Summary of the development activities in the EU for testing residential air conditioners

European Commission, DG Energy, Veerle Beelaerts

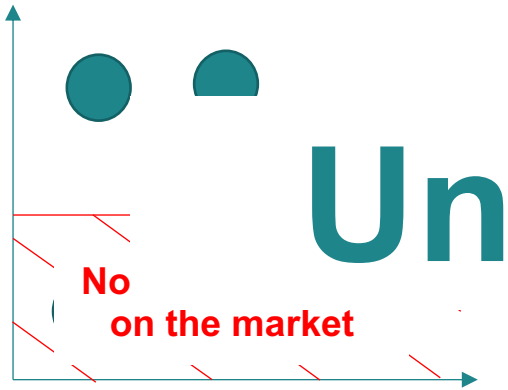
Energy efficiency requirements for residential air conditioners

Residential air conditioners and heat pumps (≤12 kW)

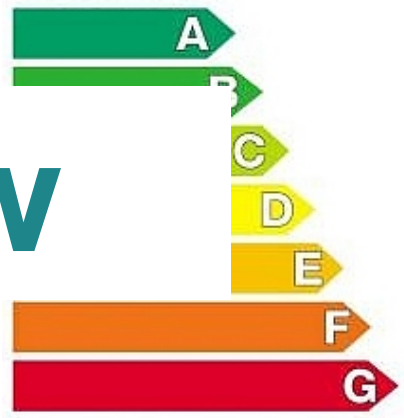
Ecodesign*

Energy labelling**

Energy efficiency



Under review



European Commission

*Regulation (EU) No 206/2012

**Regulation (EU) No 626/2011

Basis for setting requirements – seasonal efficiency (SCOP and SEER)

Tested & rating

EN 14825

- energy efficiency representative of the cooling and heating season (seasonal efficiency, i.e. SEER and SCOP)
- uses same basic principles as standard series ISO 16358 (ISO TC86 SC6)

Concerns with the current testing method (1)

The current test method doesn't require manufacturers to take into account ***thermal comfort***:

- In cooling mode ***45% of the units do not dehumidify*** (data from calculations from an EU manufacturer) -> dehumidification is necessary to ensure thermal comfort
- In heating mode the ***temperature of the air*** that blows out of the heat pump is ***as low as 27°C and commonly lower than 32°***C -> the temperature of the air that blows out of the heat pump (supply air temperature) should not be below 32 °C (temperature of the skin) and probably closer to 40 °C to ensure thermal comfort.

In reality, when thermal comfort is not ensured, the end-user will change the set point. This will increase cooling/heating loads, and will lead to ***lower real life performances***.

Concerns with the current testing method (2)

The current test method:

- requires ***manufacturers to give the settings of the unit*** during test
- ***bypasses the control***
- ***locks the compressor*** during test

This is a ***worldwide practice***

However, the ***performance of units in real life may differ*** from the performances measured in standard test conditions

Looking for solutions – ensuring thermal comfort

- **Heating**: set parameters (e.g. set values for air flow rate) such that the ***temperature blowing*** out of the heat pumps is ***between 32°C and 40°C*** (under discussion)

- **Cooling**: set parameters (e.g. max sensible heat ratio or limitation on the air flow rate) such that the:
  - ***minimum sensible heat ratio is 70% at 35°C ambient temperature, and 95 % at 30°C*** (proposal stakeholder), or alternatively
  - ***minimum sensible heat ratio is 80 % at 35°C ambient temperature***, *and* ***85 % at 30°C*** (US AHRI 1230 VRF)

Looking for solutions – independent test method (1)

2 alternative methods have been proposed by stakeholders:

1) The compensation method

   - Thermal load imposed to the machine, the unit has to maintain the set point, the compressor and outdoor fan are unlocked, real life control
   - Same test conditioners as EN 14825

   => Round robin test is ongoing in cooling mode, for heating more tests might be needed

2) The dynamic method

   - Same test method as the compensation method
   - 21 times steps of 2.5 hours covering the whole load curve and outdoor air conditions

   => Further work is needed

Proposal currently being discussed

Based on the above, a possible way forward that is currently being discussed:

- Tier 1 (1 year after entry into force, tentatively Mid-2023): improve the thermal comfort and set resource efficiency requirements
- Tier 2 (5 years after entry into force, tentatively Mid-2027): mandatory application of an independent method that doesn't fix the compressor and which fulfils the requirements for a method fit for regulatory purposes
- Review (7 years after entry into force, tentatively Mid 2029)

Thank you

European Commission

Improving thermal comfort

HEATING MODE

POSSIBLE SCENARIOS: PRINCIPLES

1. Constant indoor air flow rate, T_{supply} equal to 32 °C at an outdoor air temperature equal to the bivalent temperature (T_{biv});
2. Constant indoor air flow rate, T_{supply} equal to 40 °C at $T_{outdoor}$ equal to T_{biv};
3. Variable air indoor flow rate, T_{supply} equal to 40 °C at $T_{outdoor}$ equal to T_{biv} and T_{supply} equal to 32 °C at $T_{outdoor}$ equal to 12°C (rating point D).
4. *New: Variable air indoor air flow rate in line with water based fan coil intermediate temperature regime (variable water temperature outlet) in EN14825 (40/45 @ -10 °C down to --/28 °C @ 12 °C), calculated here based on water outlet temperature with coil effectiveness of 0.85*

Improving thermal comfort

COOLING MODE

POSSIBLE SCENARIOS: PRINCIPLES

1. Ensure minimum SHR of 70 % in A condition, and 95 % in B condition (Daikin proposal)
2. Ensure minimum SHR of 80 % in A condition, and 85 % in B condition (US AHRI 1230 VRF)