



EUROPE

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19 & 20 April, 2016 – Barcelona



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LINEAR COMPRESSOR TECHNOLOGY FOR
SMALL COMMERCIAL APPLIANCES WITH
NATURAL REFRIGERANTS

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DRIVERS

The global community, as a conclusion of **Paris COP21** meeting in December 2015 and recent **EU F-Gas regulation**, decided very aggressive targets for **reduction of CO2 emissions**

For reduction of indirect emissions , in very short time a new regulation for energy consumption of commercial products (**Eco-design**) will be issued

Embraco for many years has been actively developing and promoting **high efficiency hermetic compressors** for use with hydrocarbons (R600a, R290) for both, household and light commercial plug-in systems, including variable capacity products.

Size and mass reduction, less use of materials and their recycling at the end of life is essential part of Eco-design and WEEE EU regulations.

Embraco Wisemotion combines
the concept of **variable displacement**
with **oil-free solution.**

This combination results in a tremendous
potential for this technology,

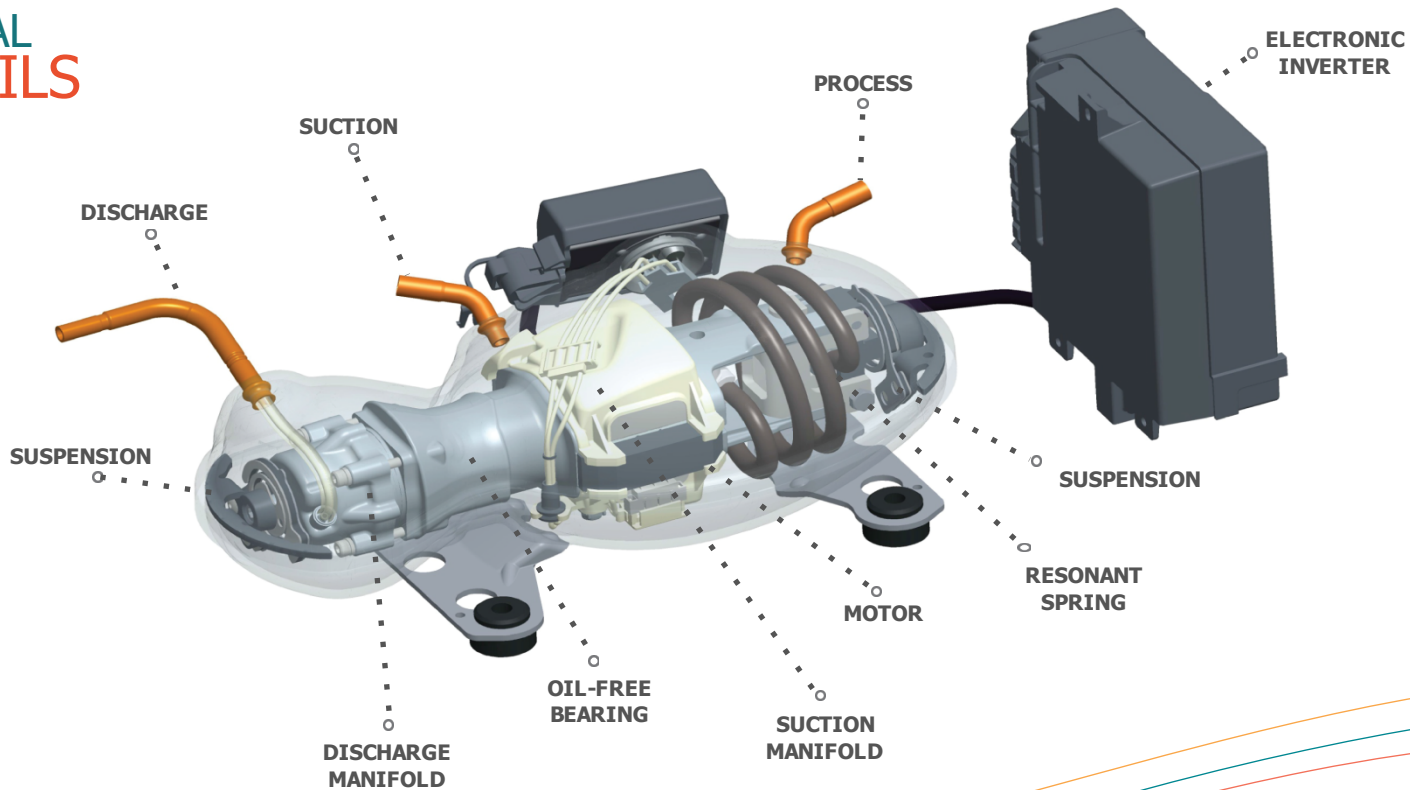
from superior energy efficiency levels
to innovative ways to assemble

the compressor and design the appliance.

WISEMOTION
embraco



TECHNICAL DETAILS





SMALLER SIZE

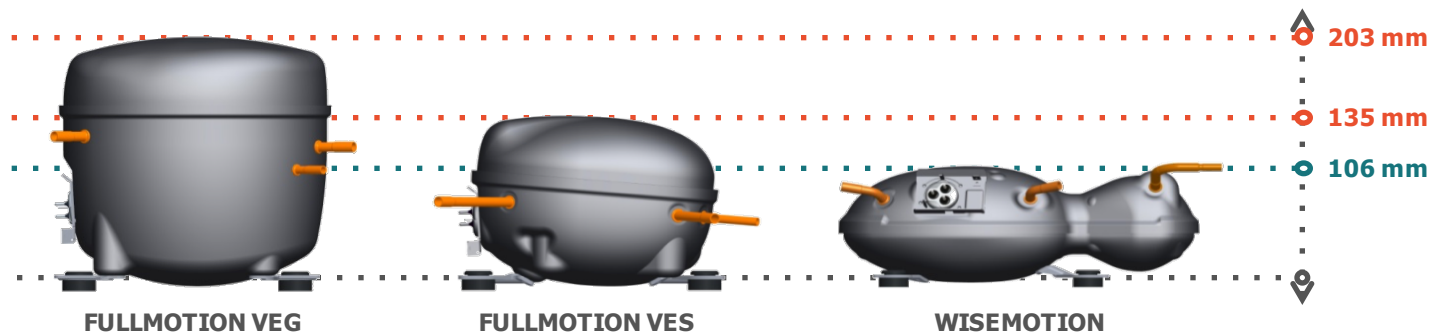


More Internal Cabinet Space

Wisemotion has a potential to save up to 20 liters for internal space vs. traditional reciprocating compressor

How it works

The way that the Wisemotion mechanism and motor were developed enabled a compressor with a smaller height.



WISEMOTION
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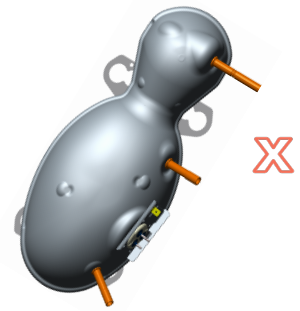
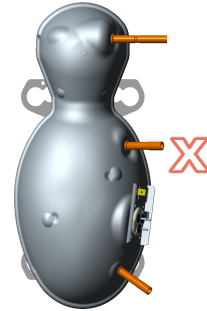
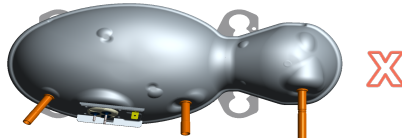
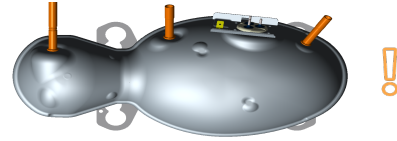


Compressor's mounting orientation

✓ Allowed

Allowed if there is a specific application need. Specific model must be created for each position

✗ Not allowed

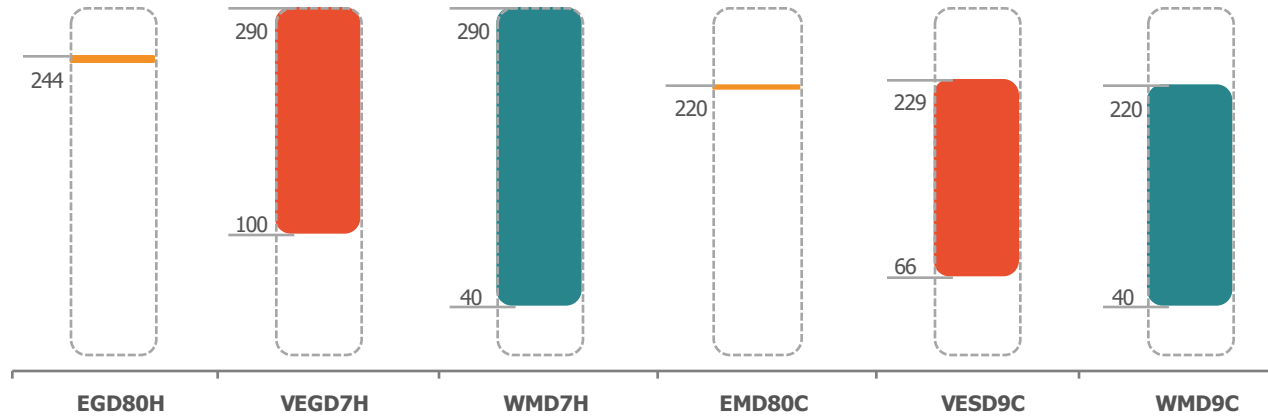


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MINIMUM TEMPERATURE VARIATION

Cooling Capacity (W)



Test conditions: ASHRAE LBP
Evaporating Temperature -23.3°C Condensing Temperature $+54.4^{\circ}\text{C}$
Ambient Temperature $+32.2^{\circ}\text{C}$

 ON-OFF  FULLMOTION  WISEMOTION

WISEMOTION
embraco



PRODUCT LINE

| MODEL | REFRIGERANT | CAPACITY RANGE (W) | BEST EFFICIENCY (W/W)* | INPUT VOLTAGE (V) | CONTROL MODE |
|-------|-------------|--------------------|------------------------|--|------------------|
| WMD9C | R-600a | 40-245 | 2.34 | 115-127V, 50-60Hz 220-240V, 50-60Hz | Frequency signal |
| WMD7H | R-134a | 40-335 | 2.21 | | |



Test conditions: AHAM LBP
-23.3°C Evaporating Temperature
+40.5°C Condensing Temperature
+32.2°C Ambient Temperature

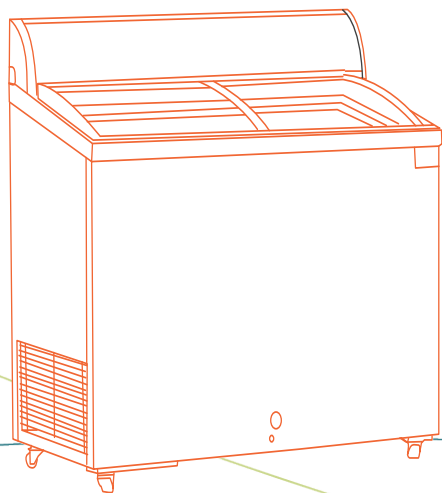
*130W Cooling Capacity

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CASE STUDY



Horizontal Chest Freezer w/Glass
285 liters



Refrigerant/Charge



ON-OFF
EMT1121U

WISEMOTION
WMD7H***

SAVINGS

R290
80gr

R290
80gr

/

Energy Consumption*



1,911
kWh/day

1,624
kWh/day

15%

Annual Energy Cost**



70-210 €

59-178 €

10-31 €

*Energy Consumption at 25°C/60%

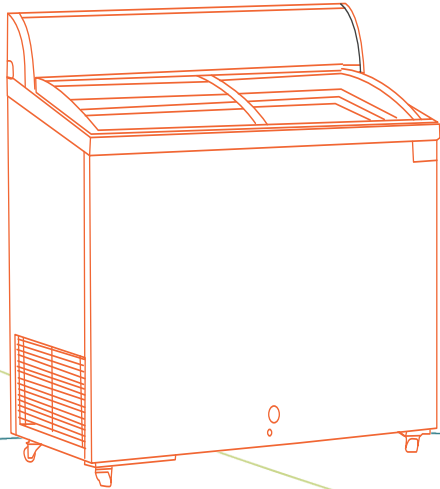
** Energy cost range 0,1 – 0,3 euro/kWh




*** R134a compressor model used with R290

POTENTIAL FOR FUTURE ACTIVITIES



Horizontal Chest Freezer w/Glass
285 liters



| | ON-OFF EMT1121U | OPTIMIZED WISEMOTION | SAVINGS |
|--|--------------------|-------------------------|----------------|
| Refrigerant/Charge  | R290 80gr | R290 TBD | / |
| Energy Consumption*  | 1,911 kWh/day | 1,410 kWh/day | 26% |
| Annual Energy Cost**  | 70-210 € | 51-154 € | 18-55 € |

*Energy Consumption at 25°C/60%

** Energy cost range 0,1 – 0,3 euro/kWh

CONCLUSIONS

Linear technology can become a valid option for small commercial appliances to
lower indirect CO2 emissions (variable capacity)

Wider cooling capacity range will **reduce** cabinet **temperature variations for**
better food preservation

Small external dimensions and oil free technology is an additional feature to be used to
allow **innovative approach to refrigeration system design** (more internal space).

Oil Free Technology – reduces the **end of life** environmental **impact**

Further optimization of compressor design and system controls **is necessary** to
gather all potential benefits of linear oil-free technology for small commercial appliances.



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Thank you very much!