kg	4,900	5,900

Conventional Cascade System

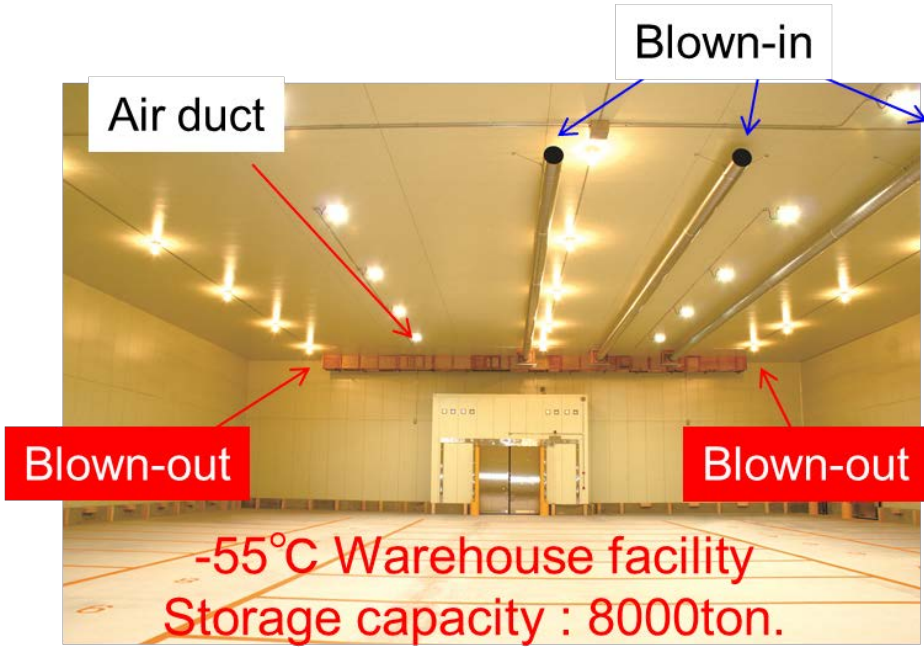
Air cooler +
Fan motors

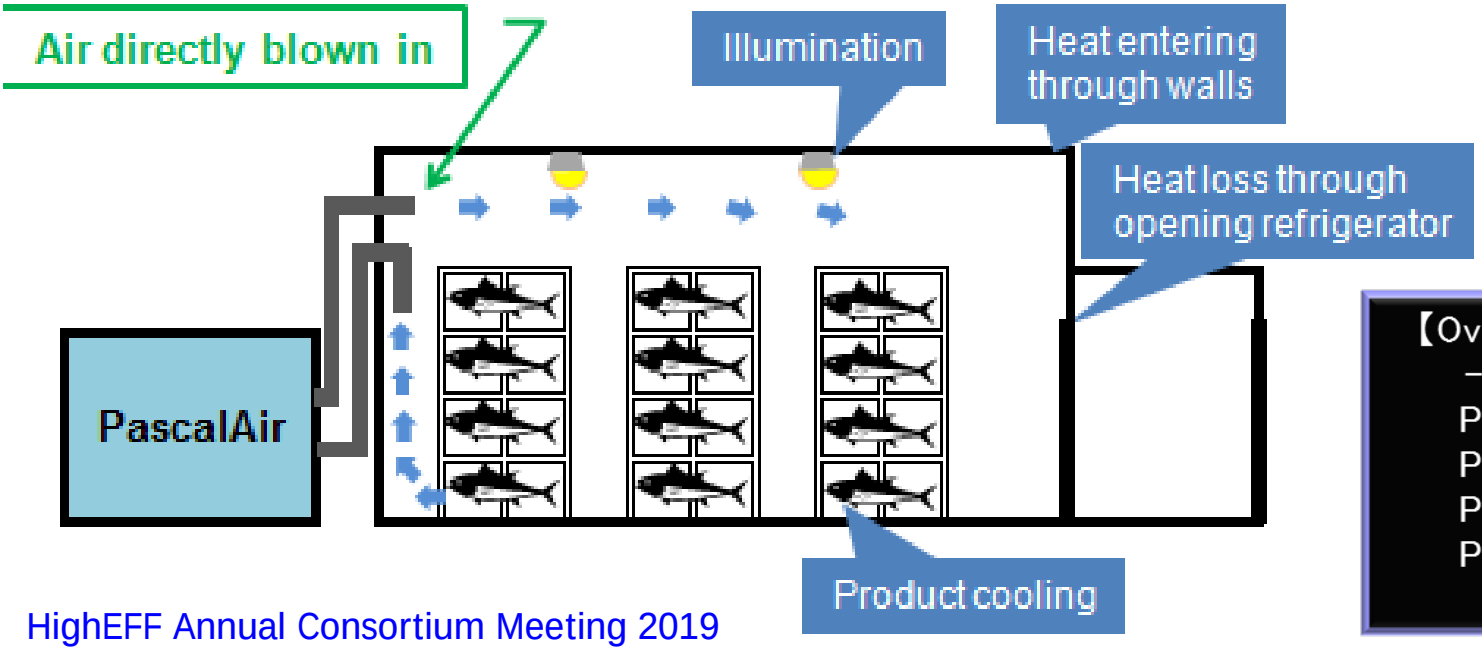
*Has an Air cooler + Fan motors
*Defrost required



"Pascal Air" System

*No air cooler + Fan motors
*No defrost
Ducts easily installed





【Overall installations】
-as of 2019.02-
PAS30-R x 82 sets
PAS30-F x 3 sets
PAS30-B x 4 sets
PAS15-R x 7 sets
Total 96 sets

MAYEKAWA Global Network

Over 70,000 Screw and Piston compressors running in more than 100 countries.

Takk for din oppmerksomhet

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