



**ANNUAL MEETING OF THE REGIONAL OZONE NETWORK  
FOR EUROPE & CENTRAL ASIA (ECA NETWORK MEETING)  
OHRID, MACEDONIA FYR, 21-23 MAY 2013**

**10 years of networking & mutual support  
between Parties to the Montreal Protocol in Europe & Central Asia**

**FIELD CASES  
WITH NATURAL REFRIGERANTS  
IN DEVELOPING COUNTRIES**

## MYCOM Compressor and Development



1924: Piston Compressor



1964: Screw Compressor



1978:  
4°K Super Low temp.  
Particle Accelerator  
(Helium)



1981:  
Nuclear  
Fusion  
(Helium)



1984:  
Mag-Levi  
Train  
(Helium)



1989:  
Rocket Fuel  
(Hydrogen)



1993: Super GE  
(Superconduct-  
EL-Generator)



1958: Multi-Cylinder  
Piston Compressor



Ethylene Plant



LNG/LPG Tanker



Organic (EOEG)



Inorganic:  
(NH<sub>3</sub>)



Pharma Plant

1924

1960

1970

1980

1985

1990

● More than 100.000 Screw and Piston Compressors have been installed over 100 countries.

## "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			Cryogenics		Cryogenics
-60°C					
-100°C					
Notes	<ul style="list-style-type: none"> <li>• Conventional system</li> </ul>	<ul style="list-style-type: none"> <li>• Eco-Cute</li> </ul>	<ul style="list-style-type: none"> <li>• Nat'l Proj.</li> <li>• Butane + Propane</li> </ul>	<ul style="list-style-type: none"> <li>• Nat'l Proj.</li> <li>• Adsorption</li> <li>• Heat recovery</li> </ul>	<ul style="list-style-type: none"> <li>• Nat'l Proj.</li> <li>• Air-cycle</li> </ul>



# FIELD CASES

## WITH NATURAL REFRIGERANTS IN DEVELOPING COUNTRIES

Authors :

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Zikica Andrejevic Klima Serbia

**MYCOM COMPRESSORS : SERBIA – MACEDONIA - CROATIA**Meat industries:

Number of meat industries	12
Total annual production of meat and meat products	9.940 t / month
Number of installed compressors “Mayekawa – Mycom”	45
Time period of compressors' installation	1987 – 2013
Compressor models	
Piston:    N4WB, N6A, N8K	1, 2, 2 = 5 pcs
Screw:    N160, N200, N250, FM160	11, 13, 7, 9 = 40 pcs
Electrical motor power	37 – 400 kW
Compressor with the highest number of working hours	135.000 h



N6K (2x) -14/+35

FM160L (2x) -40/+35

FM160L (1x) -14/+35

Meat industry  
"MEGA" Skopje, Macedonia



N6K  
NH3 TE/TC=-14/+35° C  
RT/BKW=82/26kW (90/24)





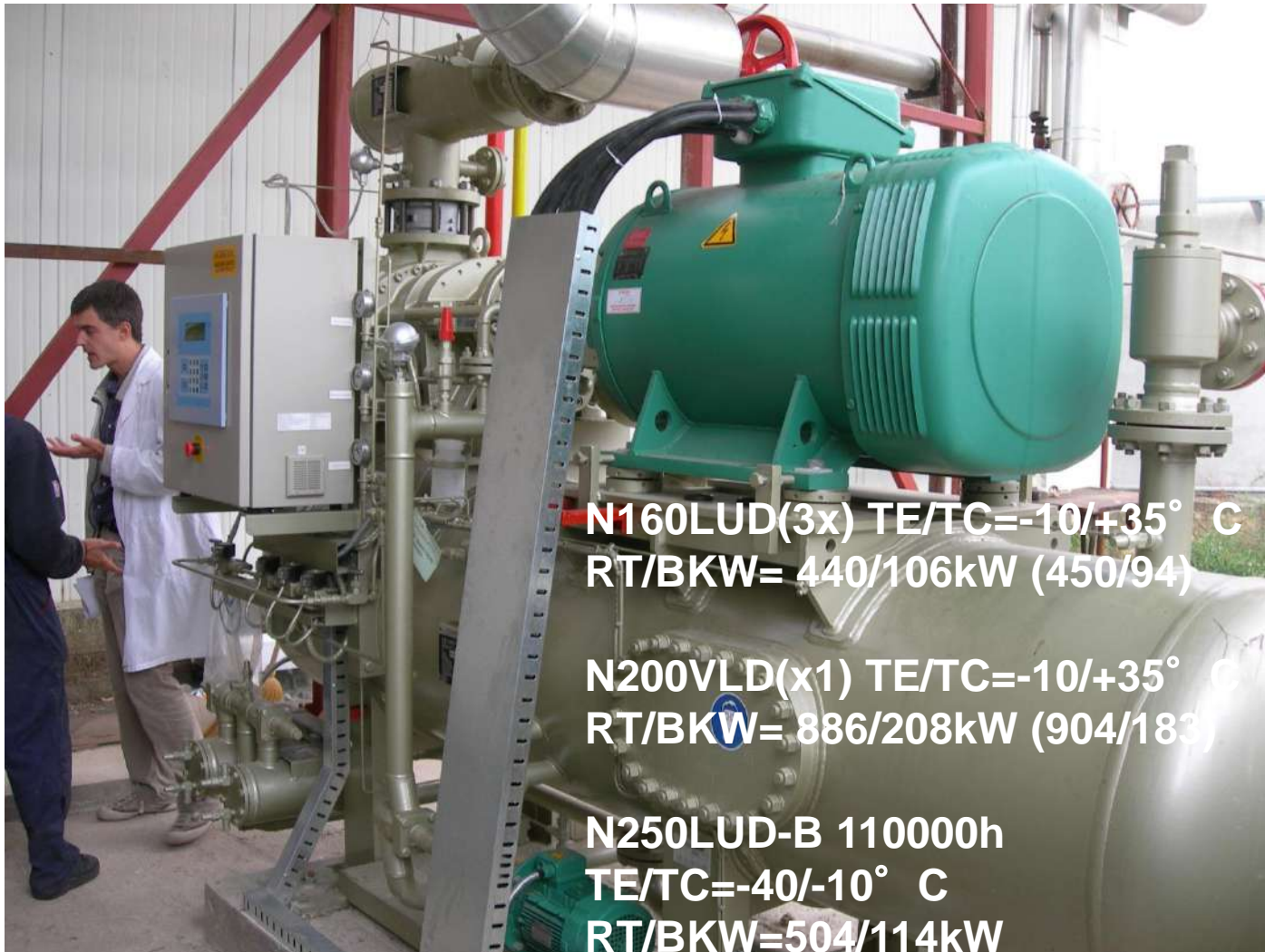
FM160L NH<sub>3</sub> TE/TC=-14/+35° C RT/BKW=346/100kW (361/89)  
FM160L-ME NH<sub>3</sub> TE/TC=-40/+35° C RT/BKW=109/87kW (116/75)

Note:

former freon chiller replaced by NH<sub>3</sub> thermosiphon oil cooler







N160LUD(3x) TE/TC=-10/+35° C  
RT/BKW= 440/106kW (450/94)

N200VLD(x1) TE/TC=-10/+35° C  
RT/BKW= 886/208kW (904/183)

N250LUD-B 110000h  
TE/TC=-40/-10° C  
RT/BKW=504/114kW

**MYCOM COMPRESSORS : SERBIA - MACEDONIA****Breweries:**

Number of breweries	8
Total annual production of beer	7.200.000 hl/year
Number of installed compressors "Mayekawa – Mycom"	19
Time period of compressors' installation	1988 – 2012
Compressor models	
Piston: -	0 = 0 pcs
Screw: N200, N250, FM160	6, 11, 2 = 19 pcs
Electrical motor power	132 – 450 kW
Total cooling capacity of all compressors at operating conditions -10°C/+35°C	18.650 kW
Compressor with the highest number of working hours	128.000 h





Brewery 2003  
"Rodić MB"  
Novi Sad - Serbia



Twin N200VLD(1x)  
N250VLD(1x)  
TE/TC=-8/+35° C  
RT/BKW=1863/408kW (1896/360)





Brewery 1991 / 2003

"Jagodinska pivara" Jagodina - Serbia





**107.600 HRS**

**N200LUD (1x)**  
**TE/TC= -10/+35° C**  
**RT/BKW=878/226kW (894/205)**  
**N200VLD (1x)**  
**TE/TC= -10/+35° C**  
**RT/BKW=886/208kW (904/183)**

## MYCOM COMPRESSORS : SERBIA – BOSNIE HERZEGOVINA - SLOVENIA

### Other industries:

Number of industries	11
Number of installed compressors “Mayekawa – Mycom”	24
Time period of compressors' installation	1988 – 2010
Compressor models	1 = 1 pcs 3, 8, 6, 6 = 23 pcs
Piston: N6HK Screw: N160, N200, N250, FM160	
Electrical motor power	90 – 355 kW
Compressor with the highest number of working hours	115.600 h
A) Wine and soft drinks production B) Production of fruit concentrates C) Motor oil refineries D) Production of edible oil and vegetable fats E) Dairies F) Production of technical gases G) Production of lyophilized fruit and vegetables H) Heat pumps	





Fruit concentrates industry  
"Nectar" V. Han, Serbia





CONDENSOR

PHE EVAPORATOR + SEPARATOR



N200VLD  
TE/TC=-10/+35° C  
N160VLD  
TE/TC=-32/+35° C









**FREEZING ROOM**



"NECTAR"  
Bačka Palanka  
Hladnjača Vladičin Han  
SRBIJA

## RASHLADNO POSTROJENJE „NECTAR“ VLADIČIN HAN

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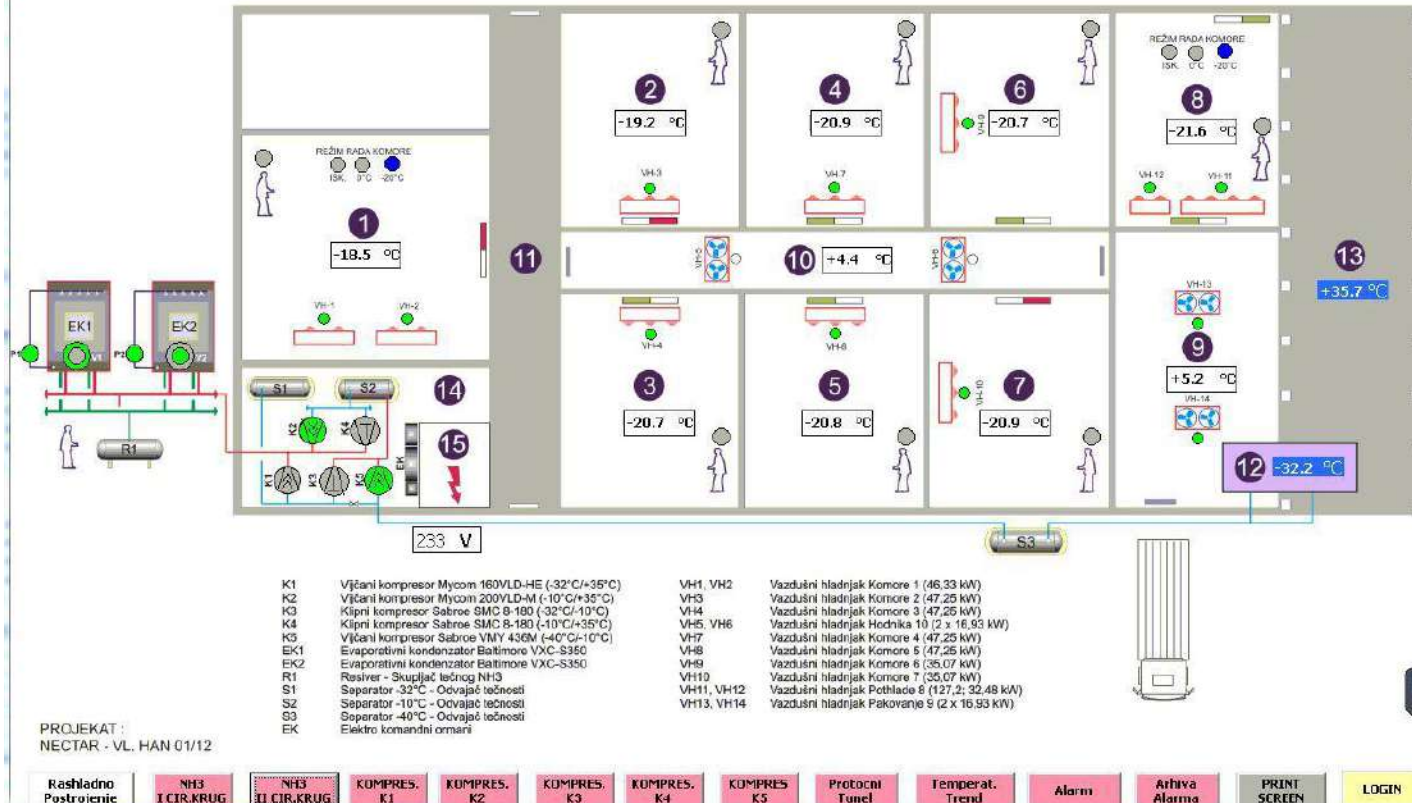
### LEGENDA:

- |                                   |                                 |                        |
|-----------------------------------|---------------------------------|------------------------|
| 1 LAGER KOMORA / POTHLADA / 400 t | 6 LAGER KOMORA 225 t            | 11 HODNIK/NEHLADENI    |
| 2 LAGER KOMORA 450 t              | 7 LAGER KOMORA 225 t            | 12 PROTOČNI TUNEL 5 Vh |
| 3 LAGER KOMORA 450 t              | 8 LAGER KOMORA /POTHLADA/ 200 t | 13 PRIJEM I PRERADA    |
| 4 LAGER KOMORA 450 t              | 9 PAKOVANJE - MANIPULACIJA      | 14 MAŠINSKA SALA       |
| 5 LAGER KOMORA 450 t              | 10 MANIPULATIVNI HODNIK         | 15 TRAFI STANICA       |

**UPOZORENJE:**  
MDK = max. 200 ppm  
(max. dozov. koncentracija NH3)  
ALARM = max. 600 ppm

koncentracija NH3  
1000 ppm

Spoljna temperatura  
+35.7 °C



PROJEKAT:  
NECTAR - VL. HAN 01/12

- Rashladno Postrojenje | NH3 I CIR.KRUG | NH3 II CIR.KRUG | KOMPRES. K1 | KOMPRES. K2 | KOMPRES. K3 | KOMPRES. K4 | KOMPRES. K5 | Protočni Tunel | Temperat. Trend | Alarm | Arhiva Alarma | PRINT SCREEN | LOGIN



"NECTAR"  
Bačka Palanka  
Hladnjača Vladičin Han  
SRBIJA

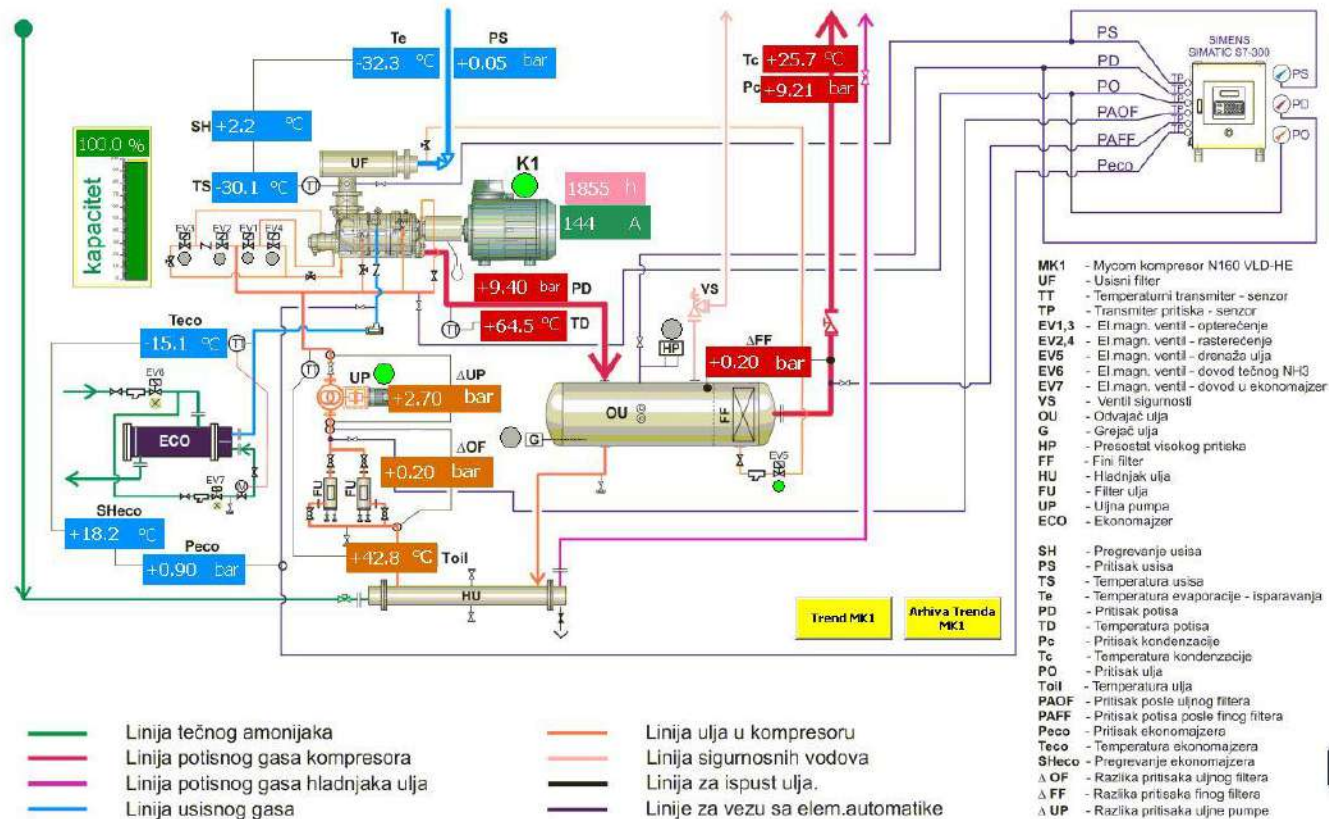
## RASHLADNO POSTROJENJE „NECTAR” VLADIČIN HAN

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Rashladni kompresor K1 - N160 VLD-HE (-32°C / +35°C)  
Q = 171,3 kW ; Nem = 110 kW

### K1



Rashladno Postrojenje NH3 I CIR.KRUG NH3 II CIR.KRUG KOMPRES. K1 KOMPRES. K2 KOMPRES. K3 KOMPRES. K4 KOMPRES. K5 Protocni Tunel Temperat. Trend Alarm Arhiva Alarma PRINT SCREEN LOGIN



MYCOM COMPRESSORS : SERBIA - CROATIA – BOSNIA HERZEGOVINA –  
RUSSIA - EGYPT

Cooling Plants:

Number of constructed facilities	36
Total storage capacity	136.500 ton
Total number of continuous freezing tunnels	38
Total capacity of continuous tunnels (2,5 t/h – 7,0 t/h)	140,5 t/h
Number of installed compressors “Mayekawa – Mycom”	92
Time period of compressors' installation	1976 – 2013
Compressor models	
Piston:    N6K, N8K, N6WB, F4.2WA	2, 1, 2, 1 = 6 pcs
Screw:    N160, N200, N250, N320, FM160, F200	5, 30, 39, 5, 5, 2 = 86 pcs
Electrical motor power	37 – 450 kW
Compressor with the highest number of working hours	162.000 h



Cooling plant - 1990 / 2004  
"Bosnaplod" Brčko - District  
Bosnia & Hercegovina



N250MUD(1x)  
N250VLD (1x)  
Economizer  
TE/TC=-40/+35° C  
RT/BKW=462/290kW  
(481/257)  
108.000 HRS



N250SUD-HE 1988 TE/TC=-40/+35° C  
RT/BKW=302/197kW



Machine oil refinery  
"Oil refinery Modriča"  
Modriča, Bosnia and Herzegovina

115000 HRS

## Automatic operation of two Evaporative condensers with Dahlander motor (two speed)

EC1, EC2 - Evaporative condenser Baltimore VXC S350 with two speed Dahlander motor (30/7,5 kW)

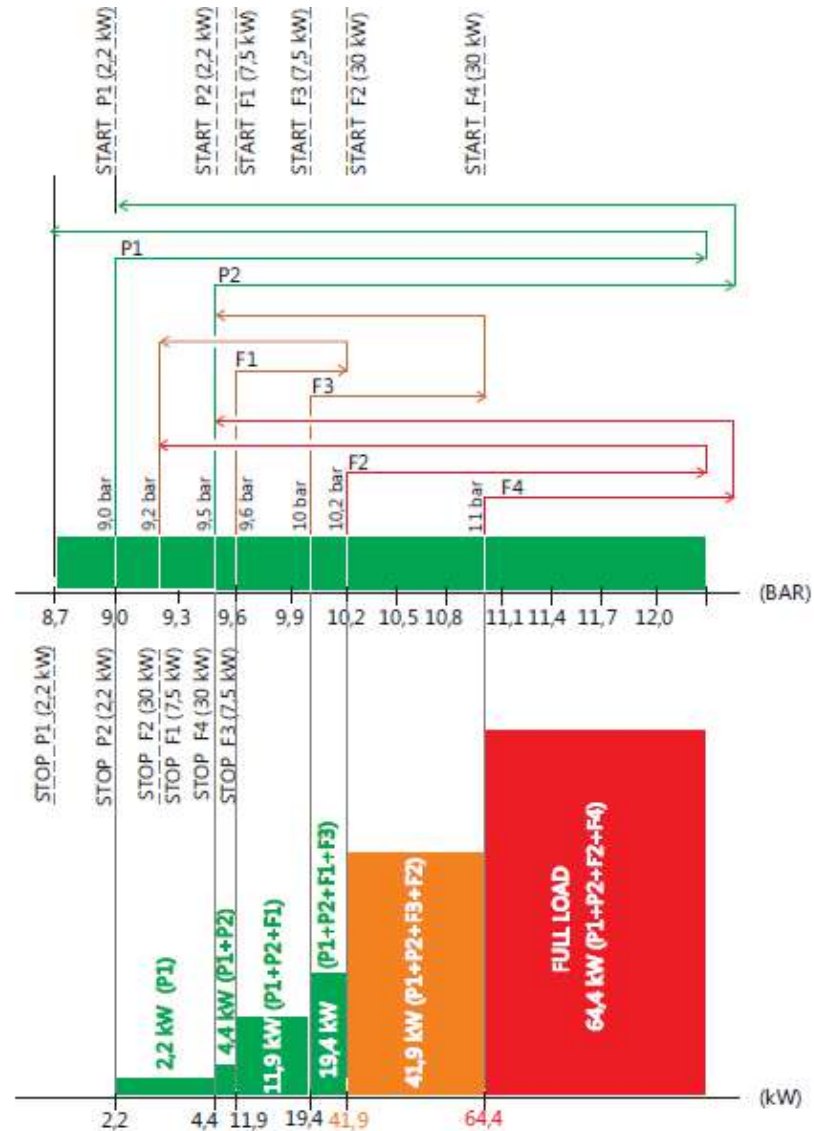
Condensing capacity  $Q = 2 \times 1160 \text{ kW}$   
 $T_c/T_{wb} = +35^\circ\text{C}/+24^\circ\text{C}$

### EC1

- P1 - Water pump;
- F1 - Fan motor I speed (7,5 kW);
- F2 - Fan motor II speed (30 kW)

### EC2

- P2 - Water pump;
- F3 - Fan motor I speed (7,5 kW);
- F4 - Fan motor II speed (30 kW)



## **ENERGY SAVING**

THE PLANTS ARE DESIGNED FOR OPTIMAL ENERGY SAVING NOT ONLY FOR CONDENSOR BUT ALSO COMPRESSOR OPERATING AT MUCH REDUCED CONDENSING PRESSURE FOR THE MAJORITY OF THE OPERATION PERIOD (SEE PERFORMANCES “(xxx)”) ”

THE DIAGRAM SHOWS THAT ALTHOUGH DESIGN PRESSURE IS AT 12,5 BARG, COMPRESSOR WILL OPERATE FOR 80% BELOW 10,2 BARG RESULTING IN A DRASTIC SAVING OF ENERGY AS INDICATED ON EACH OF THE SHOWN FIELD CASES.



**THANKS FOR YOUR  
ATTENTION!**

# MAYEKAWA Global Network

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

## Worldwide:

- 33 countries / 119 offices
- 8 production plants



## MAYEKAWA Europe Organization

MAYEKAWA Europe nv/sa

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