FIELD CASES WITH NATURAL REFRIGERANTS IN DEVELOPING COUNTRIES

Jan Boone

MAYEKAWA EUROPE S.A.,Leuvensesteenweg 605, 1930 Zaventem, Belgium

Tel. 32-2-757-9075, Fax. 32-2-757-9023

ABSTRACT

This paper focuses on the natural refrigerants which strongly contribute to the reduction of consumption of fossil fuel and significant reduction of the CO2 emissions.

Mayekawa, also well-known under the trade name MYCOM, is a world market leader in industrial refrigeration compressors and was founded 90 years ago.

The company strategy is focused on environment with use of natural refrigerants for more than 85 years and energy saving technology.

It is tradition to report from the field as we are of the opinion : 'seeing is believing'.

For this UNIDO-ATMOsphere TECHNOLOGY SUMMIT 2013 event we will present field cases with MYCOM industrial refrigeration compressor packages using ammonia as natural refrigerant, installed in developing countries such as Serbia, Bosnia Herzegovina, Croatia, Macedonia, Slovenia, Russia and Egypt.

The installations are realised by the contractor 'KLIMA'-Smederevo in Serbia, specialized in engineering in the field of industrial refrigeration plants and providing the full range of services from design, delivery of complete cooling equipment as 'turn-key' systems to the end-users in the most modern way, with visualization, till control and operating via their own software.

The focus of the refrigeration plants are in meat industry, breweries, cooling plants and other industries.

Per sector an overview of applications and references with year of installation and actual number of operating hours of the equipment is presented in this document.

UNIDO ATMOsphere Technology Summit 2013, Vienna, 3rd-4th June 2013.

File : DOC.2013-541

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

Cooling Plants:

Number of constructed facilities	36
Total storage capacity	136.500 ton
Total number of continious freezing tunnels	38
Total capacity of continious tunnels (2,5 t/h – 7,0 t/h)	140,5 t/h
Number of installed compressors "Mayekawa – Mycom"	92
Time period of compressors' installlation	1976 – 2013
Compressor models Piston: N6K, N8K, N6WB, F4.2WA Screw: N160, N200, N250, N320, FM160, F200	 2, 1, 2, 1 = 6 pcs 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

The first field case handles a cooling plant installed in Alexandria. An overview of the refrigeration compressor is given with comparison of energy consumption based on natural refrigerants.
The compressors operate until to-day 7000 hrs of operation.

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' installlation	1987 – 2013
Compressor models Piston: N4WB. N6A, N8K Screw: N160, N200, N250, FM160	 1, 2, 2 = 5 pcs 11, 13, 7, 9 = 40 pcs
Electrical motor power	37 – 400 kW
Compressor with the highest number of working hours	135.000 h

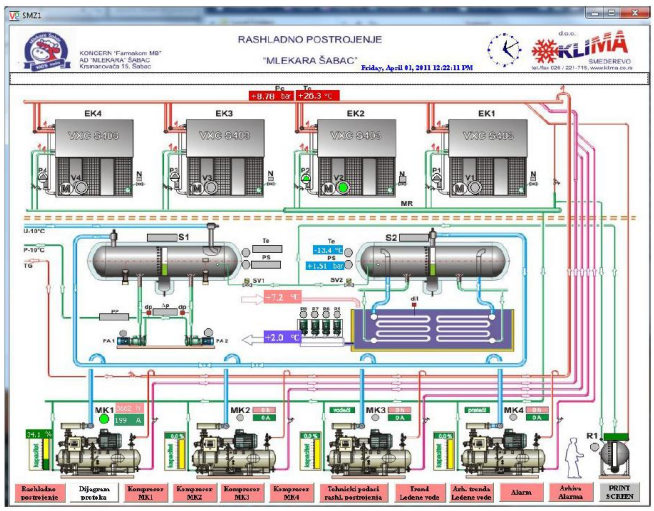
The second field case handles a meat plant installed in 1987 with an extension in 2006 in Jagodina Serbia for producing cooling at -10°C and freezing at -42°C. The compressor package is shown with cooling capacities and energy consumption. One compressor reached 135.000 hours of operation.

MYCOM COMPRESSORS : SERBIA – BOSNIE HERZEGOVINA - SLOVENIA

Other industries:

Number of industries	11
Number of installed compressors "Mayekawa – Mycom"	24
Time period of compressors' installlation	1988 – 2010
Compressor models Piston: N6HK Screw: N160, N200, N250, FM160	 1 = 1 pcs 3, 8, 6, 6 = 23 pcs
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	

The third field case handles a dairy plant installed in 2010 in Sabac Serbia for producing cooling at -10°C. The compressor package is shown with cooling capacities and energy consumption and reached 15.000 hours of operation.



UNIDO ATMOsphere Technology Summit 2013, Vienna, 3rd-4th June 2013.

File : DOC.2013-541

MYCOM COMPRESSORS : SERBIA - MACEDONIA

Breweries:

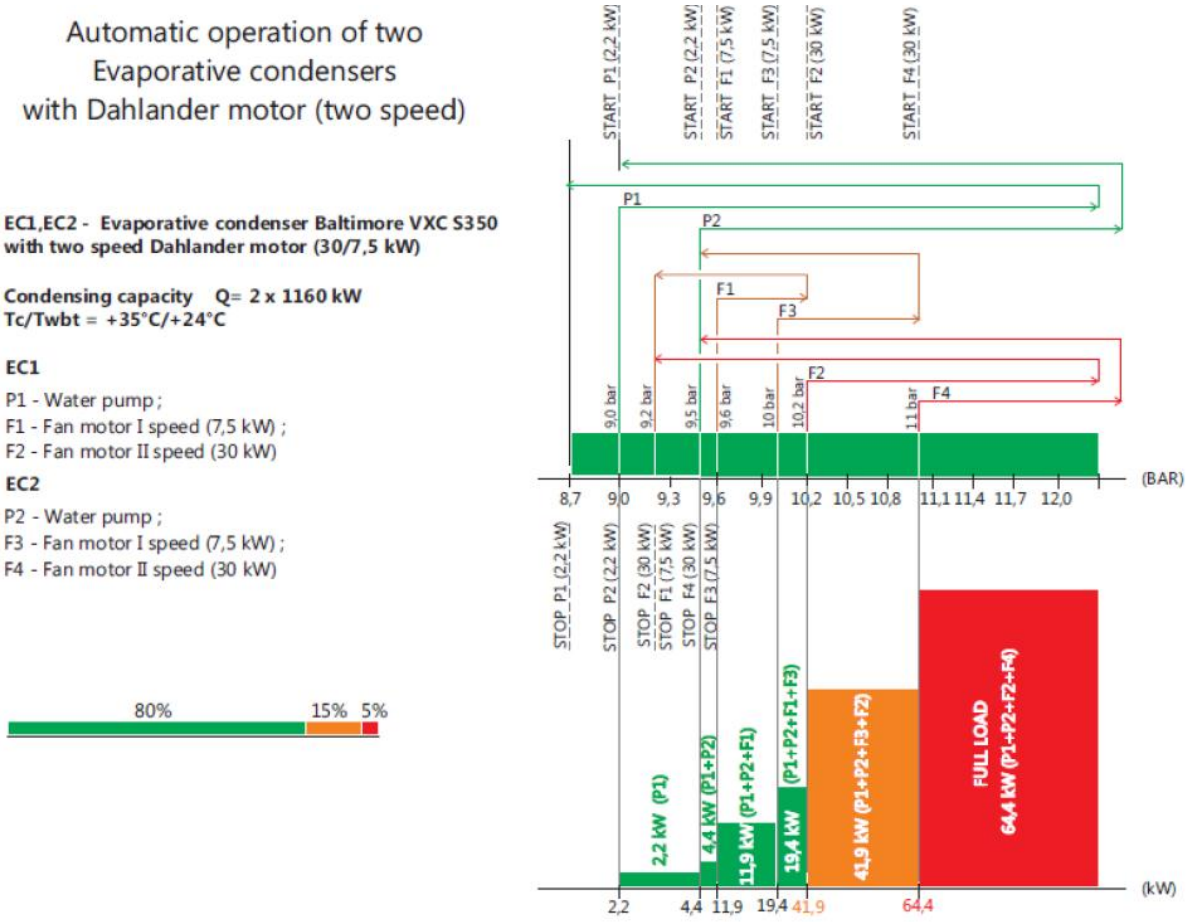
Number of breweries	8
Total annual production of beer	7.200.000 hl/year
Number of installed compressors "Mayekawa – Mycom"	19
Time period of compressors' installlation	1988 – 2012
Compressor models Piston: - Screw: N200, N250, FM160	 0 = 0 pcs 6, 11, 2 = 19 pcs
Electrical motor power	132 – 450 kW
Total 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

The fourth field case concerns a brewery installation from 1994, with further extension in 2000, in Celarevo Serbia. Four ammonia screw compressors are installed with capacities and energy consumption shown in the presentation reaching 128.000 hours of operation.

A typical example of energy saving is given for this field case where the condensing pressures have been reduced from 12.5 barg (corresponding with 35°C) to 10.3 barg (corresponding with 29°C).

An important saving on electrical power has been achieved for the amount of 34.000€ per year based on 80% (or 7.000 hrs) of the yearly operation of the plant. On the other hand a saving on extra cooling capacity was obtained during this period of extra 1.204.000kWh per year.

The automatic operation of the condensors with Dahlander motors (2-speed) allows to minimize the operation of pumps and fans requiring extra electrical energy. The design of the machinery is based on 35°C condensing temperature (corresponds with 12.5 barg), but practical the condensors are suitable for operation down to 8,7 barg. The control sequence if shown very well in the scheme.



Each condenser is evaporative type and equipped with 1 waterpump (2.2 kW electrical power) and with one 2-speed fan (7,5 kW, resp. 30 kW) which will be operated in function of the condensing pressure.

At 9,0 barg the P1 (water pump nr 1) of EC1 (evaporative condenser nr 1) will start and be kept operational up to 12.5 barg down to 8.7 barg where it will stop.

At 9,5 barg the P2 (water pump nr 2) of EC2 (evaporative condenser nr 2) will start and be kept operational up to 13,0 barg down to 9,0 barg where it will stop.

At 9,6 barg the F1 (Fan motor I speed) of EC1 will start and be kept operational up to 10,2 barg and down to 9,2 barg where it will be stopped.

At 10 barg the F3 (Fan motor I speed) of EC2 will start and be kept operational up to 11 barg and down to 9,5 barg where it will be stopped.

Up till 10 barg the maximum electrical power for operating the water pumps P1 and P2, the fans F1 (speed I) and F3(speed I) will amount to 19.4 kW.

Above 10,2 barg F1 on speed II (F2) will be operated adding 22,5kW (30-7.5kW) on electrical power.

Above 11 barg F3 on speed II (F4) will be operated adding another 22,5 kW on electrical power or total 64,4 kW.

The plants from the contractor Klima Smederevo are designed for optimal energy saving not only for condenser but also for the compressor operating at a much reduced condensing pressure for the majority of the plant operation period.

A special thank-word for Mr.Zikica Andrejevic, the Contractor KLIMA from Smederevo SERBIA, who installed the plants and gave us full access to all details of the refrigeration plants.