eurammon Symposium 2016

A perfect match:
Ammonia and Temper in large-scale indirect cooling system and using efficient brine for defrost

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Voets & Donkers koeltechniek BV

Schaffhausen, 23rd/24th June, 2016


VOETS & DONKERS
KOELTECHNIEK EN LUCHTBEHANDELING


Temper®
The Intelligent Solution

VOETS & DONKERS
KOELTECHNIEK EN LUCHTBEHANDELING

- Located in Schijndel / Eindhoven area, Netherlands
- 50 employees
- Turn over > 10 M
- Solutions for
  - (Industrial) Refregeration
  - Highcare production
  - Cheese ripening
  - Cleanrooms
  - Airconditioning

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Shared Fresh Distribution Center in Nieuwegein

Shared Fresh Distribution Center in Nieuwegein

Program of demands

• Overall dimensions :	250 * 140 * 14 m
• Total surface	42.000 m^2
• Storage	Packed and unpacked Fresh products Distribution Dutch supermarkets
• Temperature:	between 1 - 2^0 C
• Noise	50-55 dB(A)
• Cooling System	Propylene/NH_3 system (max 1500kg NH_3)
• Defrost system	Using condensing heat
• Energy consumption:	In accordance with Dutch energy list
• BREEAM Qualification	Very Good

Shared Fresh Distribution Center in Nieuwegein

- Discussion Cooling system:

Propylene Glycol (Starting point)

- Disadvantages in this project
  - Narrow space for Brine coolers in the construction
    - Use of 60 to 80 cm in the steel construction for:
      - Coolers and piping
      - Sprinkler system
      - Roof drainage system
      - Lighting system
  - Price

Shared Fresh Distribution Center in Nieuwegein

- Discussion Cooling system:

Propylene Glycol vs Ammonia Direct

- Risk Ammonia in working area with people
- Maximum amount of 1500 kg Ammonia

Shared Fresh Distribution Center in Nieuwegein

- Discussion Cooling system:

Propylene Glycol vs Carbon Dioxide as an evaporating cold carrier

- Low energy consumption
- Good heat transfer in coolers
- High system pressures, over 40 Bar
- Risk Carbon dioxide poisoning in working area
- Using condensing heat for defrost

Shared Fresh Distribution Center in Nieuwegein

- Discussion Brine system:

  Propylene Glycol vs Temper
  - Lower energy consumption
  - Pipeline/insulation dimension
  - Better heatconductivity in coolers
  - Product save

  - Use of materials and sealing's in system

Selection example cooler:

Dual discharge blow through DVS-p-84457 Low Speed P-glycol 30 Vol. % / Water

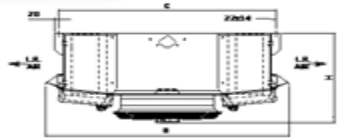
Selection data					
Capacity	kW	20,4	Coolant		P-glycol 30 Vol. % / Water
Air volume	m³/h	15005	Liquid temperature In/Out	°C	-7,0/-3,0
			Volume flow	m³/h	4,6
Air temperature In	°C	1,0 (85,0%)	Pressure Loss	Pa	87490
Air temperature Out	°C	-1,7 (91,3%)			
Condensate	kg/h	8,70			
Frost Layer	mm	0,2			

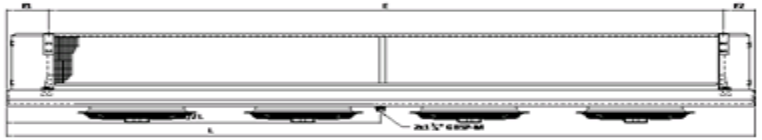
Technical data					
Fin spacing	mm	7	Coil material		Cu / Al
Surface Area	m²	284	Casing material		galvanized
Volume	dm³	65	Finish		White RAL 9003
Weight (empty)	kg	495	* Sound pressure level - distance	dB(A)-m	49,2 @ 3,0 [+/- 2 dB(A)]
Liquid In / Out	mm	35 / 35	Air throw	m	2x 11,5

Fan(s)					
Number of fans		4			
Data each fan:			ErP Compliance		2015
Fan diameter	mm	450	Phase - Voltage - Frequency	V-Hz	3 x 400 /50
Fan speed	rpm	900 [6p (D)]	Protection class		IP54
Power input	kW	0,18	Sound power level (LwA)	dB(A)	66
Nominal motor current	A	0,50			

Dimensions without options (approx.) Subject to modification!

L -	3256	mm	E -	2856	mm	E3 -		mm	F1 -	230	mm
B -	1770	mm	E1 -		mm	E4 -		mm	F2 -	170	mm
H -	590	mm	E2 -		mm				C -	1630	mm





Selection example cooler:

Dual discharge blow through DVS-p-44457 Low Speed Temper -20

Selection data

Capacity	kW	19,8	Coolant		Temper -20
Air volume	m³/h	16646	Liquid temperature In/Out	°C	-7,0/-3,0
			Volume flow	m³/h	4,8
Air temperature In	°C	1,0 (85,0%)	Pressure Loss	Pa	45680
Air temperature Out	°C	-1,3 (90,4%)			
Condensate	kg/h	8,45			
Frost Layer	mm	0,2			

Technical data

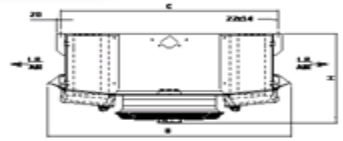
Fin spacing	mm	7	Coil material		Cu / Al
Surface Area	m²	142	Casing material		galvanized
Volume	dm³	32	Finish		White RAL 9003
Weight (empty)	kg	346	* Sound pressure level - distance	dB(A)-m	49,3 @ 3,0 [+/- 2 dB(A)]
Liquid In / Out	mm	35 / 35	Air throw	m	2x 11,5

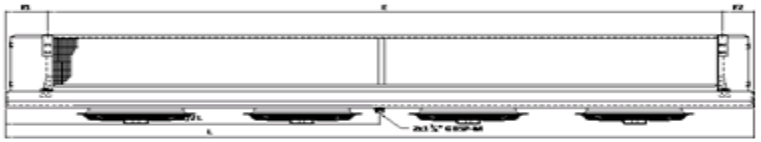
Fan(s)

Number of fans		4			
Data each fan:			ErP Compliance		2015
Fan diameter	mm	450	Phase - Voltage - Frequency	V-Hz	3 x 400 /50
Fan speed	rpm	900 [6p (D)]	Protection class		IP54
Power input	kW	0,18	Sound power level (LwA)	dB(A)	66
Nominal motor current	A	0,50			

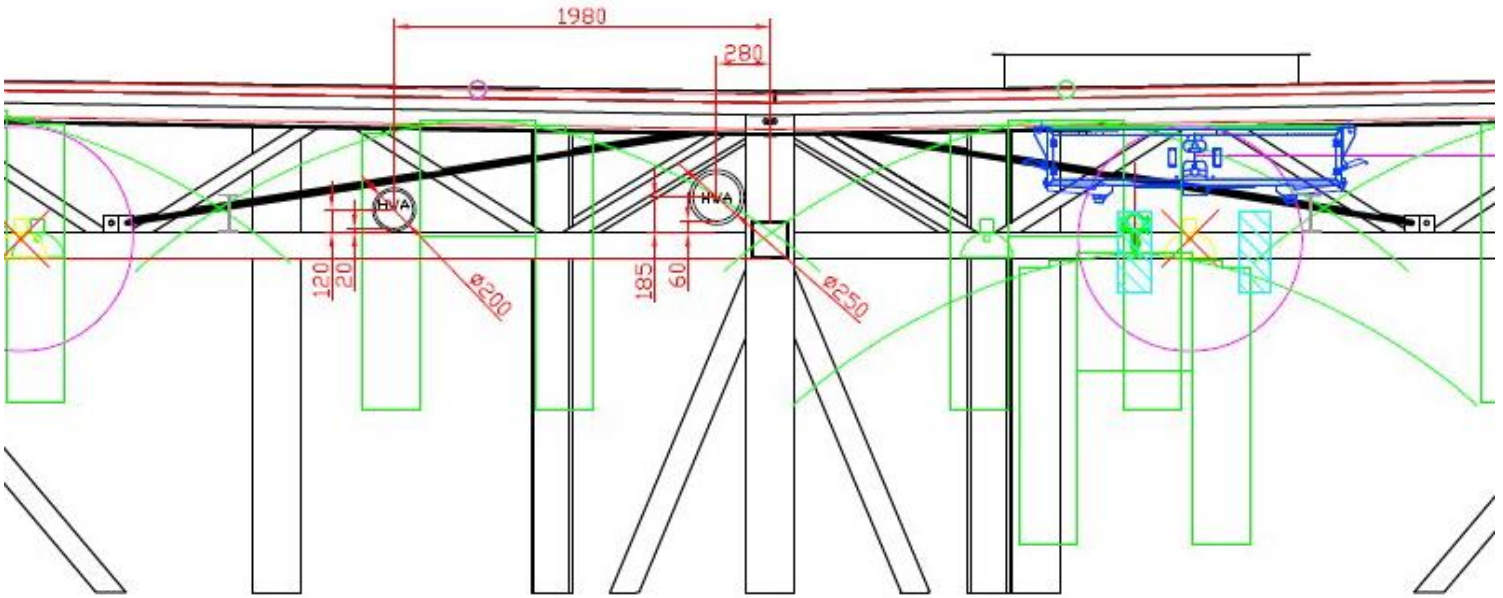
Dimensions without options (approx.) Subject to modification!

L -	3256	mm	E -	2856	mm	E3 -		mm	F1 -	230	mm
B -	1370	mm	E1 -		mm	E4 -		mm	F2 -	170	mm
H -	590	mm	E2 -		mm				C -	1230	mm



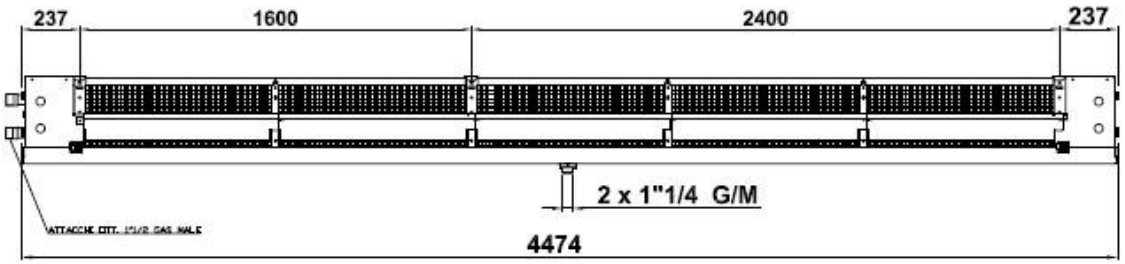


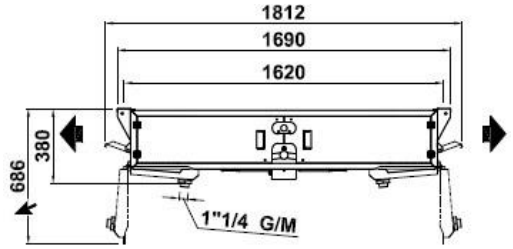
Realization coolers into the steel structure:



Selection example cooler:

Cooling Coil: COIL Code		3512L.30.CU.18.AL.16.06.4125.70.W.X.X.016.096.R 1 1/2" L					
Tube Material:	CU-.30	Ext. Surface:	143,3	m2	Volume:	47,6	dm3
Fin Material:	AL-.18	Int. Surface:	14,93	m2	Weight:	115,2	kg
External Gas:		Air	/	101,33	kPa		
Flow Rate		7,03	m3/s	=	25300	m3/h	9 kg/s
Velocity		3,04	m/s				
Inlet and Outlet Temp.		1	°C	->	-1	°C	
Inlet and Outlet Rel. Humidity		85	%	->	91,1	%	
Inlet and Outlet Water Cont.		3,46	g/kg	->	3,18	g/kg	
Condensed Water		2,52	g/s				
Sensible Heat Factor		0,71					
Pressure Drop		72	Pa				
Internal Fluid:		Other					
Flow Rate		1,67	l/s	=	6010	l/h	1,92 kg/s
Velocity		0,92	m/s				
Inlet and Outlet Temp.		-7	°C	->	-3	°C	
Pressure Drop		50,6	kPa				
Capacity:		24,06	kW	CounterFlow Calculation			
Safety Factor		17	%				
Fluid Name:		ASPEN TEMPER 20					
Spec. Heat		3248	J/kg k		Viscosity	4,16	mPa s
Spec. Weight		1148	kg/m3		Conductivity	0,47	W/m k





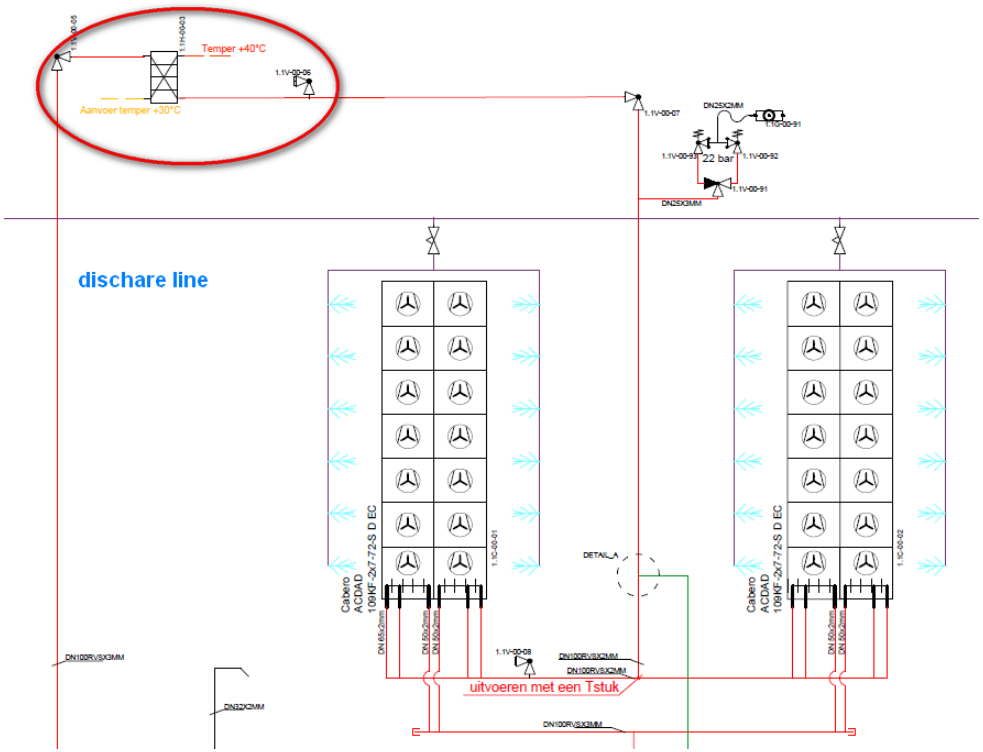
Defrost system:

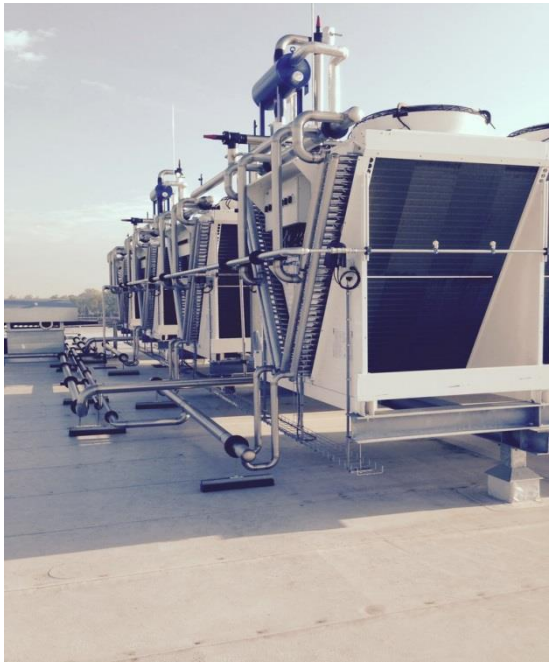
Use of condensing heat for defrost the air coolers

- Recovering condensing heat
- Separate low temperature 15-20 ^{0}C pipeline structure for deforst

Defrost system:

Use of condensing heat for defrost the aircoolers





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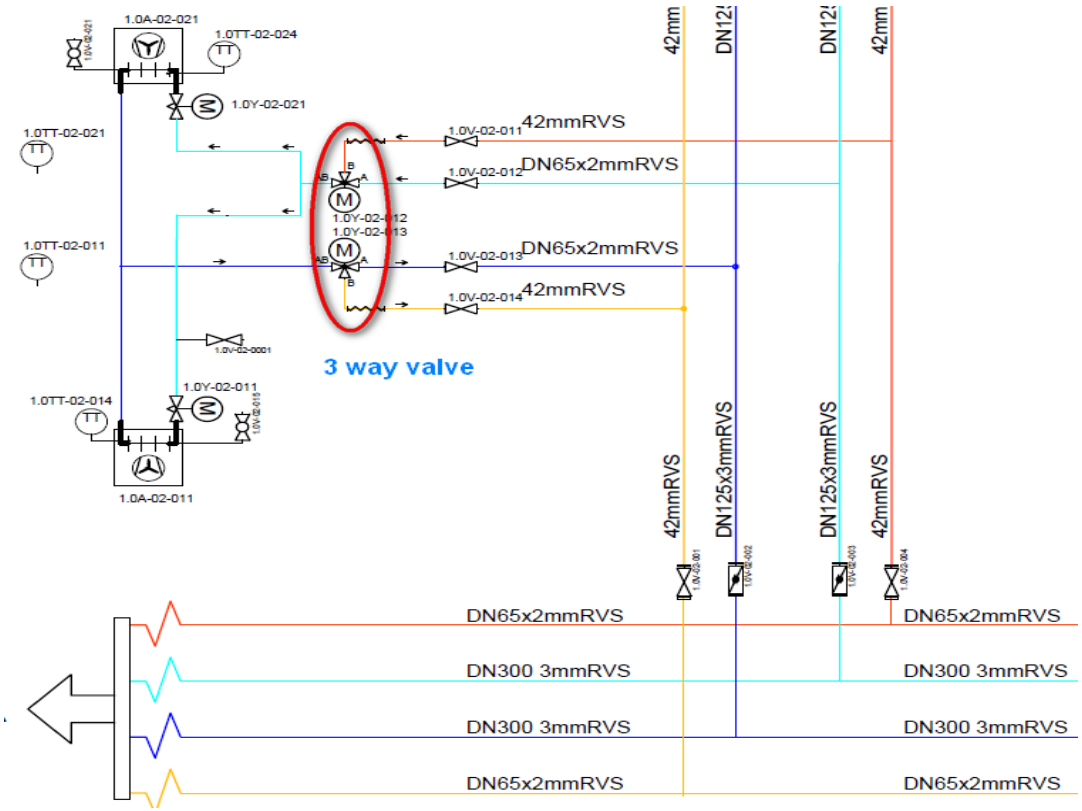
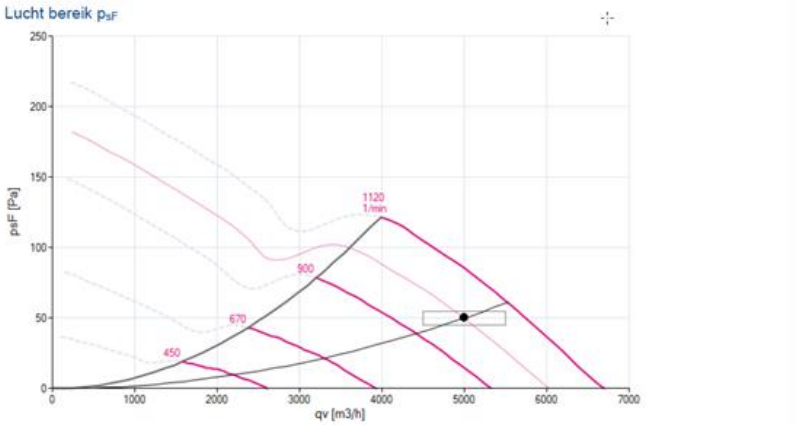
Use of condensing heat for defrost the aircoolers



Ventilation:

Al the fans in coolers and condenser are EC Fans
Increasing of:

- Energy consumption
- Noise



1 FN050-6IA.BD.A7P2

f [Hz]	sum	63	125	250	500	1000	2000	4000	8000
$L_{w(A),5}$	66	37	52	56	57	61	60	55	47
$L_{w,5}$	72	63	68	64	61	61	58	54	48

f [Hz]	sum	63	125	250	500	1000	2000	4000	8000
$L_{w(A),6}$	65	37	53	57	58	59	59	55	48
$L_{w,6}$	72	63	69	65	61	59	58	54	49

Realization Cooling system (excluding NH3 system)

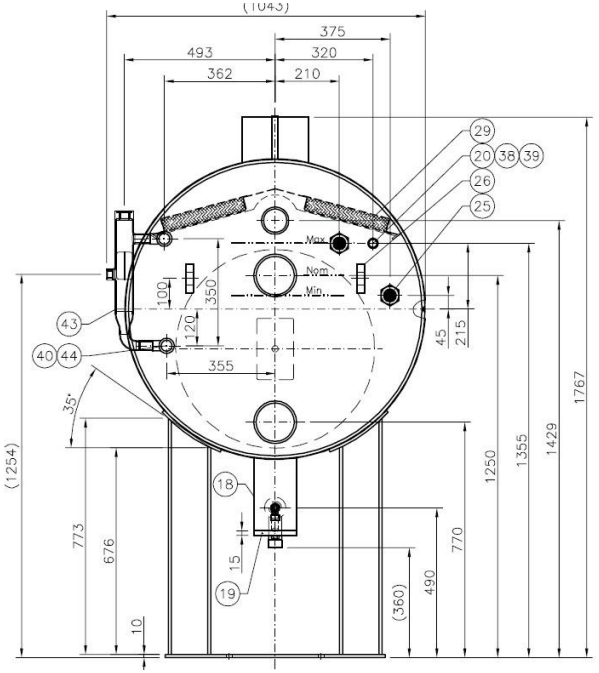
Coolers:	173 dual discharge Coolers 28 single discharge Coolers 906 EC fans 500 mm and 630 mm 201 2 way valves 196 3 way valves
Pipeline structure:	Approximately 9 km Stainless steel
Insulation:	PIR 50 ~ 25 mm and 40 mm rockwool
Content of Temper -20	100,000 dm^3

Shared Fresh Distribution Center in Nieuwegein

Ammonia System:

For minimize NH3 content we chose for the following components/system

- *i*Q-plate from vahterus
- High pressure liquid vessel
- Electronic expansion valve
- Adiabatic condenser



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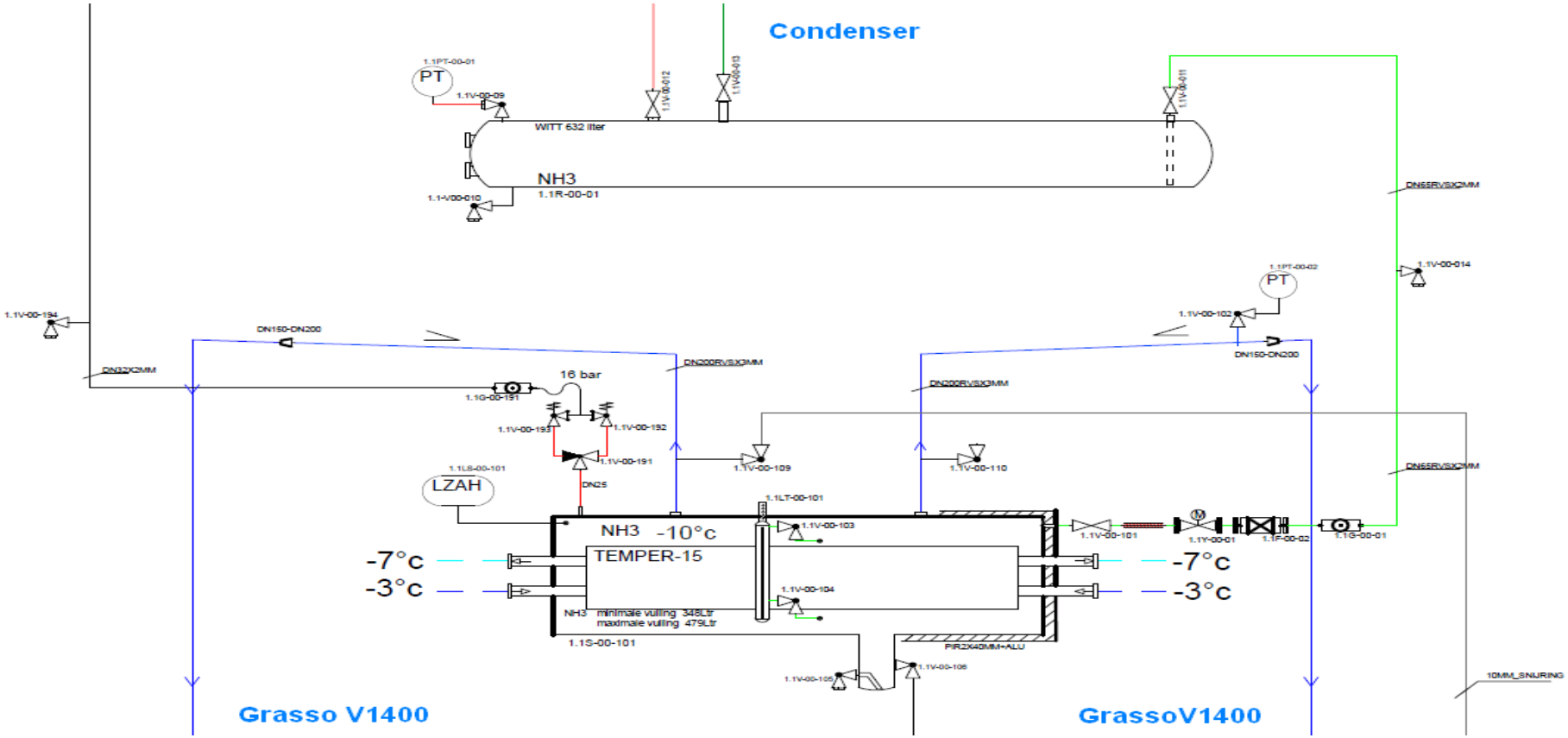

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Ammonia System:

- 4 Grasso V1400 Frequency controlled
  - Max. 702,9 kW each -10/40
  - 250 kW Drive 6 pole

Shared Fresh Distribution Center in Nieuwegein

Ammonia System:

Adiabatic Condenser with heat recovery for Defrosting

Shared Fresh Distribution Center in Nieuwegein

Ammonia System:

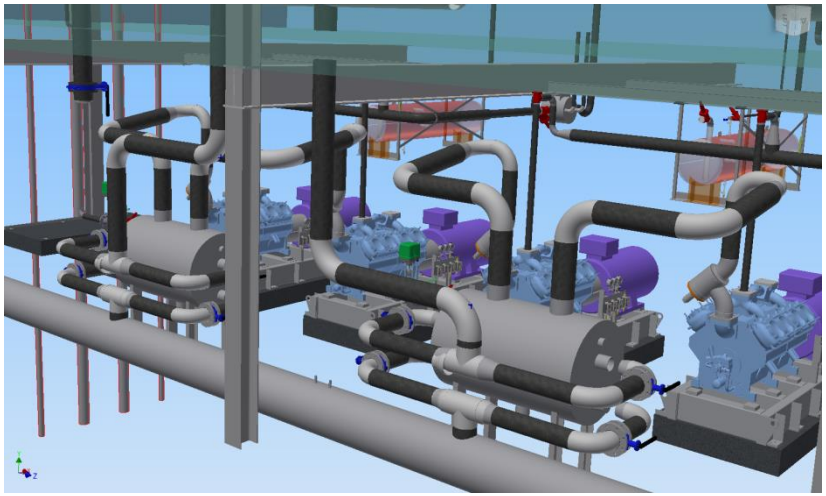
Adiabatic Condenser with heat recovery for Defrosting

Total NH3 content

2 * 495 Kg

A perfect match
Ammonia and Temper in large-scale indirect cooling system
and using efficient brine for defrost

Questions ?



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