

AMMONIA CHILLERS in different industrial plants in Switzerland

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Mayekawa Europe S.A.

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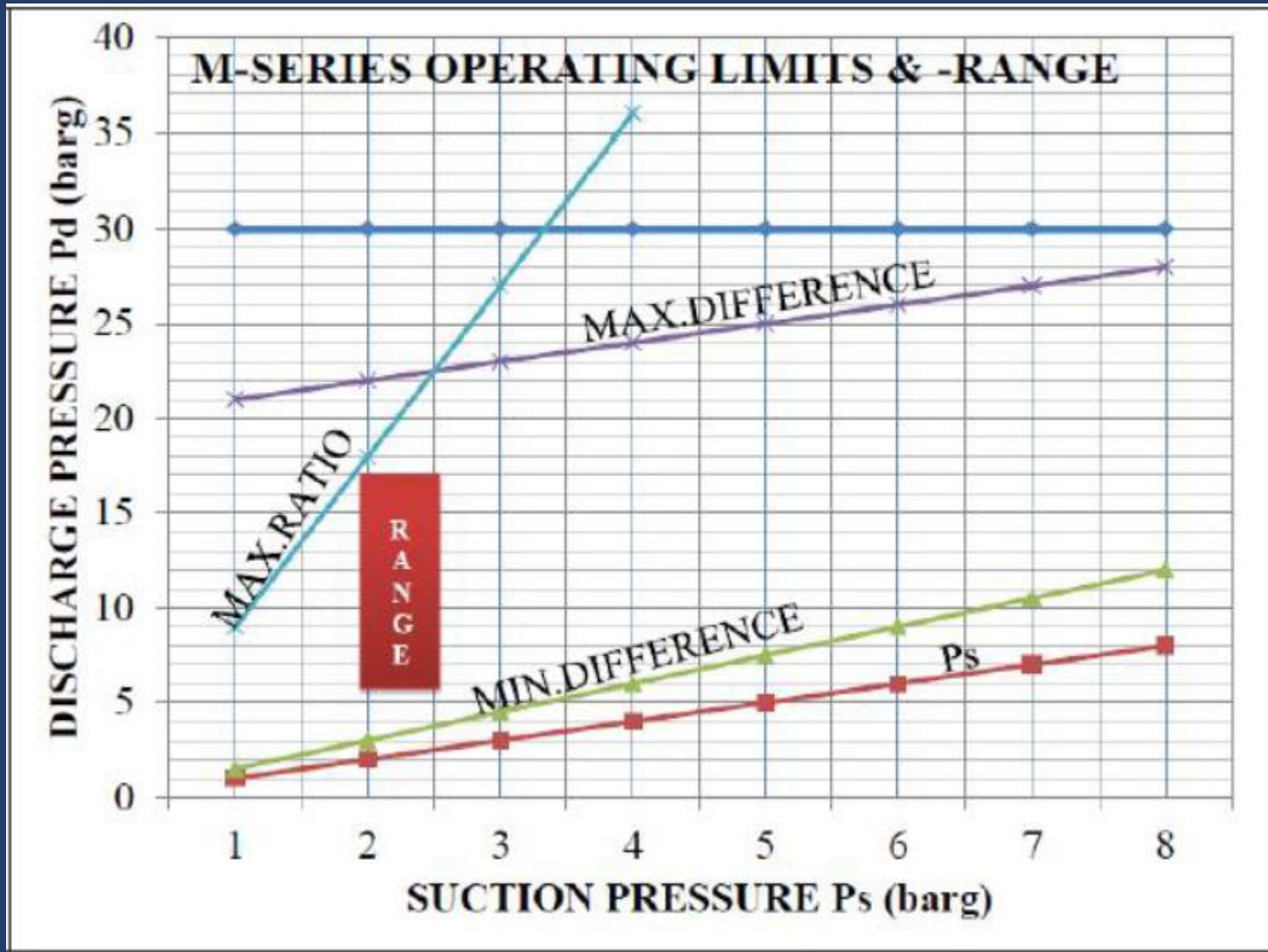
PLANT 1

NH3 PLATE IN SHELL CHILLER PACKAGE



New product 2009
Installation done 2012
by ZERO-C Switzerland
MYCOM N4M(146x106)
CAPACITY 400 to 470 kW
=f(rpm,tc-range 45 to 15°C,te -7°C)
Coverage till 27% by FD(1500->800rpm)
& bank-control (100->50%)
COPc 5 to 17% up in f(rpm)
Design : 367 kW -6°C EG/W
T-air:+37°C, T-room: +1 to +3°C

PLANT 1 - NH3 PLATE IN SHELL CHILLER PACKAGE



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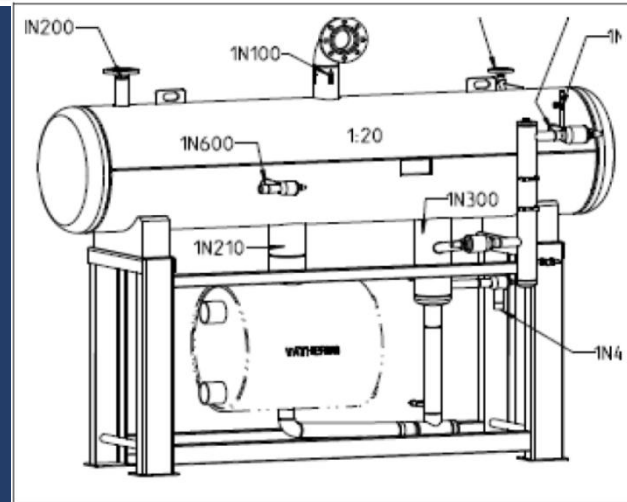


Compressor+oil system, drive motor 160kW,
PSHE evaporator + separator, control panel

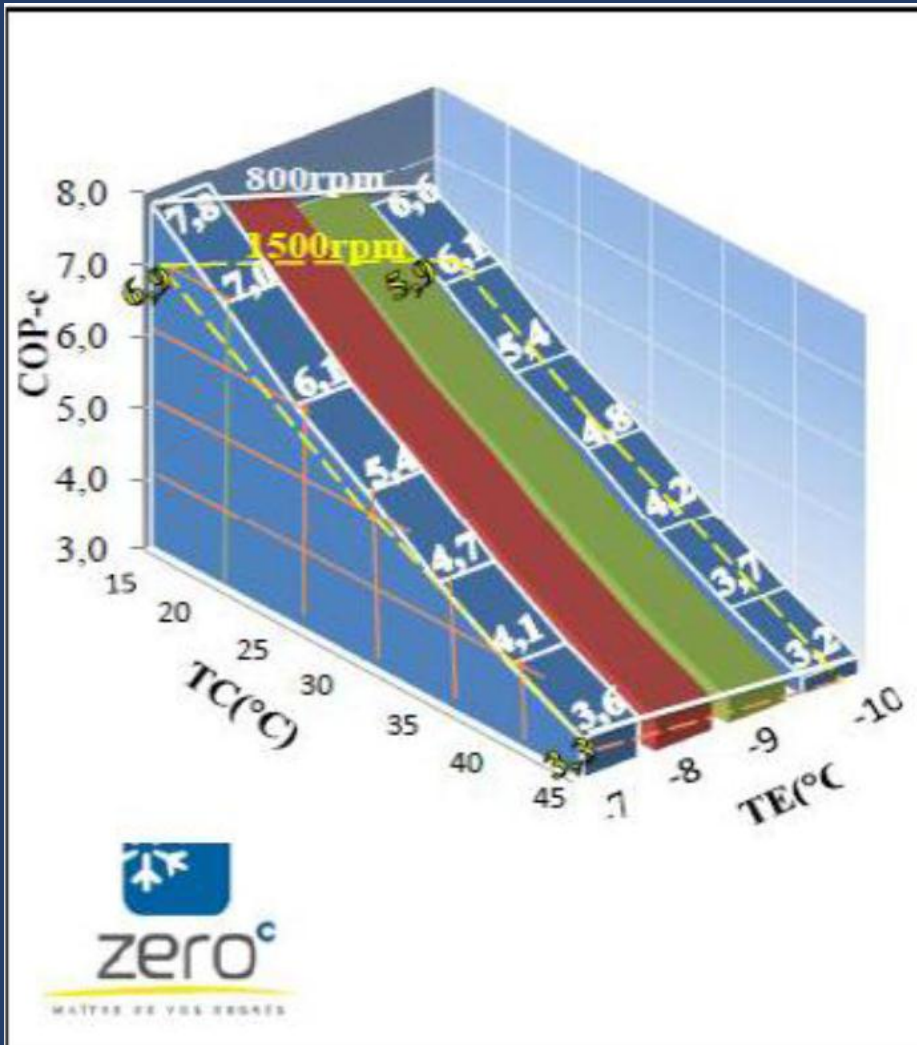
PLANT 1 - NH3 PLATE IN SHELL CHILLER PACKAGE



Aircooled condensor
HP float valve
PSHE evaporator and
NH3 separator



PLANT 1 - NH3 PLATE IN SHELL CHILLER PACKAGE



15-3-13 : 3716 hrs

charges : 102 kg NH3 & 40 l oil

COP measurement in $f(te,tc,load\%)$
COP result is based on electrical consumption measured before PD & cooling capacity measured by magnetic flow meter & PT100 glycol t°.
Overall efficiency PD & Motor 93 to 80%.

COP-c Result :

rpm-min 7.8 to 3.2, rpm-max 6.9 TO 3

COP MAXIMISATION with
M compressor technology,
wide range of conditions
& minimised TC

PLANT 1 - NH3 PLATE IN SHELL CHILLER PACKAGE

OPERATION EVALUATION			
	FROM	TILL	
DATE	1/03/2013	25/03/2013	
TIME	0:00	0:00	
PERIOD HOURS	DAYS	600	25 d
OPERATING HOURS		283	47%
STAND-STILL HOURS		317	53%
MEASURED COP			
value	number of hours	time %	
>6	2,5	1	
5-6	32,7	12	
4-5	184,9	65	
3-4	62,9	22	
TOTAL	283	100	
$(\overline{COP-c} = 4,41)$			
comparison 20/3/13 13:17hr			
glycol- t° in/out: -0,3/-4,3°C			
glycol flow : 59,2 m3/hr			
te/tc: -5,8/18,6°C(2,45/7,21barg)			
measured RT : 247 kW BKW:51,7kW			
N4M 1438rpm 50%. COP-c = 4,79			



PLANT 2

NH3 DIRECT EXPANSION CHILLER PACKAGE



PLANT 2

NH3 DIRECT EXPANSION CHILLER PACKAGE

INSTALLATION 2009

USED COMPRESSOR 2 x MYCOM N8L(115x90)
CHILLER 1 : 500kW 6°C chilled water ->13°C room t°
CHILLER 2 : 350kW -3°C eth.glycol-water ->+4°C room t°

Individual NH3 circuits with water cooled condensers
All heat exchangers PHE with minimum NH3 charge

Capacity regulation
Coverage till 20% by FD(1500->800rpm) & bank-control (100->50%)

COPc's: Chiller 1. 4,8 to 5,6 & Chiller 2. 3,3 to 3,9 f(rpm)



PLANT 2 - NH3 DIRECT EXPANSION CHILLER PACKAGE



Compressor+oil system, drive motor 132kW,
PHE evaporator + condensor + receiver, control panel



PLANT 2 - NH3 DIRECT EXPANSION CHILLER PACKAGE

CHILLER	NO 1	NO 2																								
TYPE	PHE	PHE																								
MODEL	TL500	TL500																								
plate qty	88	86																								
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">RT</td> <td style="padding: 5px;">tw-in</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">tw-out</td> <td style="padding: 5px;">dt1</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">lmtcd</td> <td style="padding: 5px;">dt2</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">TE</td> <td></td> </tr> </table>	RT	tw-in	tw-out	dt1	lmtcd	dt2	TE		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">502</td> <td style="padding: 5px;">12</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">6</td> <td style="padding: 5px;">3</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">5,43</td> <td style="padding: 5px;">9</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">3</td> <td></td> </tr> </table>	502	12	6	3	5,43	9	3		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">350</td> <td style="padding: 5px;">2</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">-3</td> <td style="padding: 5px;">4</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">5,61</td> <td style="padding: 5px;">9</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">-6,5</td> <td></td> </tr> </table>	350	2	-3	4	5,61	9	-6,5	
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HTS	41,8	40,8																								
k-value	2330	1606																								
content	58,7	57,4																								

ICF valve combination + actuator :
 Controls chiller gas outlet t°
 Compressor :
 Controls chiller glycol-water outlet t°



CHARGES (CHILLER1/-2)
 capacity 500/350 kW
 NH3 : 19,2/16,6 kg
 OIL : 30 liter each

PHE EVAPORATOR design data



PLANT 2 - NH3 DIRECT EXPANSION CHILLER PACKAGE

plant started middle 2006

actual hours :

CHILLER 1 – 10192 hrs

CHILLER 2 – 8008 hrs

COP measurement in f(te,tc,load%)

Result :

CHILLER 1 – 4 to 4,5

CHILLER 2 – approx.3

advantages NH3 dx system :

MINIMISED NH3 CHARGE

NO NH3 SEPARATOR



PLANT 3

NH3 COMBINED PLATE IN SHELL CHILLER PACKAGE



PLANT 3

NH3 COMBINED PLATE IN SHELL CHILLER PACKAGE

INSTALLATION 2011

USED COMPRESSOR 2 x MYCOM N8K(85x65)
CAPACITY : 133kW -7°C eth.glycol-water ->+0°C room t°

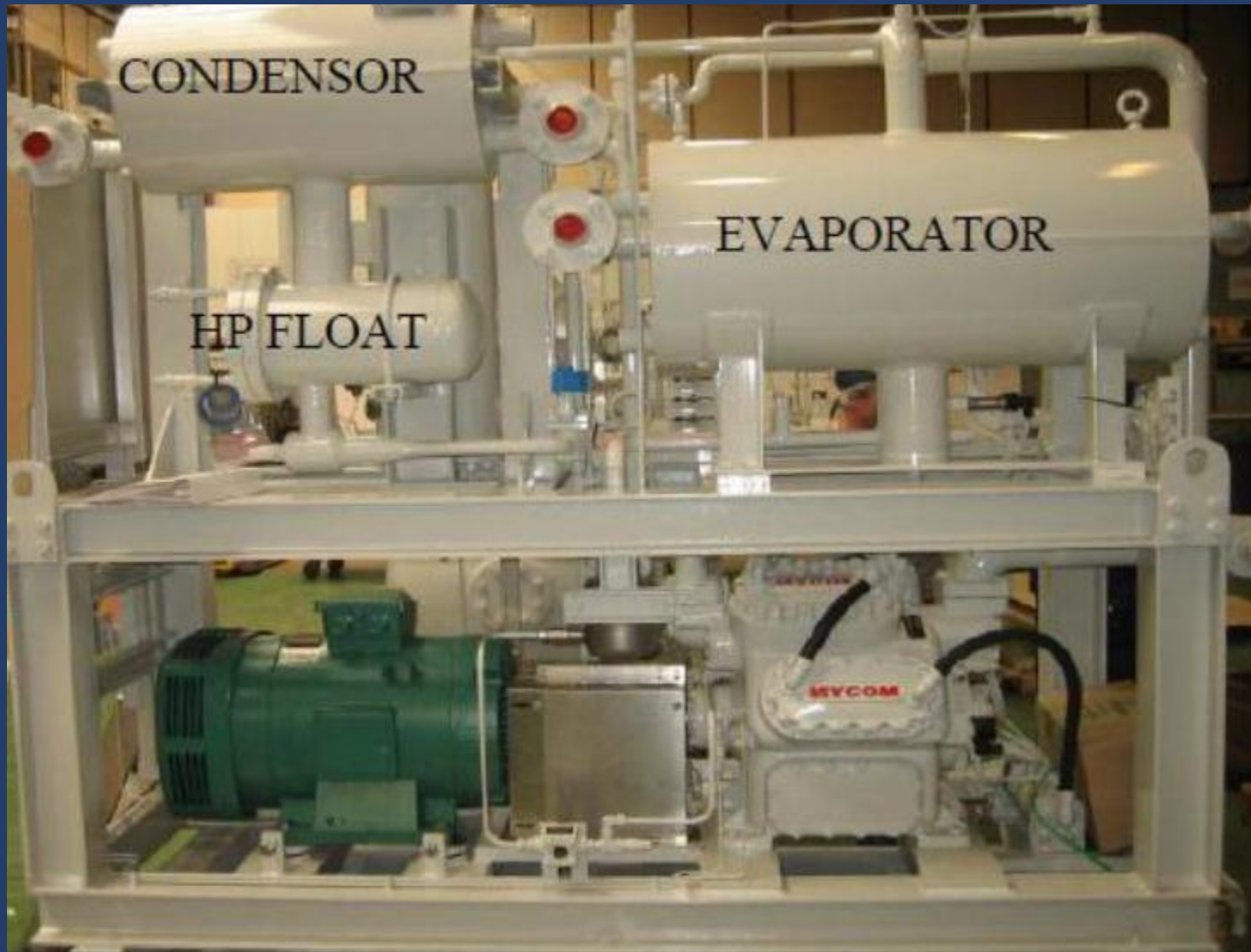
Individual NH3 circuits with water cooled condensers
All heat exchangers PSHE with minimum NH3 charge

Capacity regulation
Coverage till 20% by FD(1500->800rpm) & bank-control (100->50%)

COPc : Chiller . 3,6 (1450 rpm)



PLANT 3 - NH3 COMBINED PLATE IN SHELL CHILLER PACKAGE



PLANT 3 - NH3 COMBINED PLATE IN SHELL CHILLER PACKAGE



COMBINED PSHE

- ❑ Fully welded plate & shell h.exch.
- ❑ Combines evaporator + separator in 1 shell
 - ❑ Reducing unit dimensions
 - ❑ Reducing NH3 charge
- ❑ Uncomplicated shape vessel
 - ❑ No external piping
 - ❑ Easy to insulate
- ❑ High efficiency separator
 - ❑ Low NH3 charge
- ❑ Fill-up unusefull area NH3 ↓
- ❑ Design on practical tests
 - ❑ Easily oil drain off

PLANT 3 - NH3 COMBINED PLATE IN SHELL CHILLER PACKAGE

plant started May 2011

actual hours :

CHILLER 1 – 8500 hrs

CHILLER 2 – 7500 hrs

NH3 charge : 33 kg

Oil charge : 7 liter

COP measurement in f(te,tc,load%)

Result :

CHILLER 1&2 – approx.2,8



PLANT 3 - NH3 COMBINED PLATE IN SHELL CHILLER PACKAGE



Chiller e⁵

environmental friendly
energy saving
easy installation
easy control
easy service



MAYEKAWA
MYCOM

AMMONIA CHILLERS

in different industrial plants in Switzerland

- ❑ NH₃ chillers with different evaporator types (direct expansion & flooded with ext.& int.separator)
- ❑ Improvements achieved :
- ❑ Compactness (minimised footprint)
- ❑ Higher efficiency (compressor,h.exch.,FD)
- ❑ Lower NH₃ charges (35 to 250 g/kW)
- ❑ Optimised COPs (minimised TCs)
- ❑ Much wider load-coverage (FD & cap.control)
- ❑ Further reduction on environmental impact
- ❑ Efficiency improvement
- ❑ Safety improvement
- ❑ Reliability improvement



AMMONIA CHILLERS

in different industrial plants in Switzerland

THANKS FOR YOUR ATTENTION !



5th Conference on Ammonia Refrigeration Technology, Ohrid, 2013

ΜΑΥΕΚΑΨΑ
MYCOM