

**UNITED NATIONS ENVIRONMENT PROGRAMME  
INTERNATIONAL INSTITUTE OF REFRIGERATION  
EUROPEAN ENERGY CENTRE  
CENTRO STUDI GALILEO**



**14th EUROPEAN CONFERENCE  
THE LATEST TECHNOLOGIES  
IN REFRIGERATION AND AIR CONDITIONING.  
10<sup>th</sup>-11<sup>th</sup> June 2011  
Politecnico of Milano - Italy**



**Latest Technology in Refrigeration and Air Conditioning  
Under the Auspices of the PRESIDENCY  
XIV EUROPEAN CONFERENCE**



**OF THE COUNCIL OF MINISTERS  
MILANO 10<sup>th</sup>-11<sup>th</sup> JUNE 2011**



# **NATURAL REFRIGERANTS SECONDARY BRINE ICE SLURRY**

**LINE UP OF NATURAL FIVE : NH<sub>3</sub> – CO<sub>2</sub> – HC – WATER – AIR**

**CO<sub>2</sub> SECONDARY BRINE**

**SUPERCOOLED WATER ICE MAKING SYSTEM**

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# LINE UP OF NATURAL FIVE

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# Commitment on Natural Refrigerants



Semi-Hermetic Screw Compressor Unit



Commercial / Industrial Eco-Cute System



Adsorption Chiller



Commercial / Industrial  
Air-Conditioning / Water-Supply Heat Pump



Dehumidifying Air Refrigerant System [Air Ref]

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## "Natural Five" Refrigerants and Product Solutions

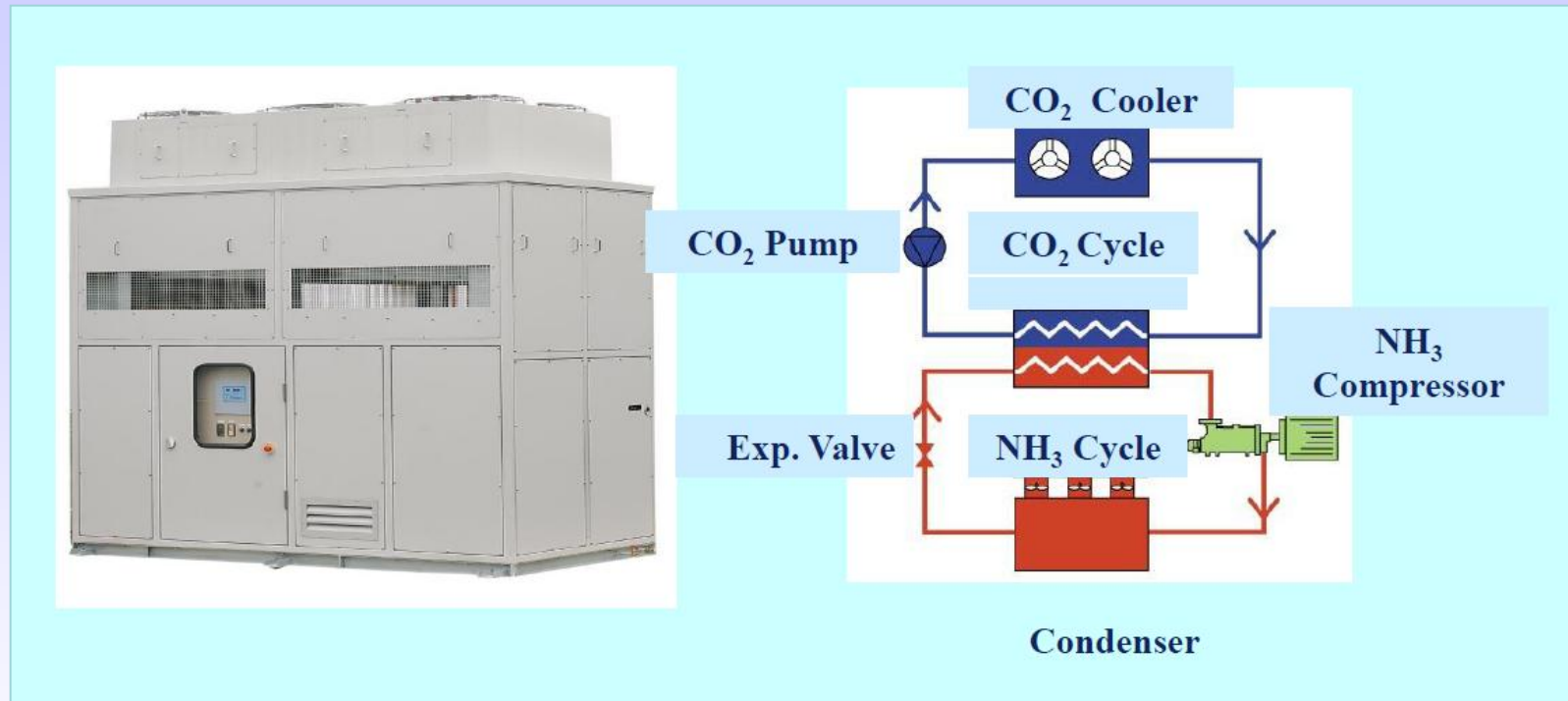
Refrigerant (Natural Five)	NH <sub>3</sub> R-717	CO <sub>2</sub> R-744	HC Hydrocarbon	H <sub>2</sub> O R-718	Air R-728
90°C		Utility hot water			
60°C	Utility hot water Heating		Utility hot water Heating HVAC	Heat recovery	
10°C	Chilled water Ice making	Chilled water Ice making		Chiller	
-15°C	Cold storage, Freezer, Fish boat				
-25°C	Specific Refrigeration needs				
-40°C	Freezer, Freeze-dry, Super Low temp storage				
-50°C					
-60°C			Cryogenics		Cryogenics
-100°C					
Notes	•Conventional system •National Projects	•Eco-Cute	•Nat'l Proj. •Butane + Propane	•Nat'l Proj. •Adsorption •Heat recovery	•Nat'l Proj. •Air-cycle

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# CO<sub>2</sub> SECONDARY BRINE SYSTEM

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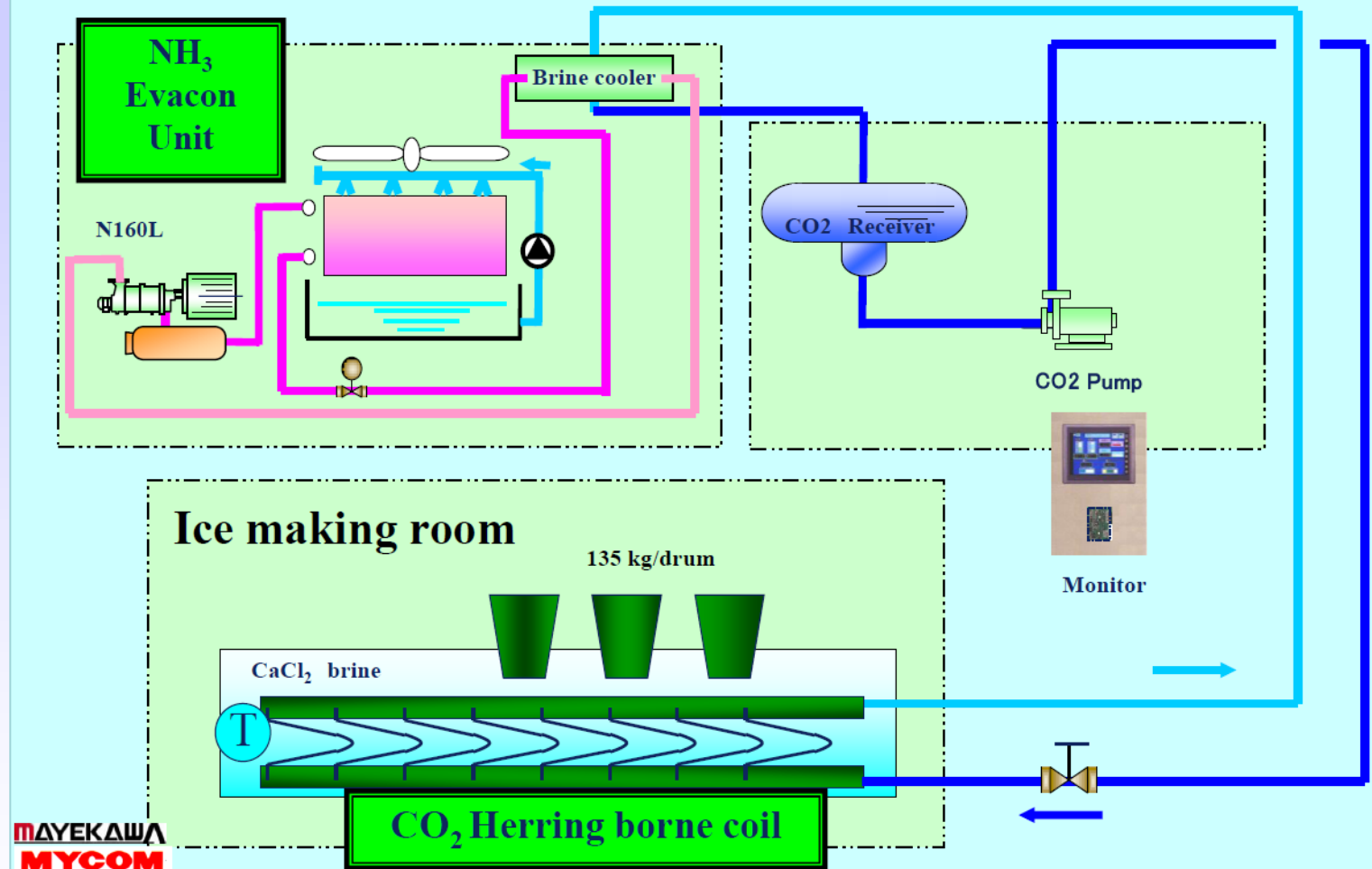
## PRINCIPLE SCHEME



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## Ice making plant



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## Ice making plant (Japan)



### Cooling System

- Unit type: 3x EK CCU 100H(N160VLR-L 100kW)
- Capacity: 610 kW
- CO<sub>2</sub> Pump: 3x 1.1kW
- NH<sub>3</sub> Charge: 3x 80 kg
- CO<sub>2</sub> Charge: 4000 kg

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# FIELD CASES

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PLANT	FROOZEN FOOD STORE	
CAPACITY	80000	m3
INSTALLATION DATE	2005	
SITE LOCATION	Mont-Pellier, FRANCE	
AVERAGE OPERATING HOURS	30.000	hrs each
CONTRACTOR	AXIMA REFRIGERATION FRANCE	

SYSTEM	NH3 COMPRESSOR + CO2 SECONDARY BRINE	
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NH3 SIDE		
compressor type	screw compound	
compressor model	N2016LSC	
motor size	200	kW
quantity	3	
evaporating temperature	-34	°C
condensing temperature	48	°C
capacity each	315	kW (100%)
absorbed motor power each	181	kW (100%)
capacity control	frequency convertor	1500->3000 rpm
	slide valve low stage	100%->30%
system control	hp&mp float valves	
liquid subcooling	open flash type	

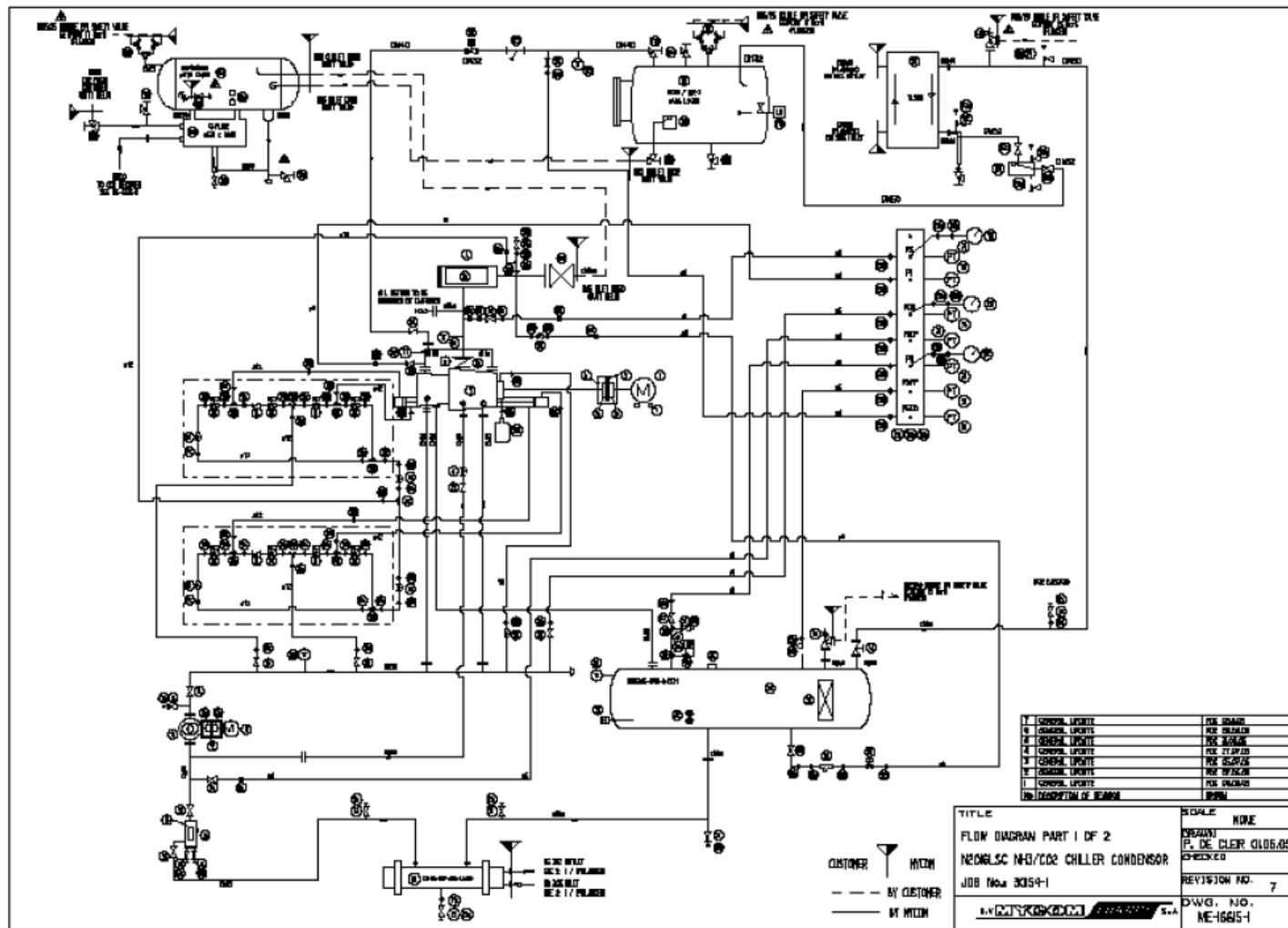
CO2 SIDE		
CO2 temperature	-30	°C
hermetic pump model	HRP-8050-EA	
pump capacity each	15	m3/hr
quantity	3	
motor size	4kW 3000rpm	
receiver volume(common)	3500	liter



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# NH3 COMPRESSION SYSTEM

**MYCOM**



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# MYCOM



# MYCOM



# COMPRESSOR UNITS

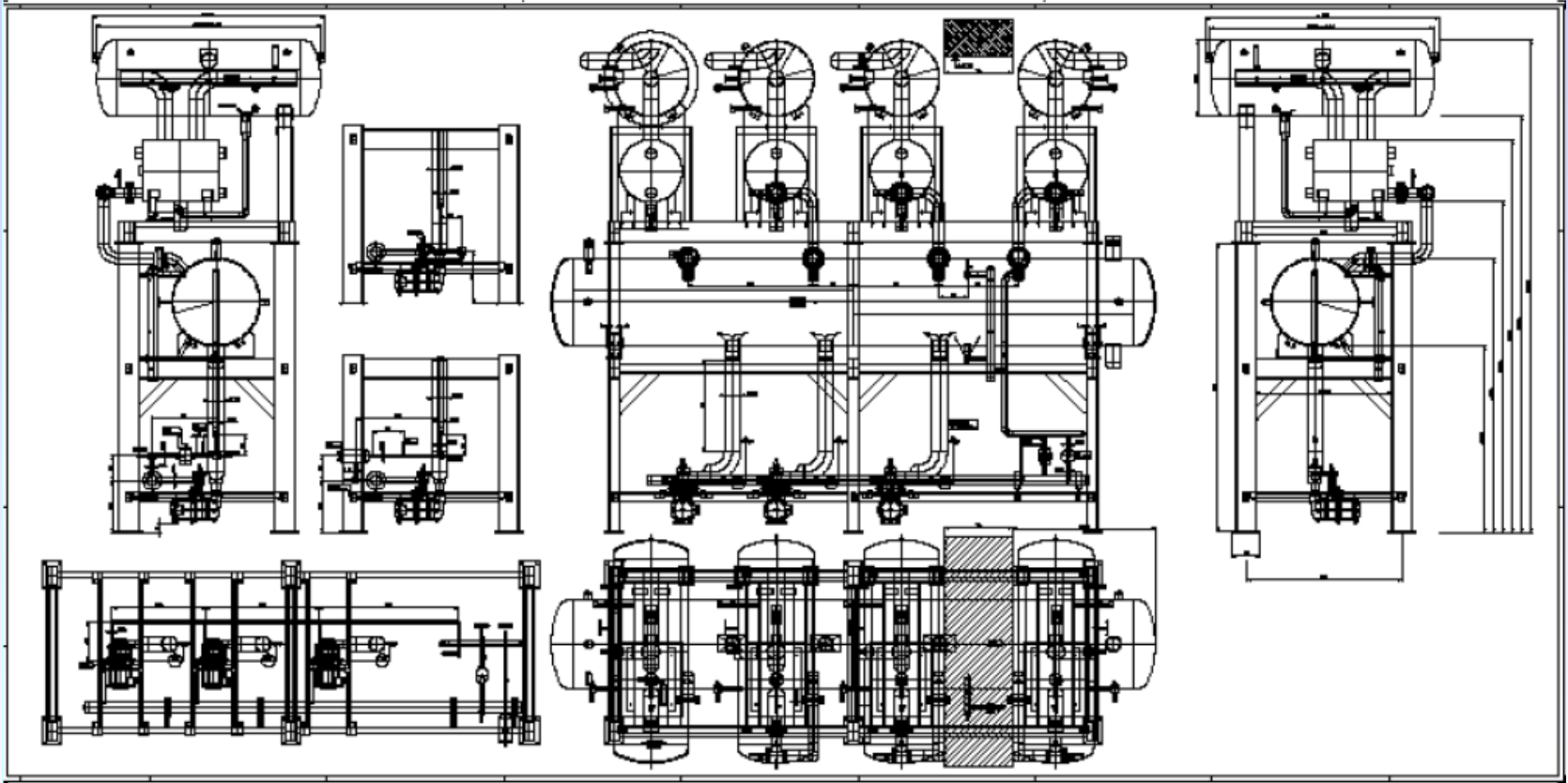
**MYCOM**



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## CO2 SYSTEM + CASCADE NH3/CO2 H.EXCH.



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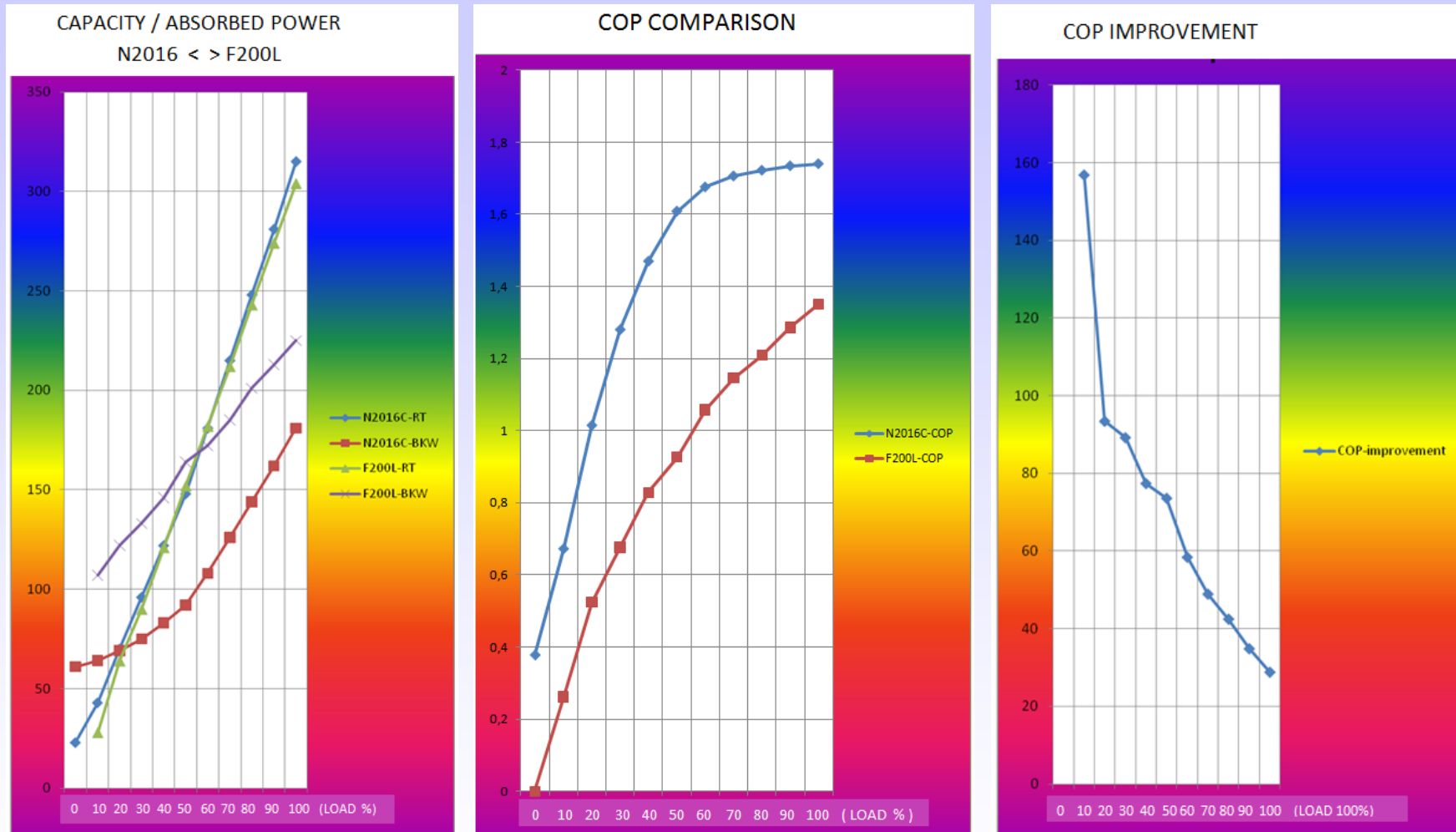
# CO2 SYSTEM

**MYCOM**



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## PERFORMANCE COMPARISON NH3<>R22



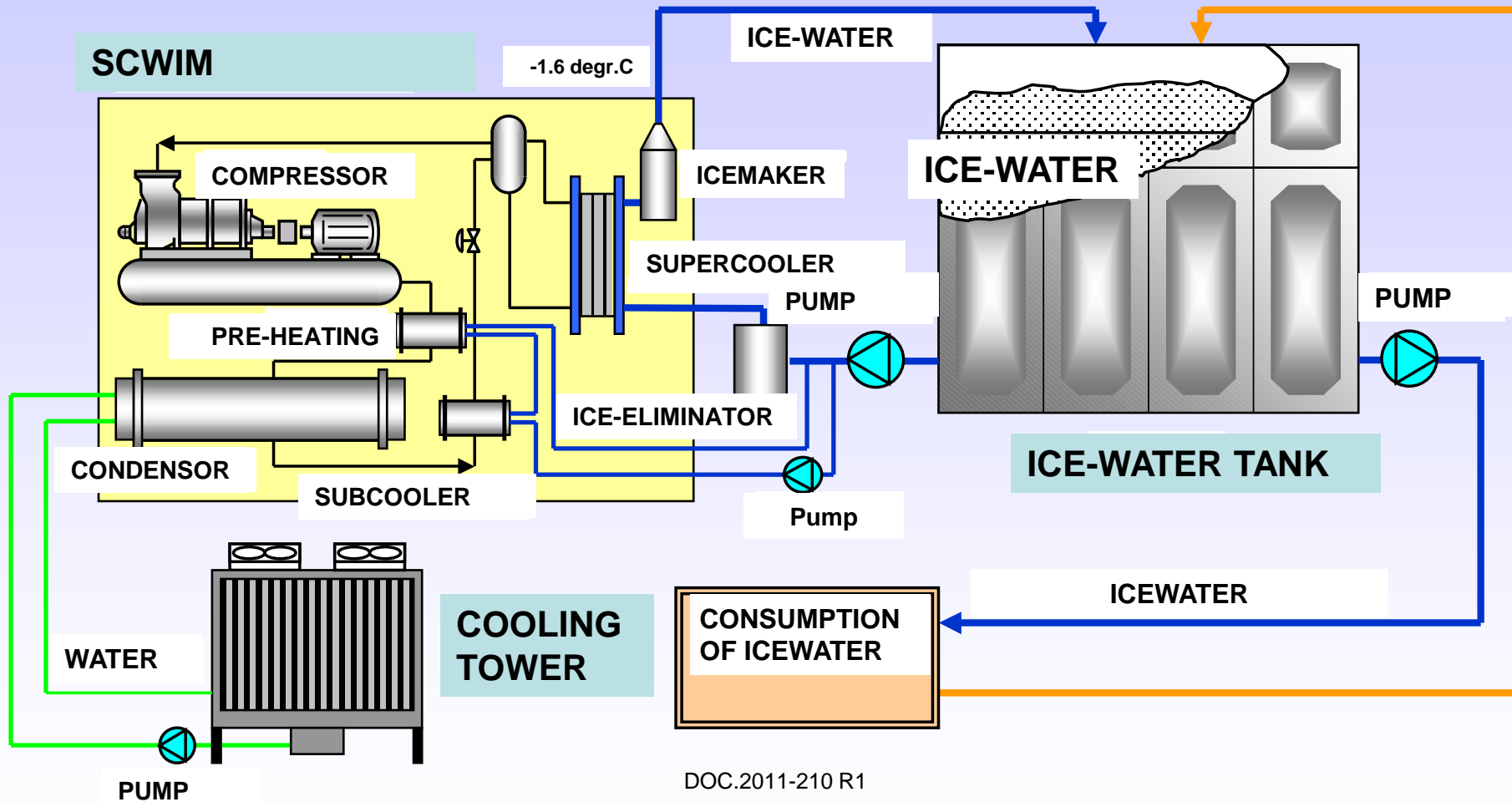
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**OVERALL ENERGY SAVING NH3<>R22 TOTAL PLANT >40%**

# SUPERCOOLED WATER ICE MAKING SYSTEM

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## PRINCIPLE SCHEME

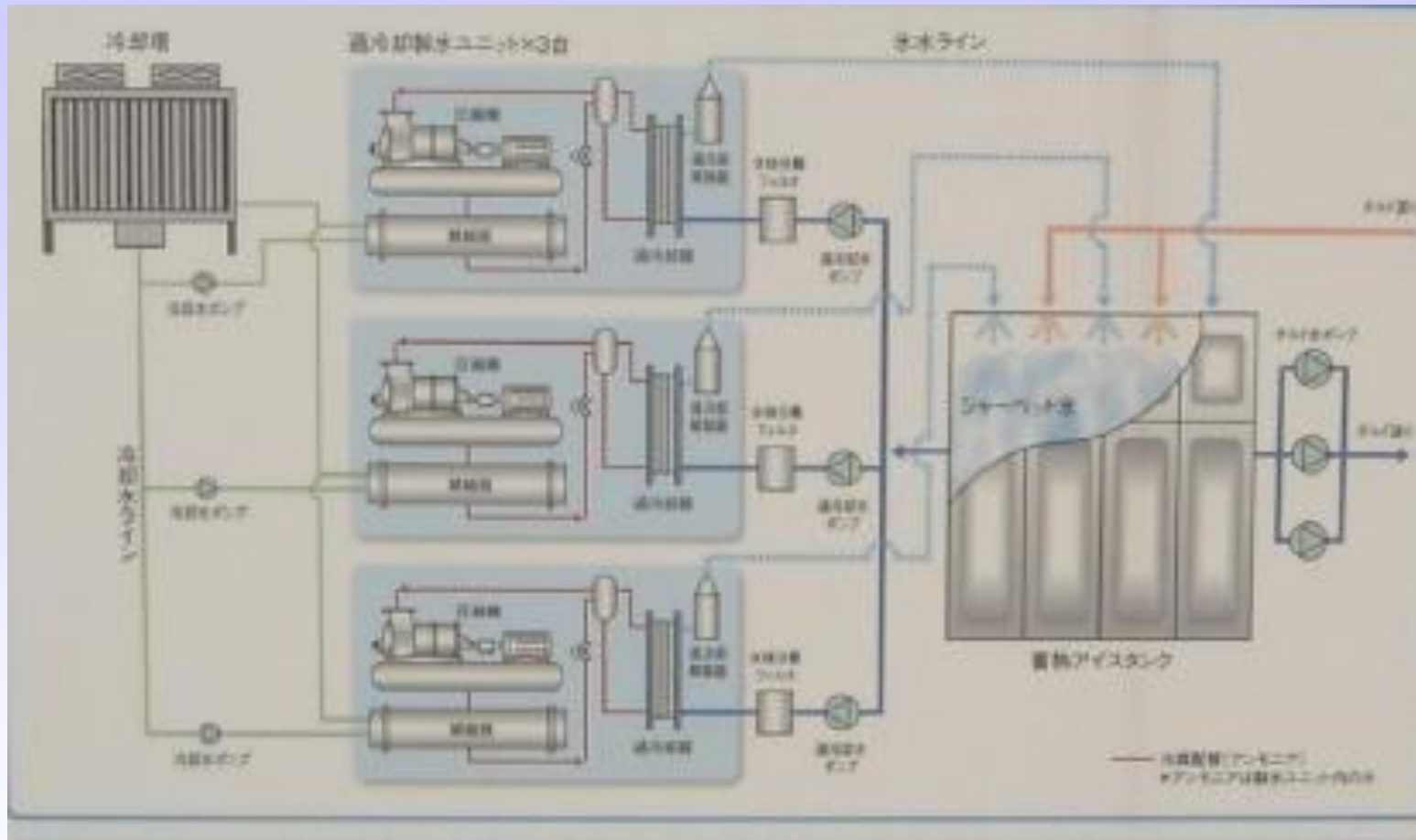


# FIELD CASES

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## PLANT SCHEME



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## SUPERCOOLER UNITS



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## SUPERCOOLER & ICEMAKER



## SUPERCOOLER



## ICE ELIMINATORS



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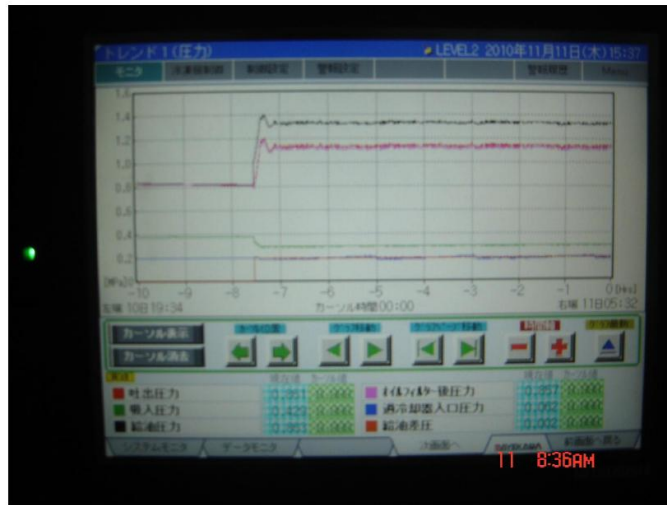
# COMPRESSOR UNIT

**MYCOM**

# COMPRESSOR UNIT

MODEL	N160VLD				
QTY	3				
REFRIGERANT	NH3				
SPEED	2950				rpm
TE	-3.5	-12	-20	-16	°C
TC	35				°C
RT (each)	523	377	261	315	kW
BKW (each)	108	105	103	104	kW
COP-c	4.8	3.6	2.5	3.0	
system	scwim	ice	on	coil	

## TREND PS/PD/POIL



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## ICE TANK



## ICETANK



## ICETANK

TOTAL VOLUME	340		M3
ICE CONCENTRATION DESIGN	40		%
ICE CONCENTRATION REALISED	48		%
ICE VOLUME/DAY	100		TON
HOURS/DAY	10		(night tarif 22:00 - >8:00hr)
Operating hrs/day (average)	6 to 7		
REQUIRED CAPACITY	9302	9302	kW/day
Required compressor operation	$9302/523/3 = 5.9$	$9302/315/3 = 9.8$	Hrs/day
Absorbed main motor power	$5.9 \times 3 \times 108 = 1911$	$9.8 \times 3 \times 104 = 3057$	
Power saving system	37		%
	scwim	Ice on coil	

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## FEATURES

REFRIGERANT	N5 (NH3)	
NH3 CHARGE	450 kg (95% down!)	Ice bank 9000 kg
ENERGY SAVING	30% down !	
CO2 EMISSION REDUCTION	30% down !	
TEC thanking award	Power peak was shift to night tarif period	

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