BERLING
REFRIGERATION GROUP

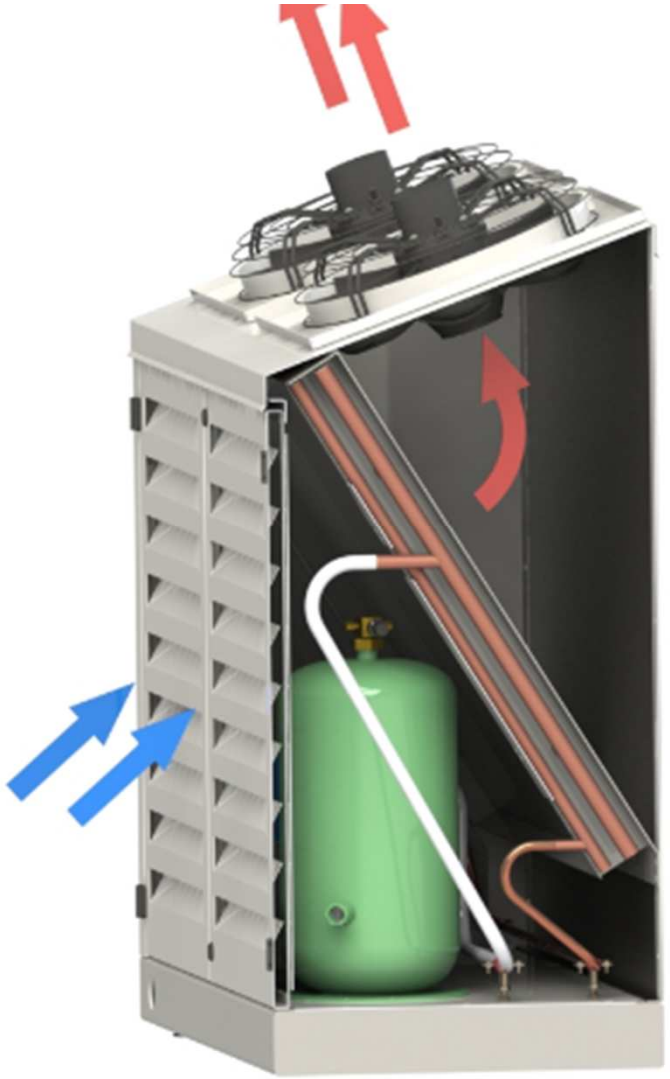
Condensing unit with frequency inverter

MARKET MASTER

ARKTON
CHŁODNICTWO KLIMATYZACJA

Features

- ✓ Compressor speed regulation in range of 30-70Hz for MM-Bitzer and 20-90Hz for MM-Dorin
- ✓ Speed regulation of air-condenser fan's→ reduction of noise emission, possibility of condensing compensation
- ✓ Intelligent PLC driver → change in operating parameters regarding to ambient temperature, calendar, digital input DI
- ✓ Power savings ca. 25-30%
- ✓ **EKO mode** – optimal power consumption by using condensing pressure regulation (increase of COP)
- ✓ **SILENT mode** – lowest possible noise emission with full range of application



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Features

- ✓ Adapting of cooling capacity to requirements
- ✓ Possibility of work with many evaporators
- ✓ Constant evaporation temperature → high quality of stored products
- ✓ Limited start current → smaller power connection
- ✓ Reduced number of compressor starts and „soft start” → longer life of compressor
- ✓ Presets – starting device by simple choosing one of predefined working application

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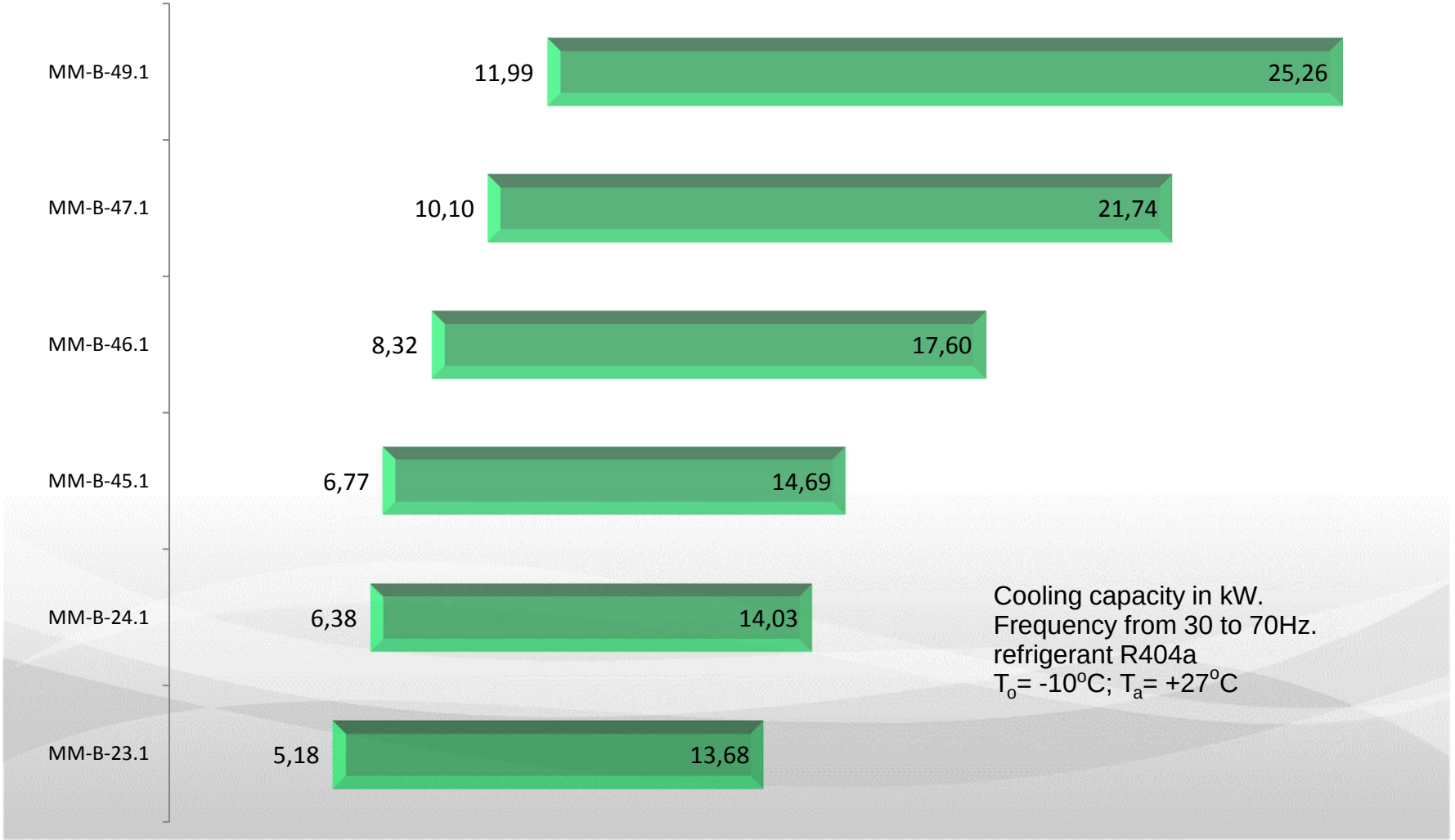
Features

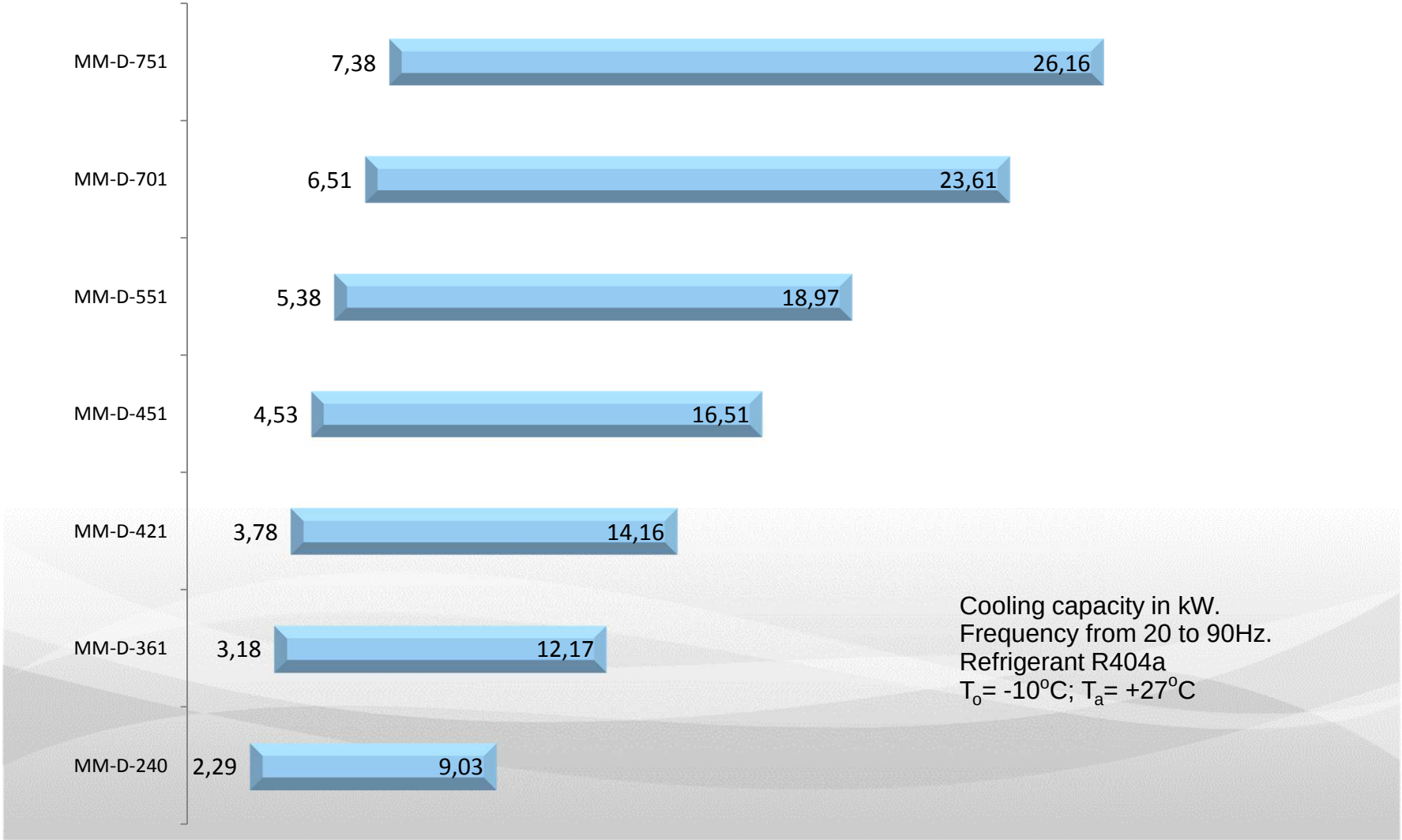
- ✓ High range of supply voltage 380-480V
- ✓ Built-in main switch-off
- ✓ Presets other than standard – on request
- ✓ Short delivery time → stock product
- ✓ Powder painted casing
- ✓ Air-condenser with two fans
- ✓ Low noise level
- ✓ Easy installation and configuration on site
- ✓ Space savings → no machinery room necessary
- ✓ Possibility of installation near wall → vertical air-flow
- ✓ Compact dimensions
- ✓ Easy service

Performance data for MM-B



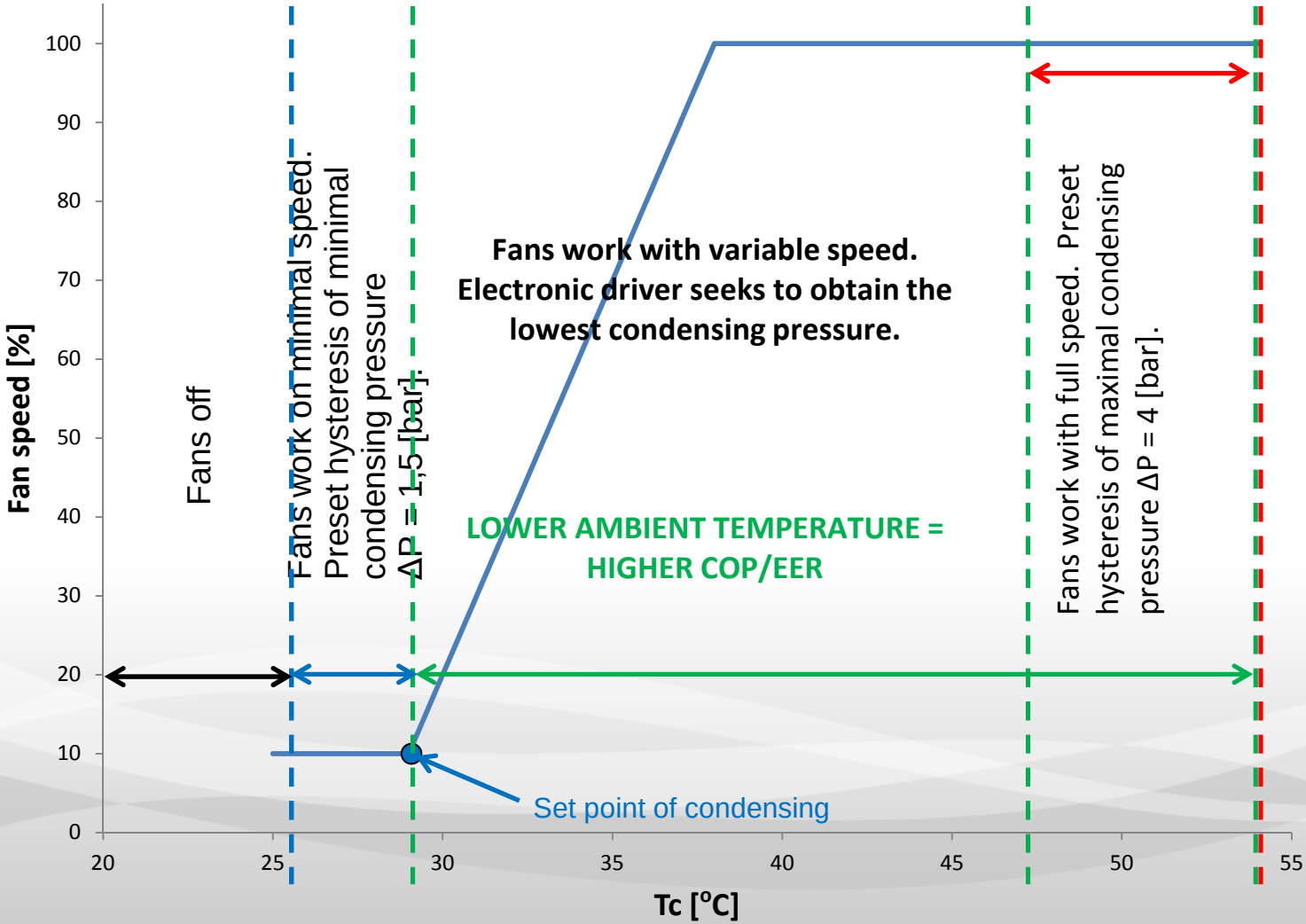
Cooling capacity in kW.
Frequency from 30 to 70Hz.
refrigerant R404a
T_o= -10°C; T_a= +27°C

Performance data for MM-D



Cooling capacity in kW.
Frequency from 20 to 90Hz.
Refrigerant R404a
T_o= -10°C; T_a= +27°C

Controlling – condensing pressure, preset



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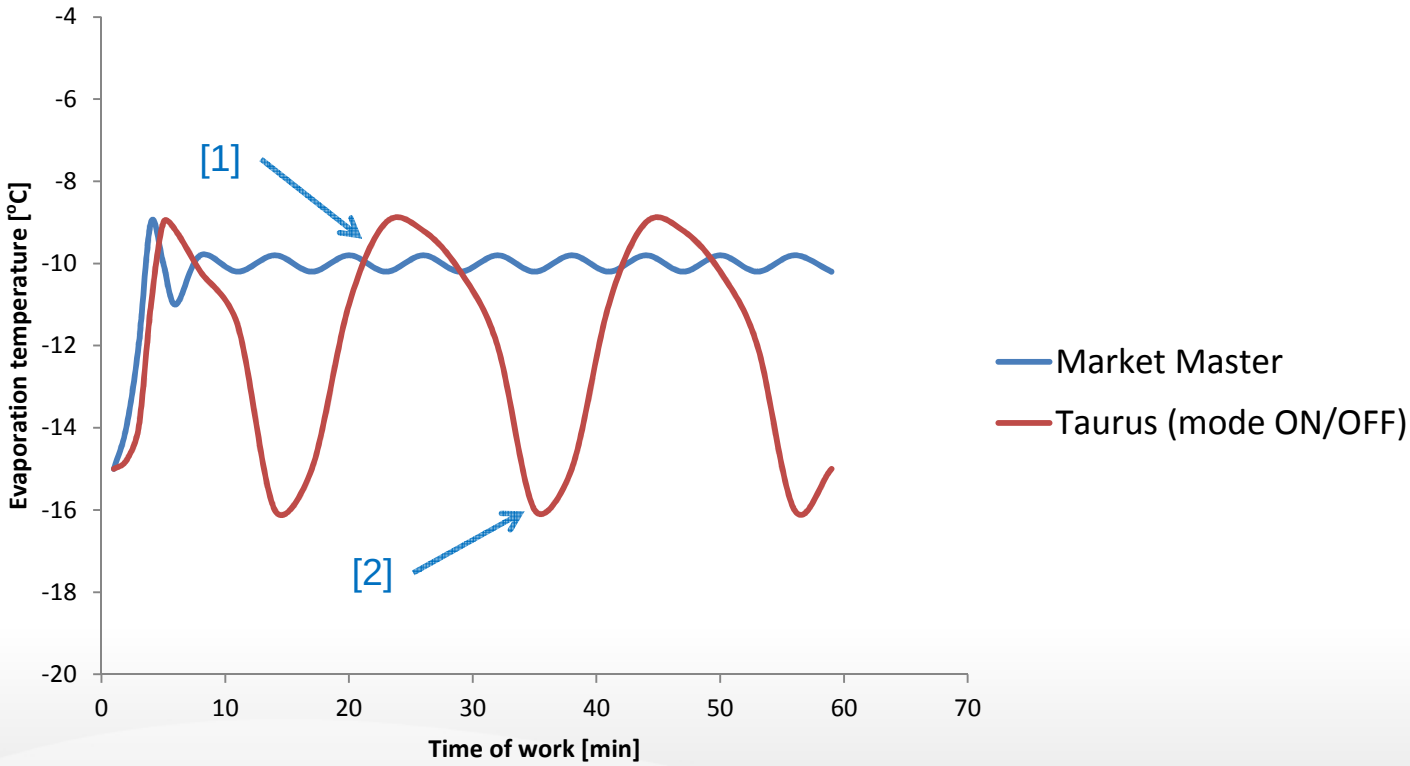
Controlling – precise regulation of suction pressure



1 – compressor on; 2 – compressor off;

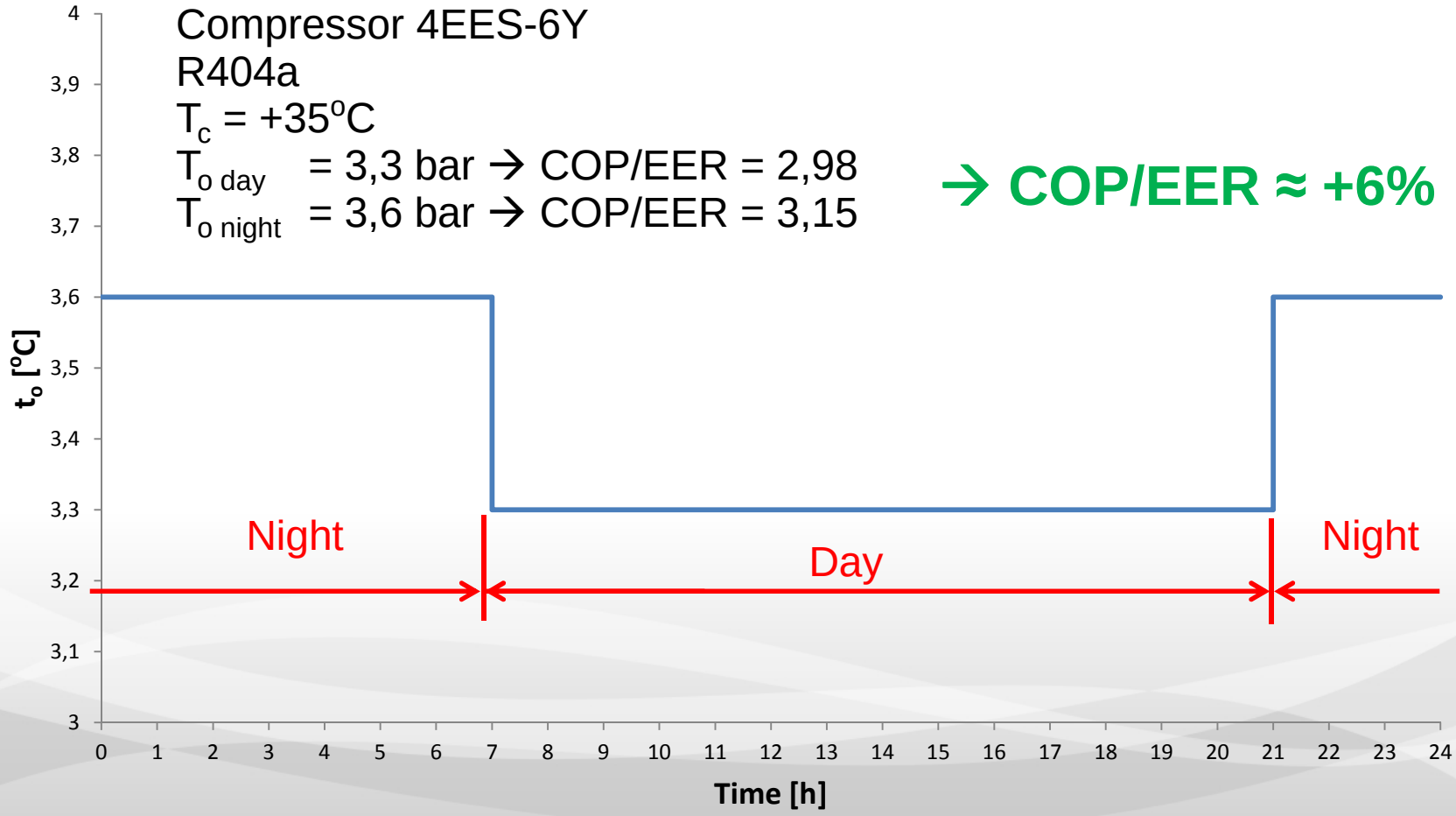
BETTER QUALITY OF STORED PRODUCTS BY:

- **REDUCTION OF EVAPORATION TEMPERATURE FLUCTUATION**
- **REDUCTION OF TEMPERATURE DIFFERENCE BETWEEN COOLED AIR AND EVAPORATOR SURFACE**

Controlling – higher suction pressure at night

Compressor 4EES-6Y
R404a
T_c = +35°C
$T_{o\ day}$ = 3,3 bar → COP/EER = 2,98
$T_{o\ night}$ = 3,6 bar → COP/EER = 3,15

→ COP/EER ≈ +6%



Controlling – presets

Parameter	Medium-temperature application	Low-temperature application
Suction pressure [bar]	3,3	0,7
Hysteresis of compressor switch-off [bar]	1,5	0,2
Condensing pressure [bar]	13,0	
Hysteresis of fans switch-off [bar]	1,5	
Maximal condensing pressure [bar]	24,0	
Hysteresis of maximal condensing pressure [bar]	4,0	
Minimal time of compressor stop [sec]	60	
Mode of work	Silent	
Suction compensation value (pre-defined) in Silent mode [bar]	+0,3	+0,2
Condensing compensation value (predefinde) in Silent mode [bar]	+4,0	
Houres of compensation	21:00-7:00	

Controlling – available options – types of displays

* - Panel HMI and Modbus RTU are interchangeable and cannot be used at the same time

Option	Basic panel – built-in in frequency inverter	Panel HMI*	Modbus RTU*	Modbus TCP
Check of current pressures	x	x	X	x
Change of pressure values	x	x	x	x
Change of PID regulators values	x	x	x	x
Application change (medium-temperature / low-temperature)	x	x	x	x
Change of work mode	x	x	x	x
Change of frequency prohibited values	x	x	x	x
Limit of maximal frequency	x	x	x	x
Edition of compensation parameters		x	x	x
Change of compensation callendar		x	x	x
Change of regulation parameters: • Maximal pressure • Hysteresis • Time of compressor off		x	x	x
Check of alerts		x	x	x
Available languages • Polish • English • German • Russian • Spanish		x	x	x

Controlling – basic panel built-in in frequency inverter

Frequency inverter is equipped with basic panel.

By using F1-F4 keys it is possible to:

- Change condensing and suction pressure values
- Change application range (low- and medium-temperature application)
- Change mode of work (SILENT and EKO)
- Limit maximal compressor working frequency

In standard menu of frequency inverter panel it is also possible to:

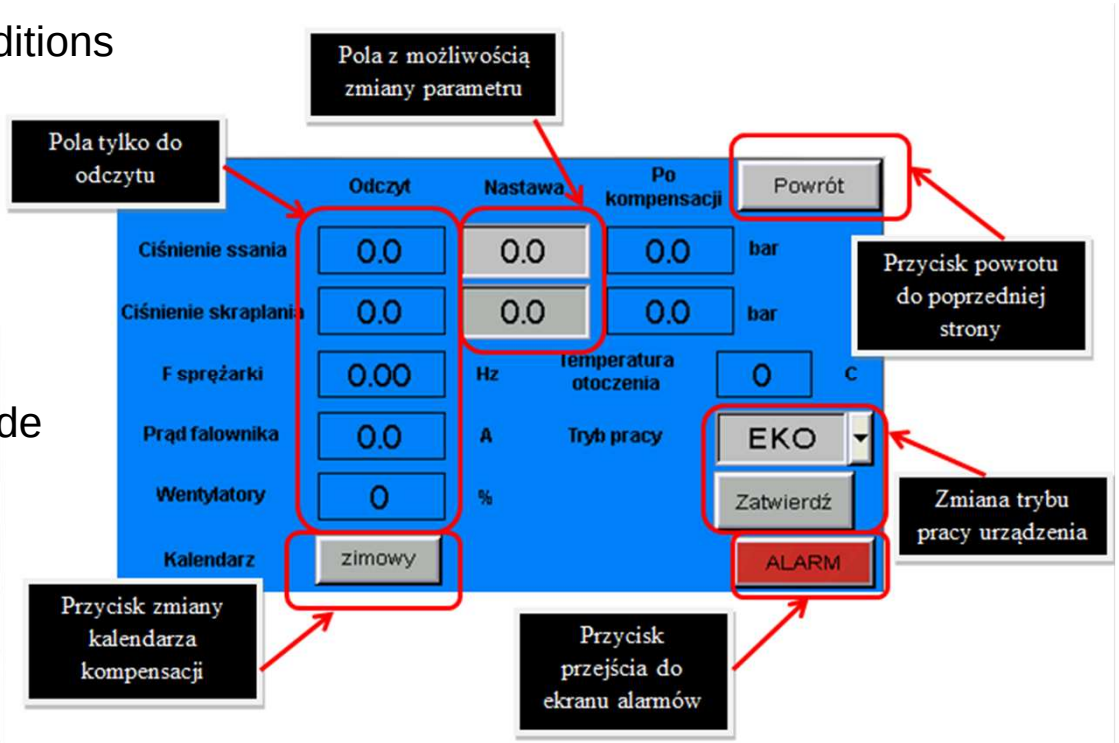
- „cut-off" the resonant frequency
- change of PID regulator values (regarding quality of suction pressure regulation)
- change of PI regulator values (regarding quality of condensing pressure regulation)

Any change is possible only when mode of worke is set to „STOP"

Controlling – optional HMI display, „Operator mode”

In „Operator mode” it is possible to:

- ✓ view alerts
- ✓ view current working conditions
- ✓ change of suction and condensing pressures
- ✓ change of compensation callendar
- ✓ change of application mode (SILENT/EKO)



Controlling – optional HMI display, „Service mode”

„Service mode” is protected by a password

„Service mode” allows to:

- ✓ change parameters of PID and PI regulators – parameters affect the quality of regulation
- ✓ change of min/max values; hysteresis of fans switch-off, max condensing pressure, hyseresis of maximal condensing pressure, minimal time of compressor stop, hysteresis of compressor switch-off
- ✓ set the parameters of electric motor of compressor; rated current, rated voltage, min and max frequency, time of acceleration and slowdown
- ✓ set the forbidden frequency (resonate frequency)
- ✓ change working conditions; low- and medium-temperature application
- ✓ view and delete alerts
- ✓ change parameters of suction and condensing compensation regarding to: external temperature, digital input or calendar. There is posibility to define different compensation values for summer and winter time.

Sound pressure level – catalogue data

Sound pressure level from distance of 10m +/- 2dB – ECO mode without acousting insulation			
MM-D-240	47,3	MM-B-23.1	42,3
MM-D-361	47,0	MM-B-24.1	42,0
MM-D-421	47,9	MM-B-45.1	42,5
MM-D-451	47,9	MM-B-46.1	44,1
MM-D-551	48,5	MM-B-47.1	45,2
MM-D-701	50,3	MM-B-49.1	45,6
MM-D-751	50,5		

Sound pressure level is reduced by about 3 dB in Silent mode

Stepless compressor speed regulation – economic reasons

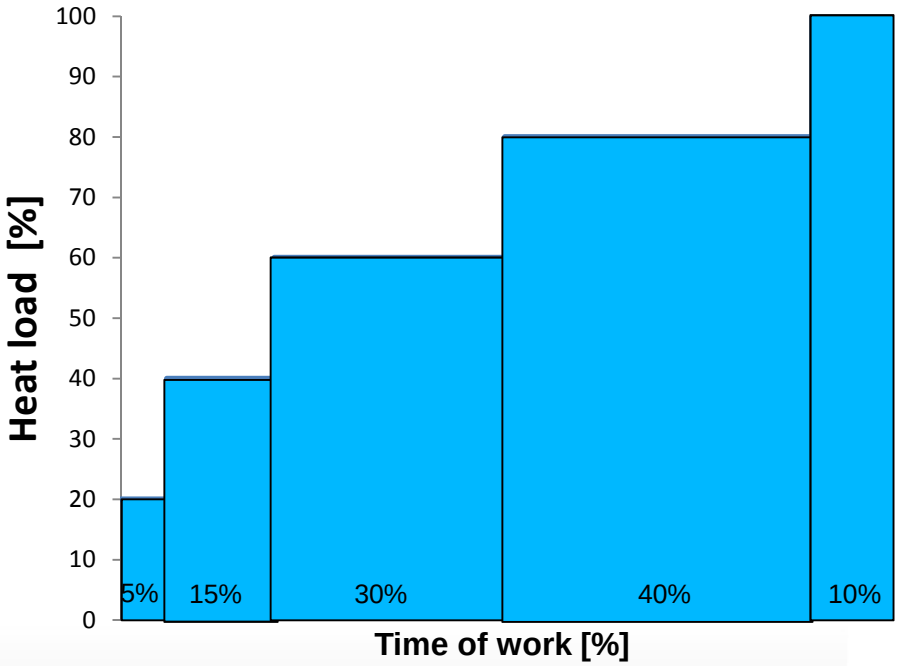
The use of frequency inverter allows to:

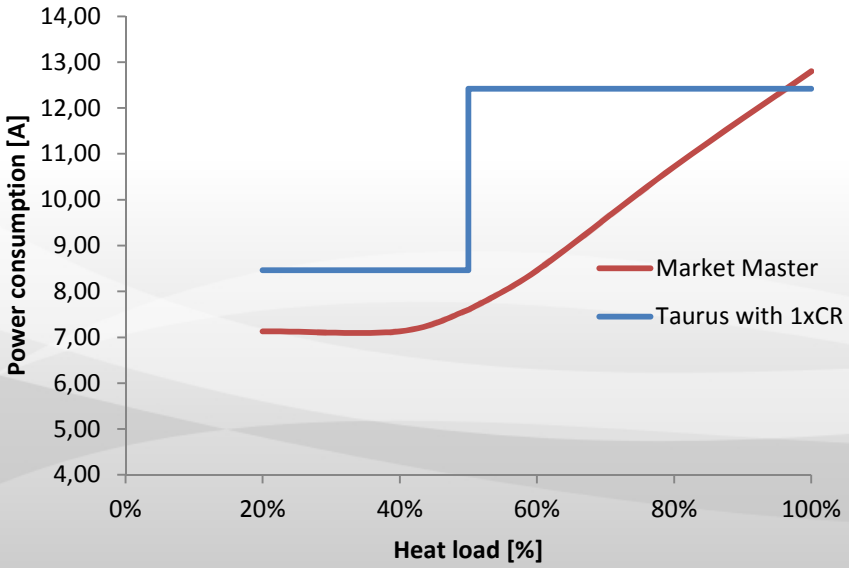
- ✓ reduce number of compressor starts and stops
- ✓ obtain higher average evaporation temperature
- ✓ adapt quickly and precisely to heat load change
- ✓ use „soft start” – smaller electric connection
- ✓ reduce electric and mechanic load
- ✓ lower power consumption by selection of smaller compressor
- ✓ reduce power consumption by compressor when heat load is below maximum; compressor matches performance to current system needs
- ✓ ensure lower condensing pressure when cooling demand is below 100%

Stepless compressor speed regulation – economic reasons

Comparison of Market Master with standard on/off condensing unit

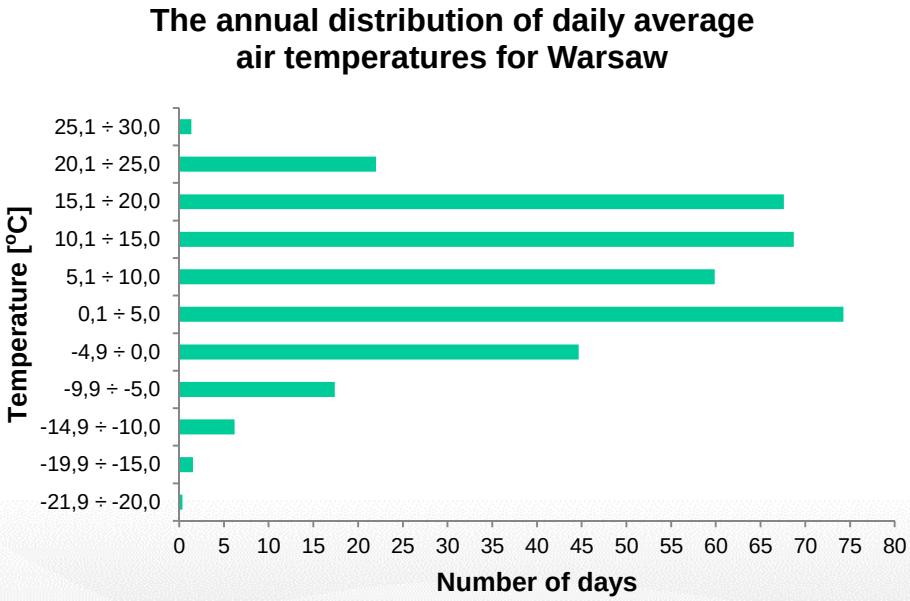
Working conditions:
Multi-evaporators application
Variable load during day and year
Maximum load of 18kW
Market Master 18kW at 70Hz
Taurus 18kW at 50Hz + 1x capacity regulation





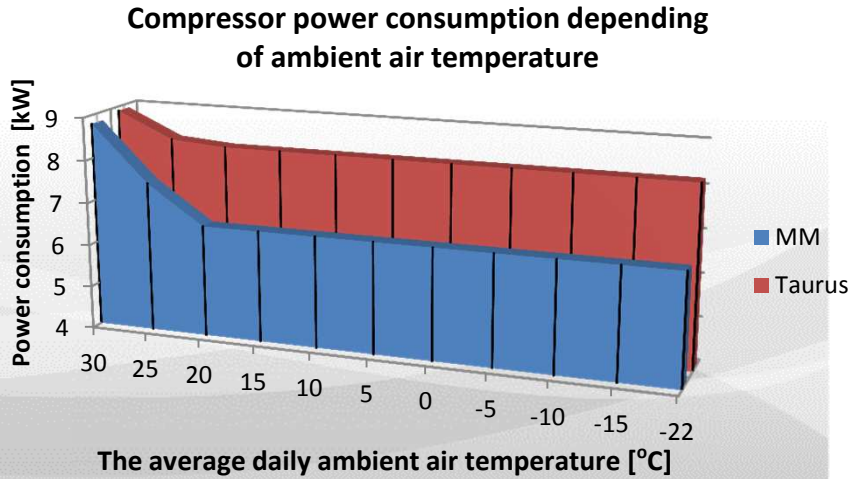
Power savings ≈ 20%

Condensing pressure compensation – economic reasons



The average daily air temperature is below 15˚C for over 6 months.
COP/EER can be increased by using this fact and possibility of condensing pressure compensation.

Market Master vs Taurus
COP/EER higher at least about 25%



Amortization of purchase cost within two years!!!