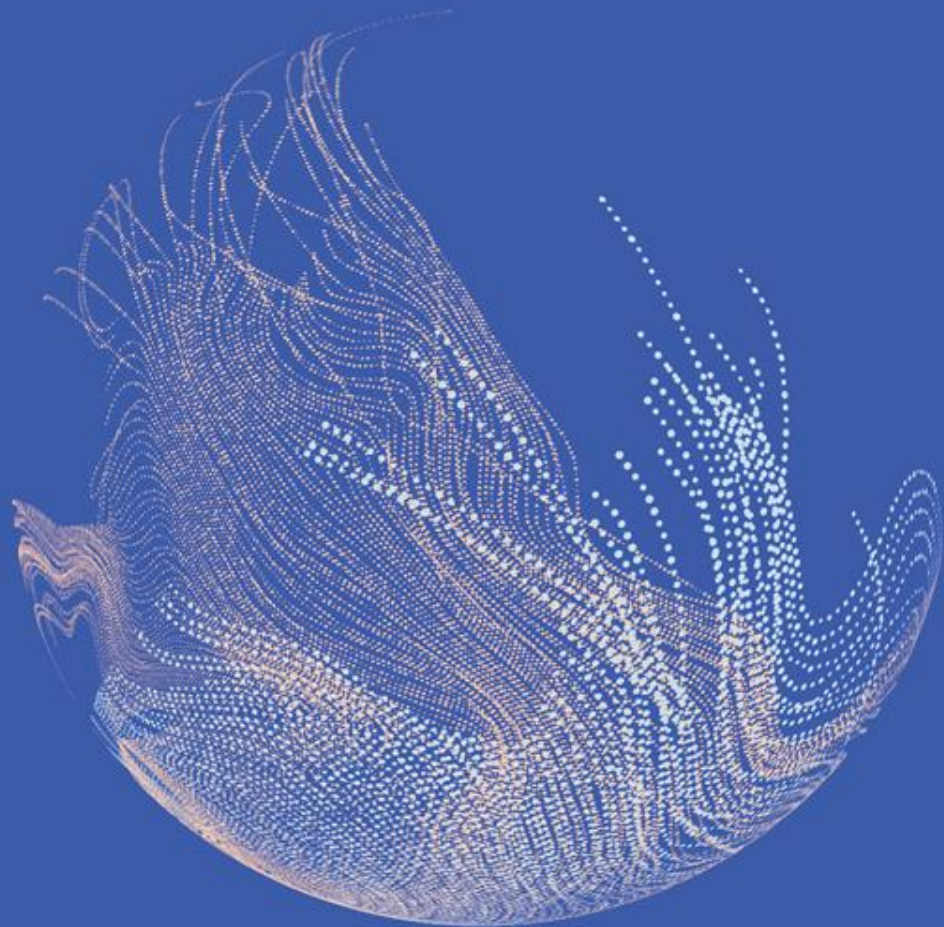




Business Case for
Natural Refrigerants



15-16/11/2022
BRUSSELS



**Energy efficiency in walk-in cold rooms
through R290 inverter compressor technology**

Embraco (Nidec G.A.) | Daikin Europe NV

ing. Marino Bassi | ing. Erik Venturi

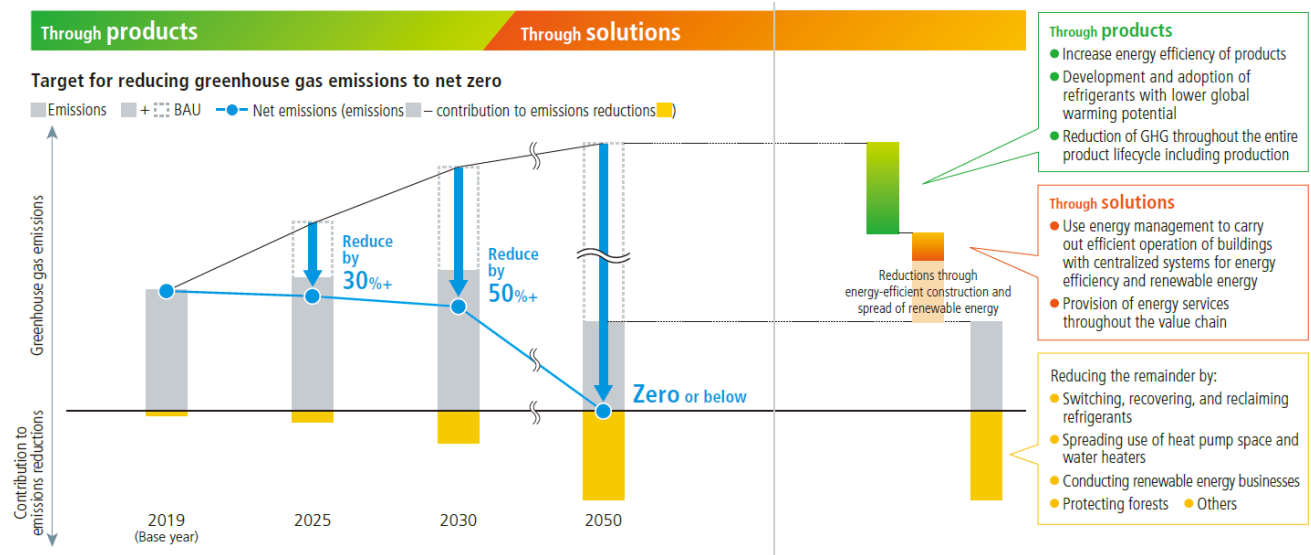
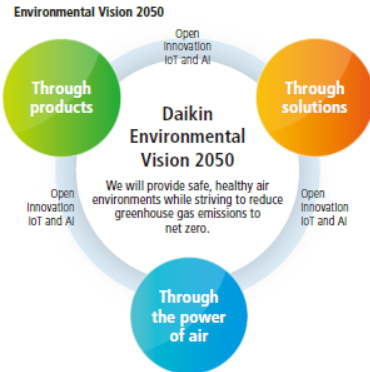
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Megatrend

Toward Net Zero Greenhouse Gas Emissions

In 2018, Daikin established Environmental Vision 2050, a plan that lays the groundwork for the company to reach net zero greenhouse gas emissions by 2050.

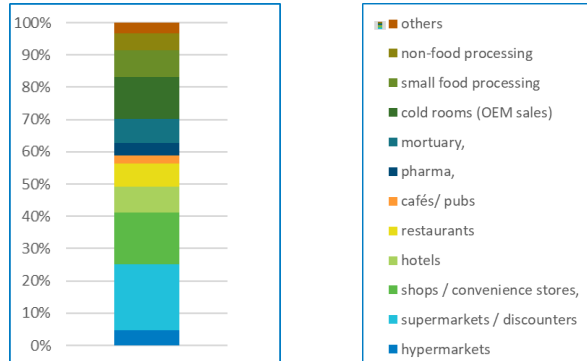


Source:
Daikin Sustainability Report 2022,
Daikin Corporate Page

Packaged refrigerating unit for walk-in cold room

“Monoblock” appeared on the market in the '70s and nowadays it is chosen in a wide variety of appliances such as Ho.Re.Ca., FRC and light industrial.

Despite that, it has only recently been defined as “packaged refrigerating unit” in EN 17432:2021



Technical data of LMSEY product lineup



Daikin's LMSEY series is product lineup of wall mounting R290 packaged refrigerating units for walk-in cold rooms equipped with inverter compressor technology.

Having same dimensions of common HFC units, LMSEY models allow easy refurbishment of existing cold rooms appliances.

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	LMSEY1	LMSEY2
Installation kind	Wall mounting	
N° of circuit	1	2
Cooling capacity [kW] MT (Tc 0°C - Ta 32°C)	1,28	2,45
Cooling capacity [kW] LT (Tc -20°C - Ta 32°C)	0,75	1,41
Operation range	-25/+10 °C	
Outdoor temperature	+5/+45 °C	
Compressor type	Reciprocating with inverter	
N° of compressor	1	2
Compressor	Embraco FMFT415U	
Condensation	Air cooled	
Expansion device	Electronic expansion valve	
Fans	EC Brushless fan motors	
Refrigerant	R290	
Refrigerant amount [kg]	max 0,150 per circuit	
Connection of units	Up to 5, to increase total capacity	
Connectivity	Bluetooth with App, WLAN, Cloud	

Some benefits of Embraco's VCC Compressors



ENERGY
EFFICIENCY



FOOD
FRESHNESS



FAST
COOLING



LOW NOISE &
VIBRATION



WIDE VOLTAGE
RANGE



LOWER
TLCO

Embraco Inverter Control Options

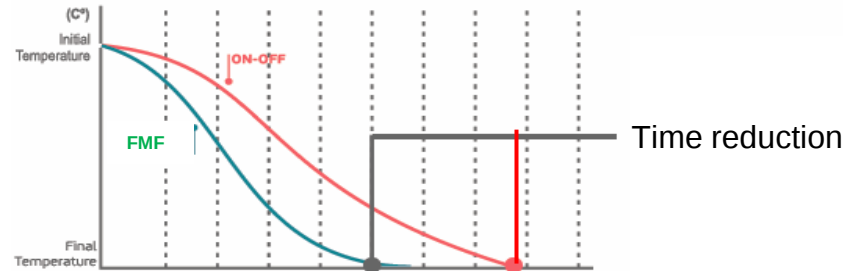
Smart Drop-in (SDI)	Frequency	Serial
• Control logic already embedded in the inverter • Customize the control logic on OEMs own lab or even production • Fast development of new appliances • Few parameters for optimization	• Possible to develop own control logic • Specific control for appliance	• Possible to develop own control logic • Feedback on compressor operation • Two-way communication

Frequency control Benefits

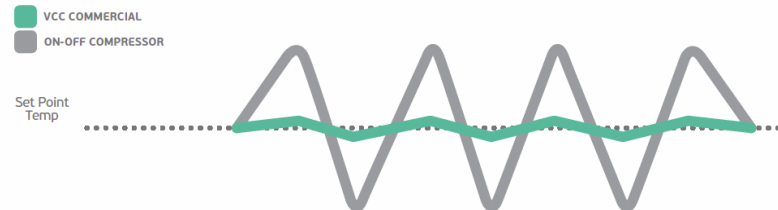
Frequency control allows to develop an own logic, correlating the information received from the temperature sensors connected to the electronic control on the base of the specific needs.

In addition to a fast pull-down and temperature recovery after defrost of the VCC compressors, the frequency inverter allows a fine control over thermal fluctuations reaching an optimize level of food preservation.

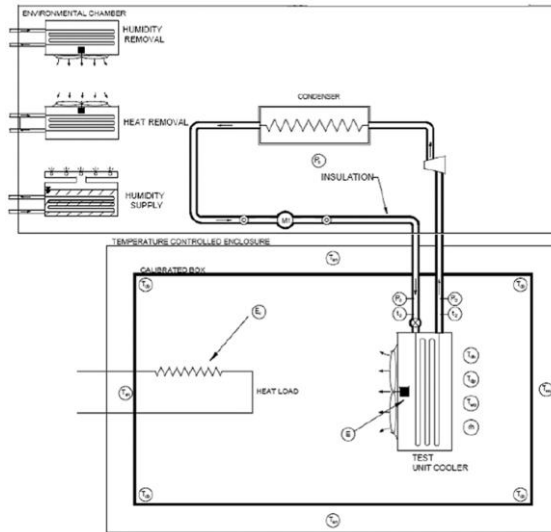
Pull-down



Normal cycling



Differences between tests and real conditions



LT conditions:
Exterior temperature at inlet 32 °C
Interior temperature at inlet -20 °C

MT conditions:
Exterior temperature at inlet 32 °C
Interior temperature at inlet 0 °C

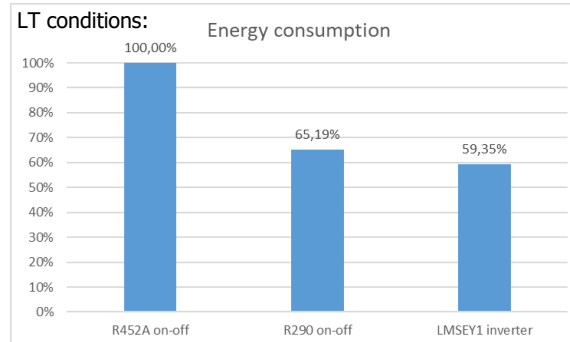
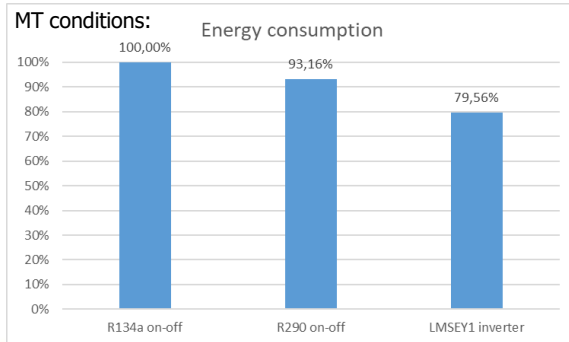
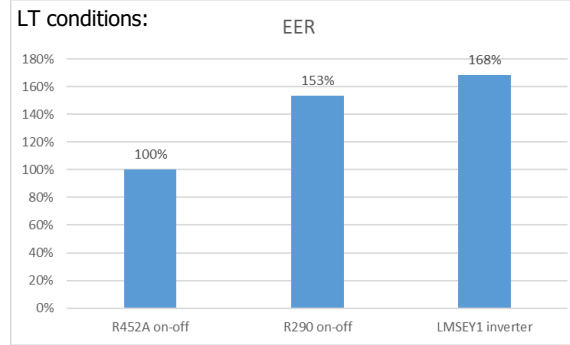
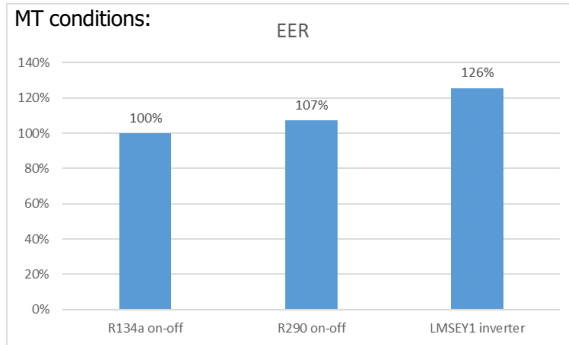
Tests have been performed accordingly to EN 17432:2021, which understate:

- Stationary load condition
- Dry evaporator condition

Consequently, following results are more conservative than real situations, which show conditions such as:

- Door openings of the walk-in cold room
- Food perspiration
- Variable heat load due to foodstuff rotation
- Variable heat load due to outdoor conditions

Performance of the unit compared to similar appliances

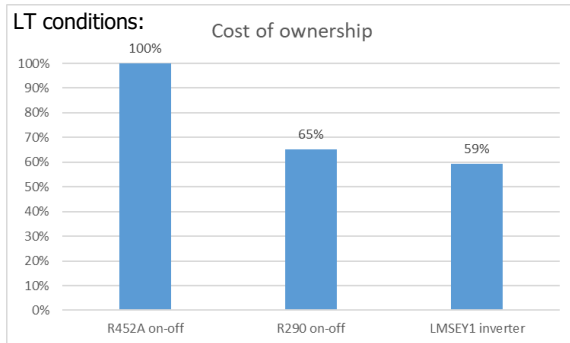
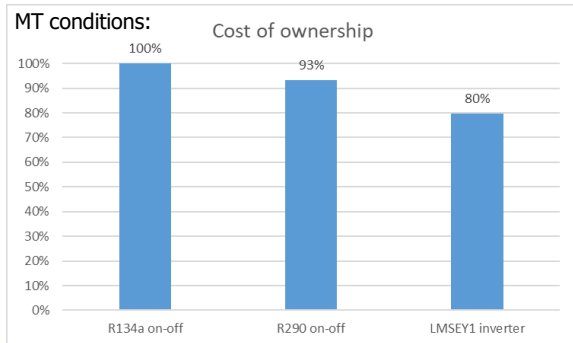
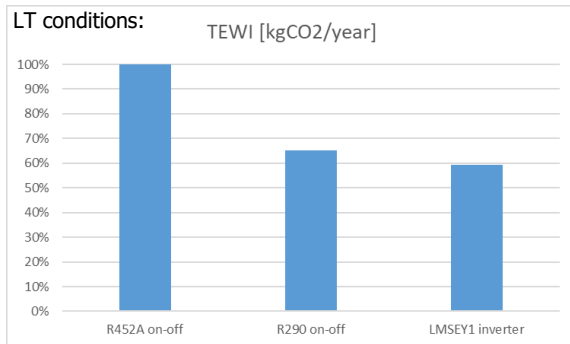
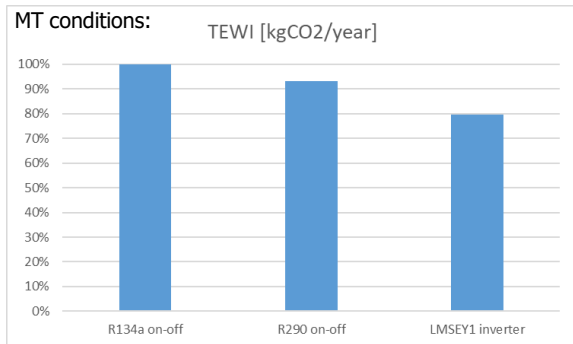


LMSEY1 has been compared, through EN 17432 tests, with similar capacity R134a (MT only), R452a (LT only) and R290 units available on the market and equipped with on-off compressors.

LMSEY1 results show better EER both in MT and LT conditions.

Better EER allowed by inverter technology translates into lower electrical energy consumption.

Performance of the unit compared to similar appliances



Through energy efficiency, LMSEY1 allows to decrease the TEWI on annual baseline.

Assumptions:

Equivalent CO₂ for 1 kWh = 0,229 kgCO₂/kWh

Direct emissions = negligible on all appliances, due to hermetically sealed circuits

The annual cost of ownership also reduce, giving concrete economic benefits to the final users.

Assumptions:

Electricity cost = 185 €/MWh

Conclusion

The case study has shown how:

- Entry-level on-off R290 design guarantees an improvement of efficiency, if compared to HFC appliances; nevertheless, this should be considered the minimum requirement
- Inverter compressor technology guarantees a remarkable improvement of efficiency if compared with on-off appliances
- A quick refurbishment of existing cold room to reduce cost and environmental impact is possible with limited efforts





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