Working document on possible Commission Regulations implementing Directive 2009/125/EC with regard to professional refrigeration products

Brussels, 09.12.2011

PART 3 – WALK-IN COLD ROOMS

Subject matter

This working document pursuant to Directive 2009/125/EC establishes Ecodesign requirements related to walk-in cold rooms. The preparatory study showed that energy in use phase is the only significant environmental aspect which can be addressed through product design. Other Ecodesign parameters referred to in Annex I, Part 1 of Directive 2009/125/EC, are not considered as significant.

Definitions

Walk-in cold rooms are considered as energy related products within the meaning of Article 2 (1) of Directive 2009/125/EC.

For the purpose of this working document the following definition shall apply.

A 'walk-in cold room' is a refrigerated enclosure intended for the storage of chilled and/or frozen foodstuff or other perishable items, accessible via at least one door, and which is large enough to let somebody walk in it.
'Operating temperature' means the target storage temperature which is intended to be maintained within the walk-in cold room
'Medium operating temperature' means any temperature above -2°c, with reference point at +5°c (M1 temperature class)
'Low operating temperature' means any temperature below -2°c, with reference point at -18°c (L1 temperature class)
For the definition of the 'storage volume' or 'internal volume' for the purpose of determining whether a walk-in cold room falls into the scope of the present Regulation, two options are proposed:

- Option 1: "net storage volume containing foodstuff within the load limit", in m^3 and rounded to three decimal places. This would correspond to the shelf base area multiplied by the loading height. The measurement method would be that of EN441 used for professional refrigerated cabinets
- Option 2: "gross storage volume", in m^3 and rounded to three decimal places. This would correspond to the internal dimensions of the cold room, measured from floor to ceiling and from left to right (total height*width*length). The measurement method could be that of EN ISO 10211

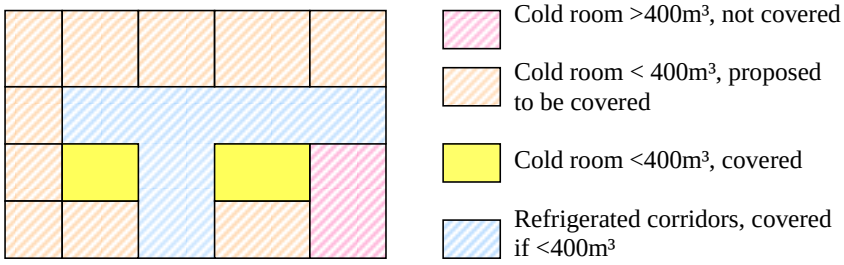
It is intended that the proposed Regulation will cover any walk-in cold room of a storage volume smaller than 400m^3. This includes:

– Walk-in cold rooms which are prefabricated kits
– Customised walk-in cold rooms which are built from separate insulating panels, and assembled and charged with refrigerant in-situ by qualified professionals
– Walk-in cold rooms which are used as corridors, working rooms or areas where food and other stuff is processed
– Walk-in cold rooms operating at medium and low temperatures

Kommentar [LB1]: Need for a precise definition, which should be aligned with ETAG021 definition

In addition, it is intended to include in the scope of the proposed Regulation walk-in cold rooms of less than 400m³ which are leant or standing directly against at least one exterior wall (with no cladding between the refrigerated space and the exterior wall). In this instance, "exterior wall" means a façade wall in direct contact with the outdoor climate. These cold rooms may form part of the building and may have load-bearing walls. Therefore, they may fall into the scope of national Building Codes. This implies a risk of duplication of legal requirements at product and building level. However, the risk of "holey cheese" legislation was considered more serious, as illustrated below. Besides, many national Building Codes do not cover refrigerated buildings.

Figure 1 – example of agro-food facility or warehouse



It is intended to exclude walk-in cold rooms of less than 400m³ from the scope which:
– Are designed and intended exclusively for medical, research or scientific purposes
– Incorporate loading bays designed to provide access to vehicles

Eco-design requirements

Products falling under the definitions of paragraph "Definitions" above shall meet the ecodesign requirements set out in Annex I.

The use phase is the dominating phase in the life cycle of a walk-in cold room. It accounts for 87% of the Gross Energy Requirement (GER) and 65% of the Global Warming Potential (GWP) of a walk-cold room over its lifetime (10 years). 75% of the Total Equivalent Warming Impact (*TEWI*) of a walk-in cold room over its lifetime is due to energy consumption in the use phase and, to a lesser extent, to the incineration of plastics and other materials at end of life. 25% of TEWI is due to direct emissions from refrigerant fluids. The refrigerant charge of walk-in cold rooms is 3kg on average, with annual leakage rate of 9%, and 73% dumped refrigerants at end of life. The total leakage over the product lifetime is therefore 163% of the initial refrigerant charge. This could be reduced through maintenance and end-of-life practices, but these are beyond the scope of the present Regulation. Regarding possible product design requirements to encourage the use of low GWP refrigerants in walk-in cold rooms, a first obstacle is that 55% of walk-in cold rooms are connected to a central

refrigeration plant or remote condensing unit which may serve several refrigeration appliances. Secondly, available technologies such as hydrocarbons have drawbacks such as high flammability. The use of natural refrigerants has not been selected as a possible technical improvement by the preparatory study. Besides, a ban of high GWP refrigerants in walk-in cold rooms would prejudge the outcome of other political debates at EU-level (in particular, F-Gas Regulation).

As regards energy consumption in the use phase, 80 to 90% is due to the electrical consumption of the compressor (~50%) and of the fans located in the evaporator and condenser of the cold room. However, the preparatory study did not manage to propose suitable minimum requirements on the energy efficiency of the walk-in cold room as a whole, mainly because of data unavailability and lack of measurement standards. Energy efficiency of walk-in cold rooms will therefore be (partially) addressed through:

- Minimum thermal insulation requirements proposed under the present Regulation
- Minimum energy efficiency requirements proposed on remote condensing units (Part 5 of the Working Document)

No regulatory requirement on the energy efficiency of monoblock units and central refrigeration systems (e.g. compressor racks) is proposed by the present Working Document.

The following staged approach is proposed.

1) **Tier-1**: January 1, 2014 onwards, walk-in cold rooms falling into the scope of the present Regulation shall comply with minimum thermal insulation requirements as indicated in Annex 1. Corresponding product information requirements are set, as well as generic requirements on air infiltration and installation (merely requiring proper installation of customised cold rooms according to state-of-the-art practices).

2) **Tier-2**: January 1, 2016 onwards, walk-in cold rooms in the scope of the present Regulation shall comply with product information requirements related to the energy consumption of electrical components integrated into the cold room, and to the energy efficiency of the refrigeration unit or system which serves the cold room

3) **Review**: no later than 4 years after entry into force, the present Regulation shall be reviewed by the European Commission, with special attention paid to:

i. Adequacy of the minimum thermal insulation requirements set by the present Regulation, and the possible need for raising the performance thresholds

ii. Appropriateness of introducing minimum energy efficiency requirements for the cold room as a whole, taking into account potential synergies or overlaps between the present Regulation and the Ecodesign Regulation on remote condensing units, as well as regulatory requirements introduced in the meantime in other regions of the world

Kommentar [LB2]: Similar to mandatory requirements applicable in California since 2009

Kommentar [LB3]: So far, proposed installation requirements would only cover the construction of the insulated shell of customised walk-in cold rooms. This is because thermal bridges of prefabricated kits are covered directly by the present Regulation. However, if a future installation standard would also cover the refrigeration part (e.g. installation of the condensing unit in a sufficiently ventilated area; proper sizing of the system in proportion to the cooling load of the insulated "box" etc.), then it would make sense to cover both customised cold rooms and prefabricated kits with this new standard

The estimated saving potential of the proposed insulation requirements is ~24%, leading to 1.8 TWh savings per year in 2020 and 3.2 TWh in 2025 compared to a "freeze" scenario. This saving potential may be underestimated since it ignores the impact of proposed generic requirements.

Typical U values associated with various thicknesses

Thickness	Min U value	Max U value
60	0.30	0.40
80	0.25	0.28
100	0.20	0.24
120	0.15	0.20

Form of the Implementing measure

It is intended to propose a directly applicable Implementing Regulation under Directive 2009/125/EC. The proposed Regulation is not expected to have a particular impact on the EU acquis.

Measurement methods

- As regards the method for measuring the U, ψ and χ values of walk-in cold rooms which are prefabricated kits, the Commission intends to publish the references of ETAG021 in the Official Journal, C series, once it is updated and translated into an EN standard for the purpose of the present Regulation
- As regards the method for measuring the U values of customised walk-in cold rooms, the Commission intends to publish the references of ETAG016 and EN14509 in the Official Journal, C series, once these are updated and translated into EN standards for the purpose of the present Regulation
- As regards presumption of conformity with generic requirements on proper installation of customised walk-in cold rooms, the Commission intends to mandate a new harmonised standard for the purpose of the present Regulation. The French standard DTU45-1 covers the construction of the insulated envelope of the cold room and may serve as a basis.
- As regards the method for measuring the energy consumption of electrical components integrated into the insulated envelope of the walk-in cold room such as anti-sweat heaters, the Commission intends to mandate a new harmonised standard
- As regards the method for measuring the cooling capacity, power input and coefficient of performance (COP) of the refrigeration unit or system serving the walk-in cold room, the Commission intends to mandate a new harmonised standard. EN13215/ EN13771 (remote condensing units) and PAS 57:2003 (refrigeration systems) may serve as a basis

The mandate(s) to European Standardisation Organisations will notably include:

- A request to cover ψ and χ values and U of the floor in walk-in cold rooms which are prefabricated kits (definition, measurement and declaration); this should basically consist in an update of ETAG021 (and its translation into an EN standard). As regards ψ and χ values, it is proposed that EN ISO 10211 serves as a basis. Therefore, calculations base on internal dimensions of the walk-in cold room.
- A request to cover the U of doors, floor and windows in customised walk-in cold rooms (definition, measurement and declaration); this should basically consist in an update of EN14509 and ETAG016
- A request to cover the cooling capacity, power input and COP of refrigeration units or systems serving walk-in cold rooms (definition, measurement and declaration), on the basis of PAS 57:2003 and EN13215
- A request to cover the energy consumption of electrical components integrated into the insulated envelope of the walk-in cold room

Conformity Assessment

A conformity assessment shall be carried out according to Chapter 8 of Directive 2009/125/EC, Annex IV (Internal design control) or Annex V (Management system for assessing conformity).

Market surveillance

When performing the market surveillance checks referred to in Directive 2009/125/EC, Chapter 3 (2), Member State authorities shall apply the verification procedure set out in Annex IV of this working document.

Kommentar [LB4]: The verification procedure is the most usual one under the Ecodesign Directive. However, given the size and price of a typical WICR, some adaptation may have to be considered by the Members of the Consultation Forum

Benchmarks

No Ecodesign benchmarks are proposed for walk-in cold rooms.

Review

A review of the proposed requirements shall be presented to the Consultation Forum depending on technological progress and not later than 5 years after its entry into force.

Annex I: Ecodesign requirements

a) Generic requirements

January 1, 2014 onwards, walk-in cold rooms falling into the scope of the present Regulation shall be designed to reduce ingress of ambient air into the internal storage space through door(s) or any other opening meant to let somebody walk in the cold room.

January 1, 2014 onwards, the construction of the insulated envelope of customised walk-in cold rooms falling into the scope of the present Regulation shall be subject to proper installation according to generally recognised state of the art practices.

b) Specific requirements - Minimum thermal insulation requirements applicable to the insulated envelope of walk-in cold rooms

January 1, 2014 onwards, walk-in cold rooms falling into the scope of the present Regulation shall meet the following minimum thermal insulation requirements

Maximum U values allowed for placing on the market		
	Medium storage temperature	Low storage temperature
Walls and ceiling	0.35	0.20
Floor	0.55	0.40
Doors	1.0	0.7
Windows and fully transparent or translucent doors	1.1	1.1

January 1, 2014 onwards, walk-in cold rooms falling into the scope of the present Regulation and which are prefabricated kits shall meet the following minimum thermal insulation requirements:

Maximum ψ values allowed for placing on the market	
Wall-to-wall linear thermal bridges	0.6
Wall-to-floor linear thermal bridges	0.6
Wall-to-ceiling linear thermal bridges	0.6
Wall-to-door linear thermal bridges	0.7

In addition, January 1, 2014 onwards, walk-in cold rooms falling into the scope of the present Regulation and which are prefabricated kits shall not include punctual thermal bridges with a χ value higher than 0.3

c) Product information requirements

January 1, 2014 onwards, the following parameters shall be reported in the product documentation accompanying walk-in cold rooms falling into the scope of the present Regulation:

- Intended storage temperature(s), expressed in °c

- Storage volume, expressed in m^3 and rounded to three decimal places
- U values of walls, floor, ceiling, door(s) and window(s), expressed in $W/m^2.K$ and rounded to three decimal places
- (for prefabricated kits only), ψ value of all linear thermal bridges, expressed W/m.K and rounded to three decimal places
- (for prefabricated kits only), χ value of any punctual thermal bridge, expressed in W/K and rounded to three decimal places
- the selected method for reducing ingress of ambient air into the internal storage space

January 1, 2016 onwards, the following parameters shall be reported in the product documentation accompanying walk-in cold rooms falling into the scope of the present Regulation:

- the energy consumption of electrical components integrated into the insulated envelope of the cold room, expressed in kWh/ day and rounded to two decimal places
- the cooling capacity and power input of the refrigeration unit or system serving the cold room, expressed in kW and rounded to two decimal places
- the coefficient of performance (COP) of the refrigeration unit or system serving the cold room, rounded to two decimal places

Annex II: Calculation methods

DEFINITION OF TECHNICAL PARAMETERS

U is defined as the thermal transmittance coefficient of a given surface such as a wall or floor, expressed in W/m².K and rounded to three decimal places

COP is the coefficient of performance of a given refrigeration unit or system, at full load and at ambient temperature +32°c, rounded to two decimal places

$$COP = \frac{P}{D}$$

Where

- P is the cooling capacity, expressed in kW and rounded to two decimal places
- D is the power input, expressed in kW and rounded to two decimal places

CALCULATION OF Ψ AND χ VALUES

Ψ is the linear thermal bridge between two surfaces of a cold room, expressed in W/m.K and rounded to three decimal places

$$\psi = \frac{\phi t}{\Delta T} - \sum_{i=1}^{n} Ui \cdot Li$$

Where

ϕt is the total flow through the walk-in cold room, expressed in W/m and rounded to two decimal places

ΔT is the temperature gap between the inside and the outside of the walk-in cold room, expressed in K and rounded to one decimal place

Ui is the thermal transmittance coefficient of surface i (neighbouring surfaces), expressed in W/m².K and rounded to two decimal places

Li is the internal length which Ui is applicable to, expressed in meters and rounded to two decimal placesμ

χ is the punctual thermal bridge due to the insertion of a valve within a given surface, expressed in W/K and rounded to three decimal places

$$\chi = \frac{\phi t - \phi c}{\Delta T}$$

Where

ϕt is the total flow through the walk-in cold room, expressed in W/m and rounded to two decimal places

ϕc is the total flow through the walk-in cold room without the punctual thermal bridge, expressed in W and rounded to two decimal places

ΔT is the temperature gap between the inside and the outside of the walk-in cold room, expressed in K and rounded to one decimal place

Annex III: Measurement methods

Kommentar [LB5]: The conditions how to use “representative” models could be detailed in this Annex

For the purpose of compliance with the requirements of this Regulation, measurements shall be made using a reliable, accurate and reproducible measurement procedure, which takes into account the generally recognised state of the art measurement methods, including methods set out in documents the reference numbers of which have been published for that purpose in the Official Journal of the European Union.

Annex IV: Verification procedure for market surveillance purposes

For the purposes of checking conformity with the requirements laid down in Annex I, Member State authorities shall test a single walk-in cold room. If the measured parameters do not meet the values declared by the supplier within the ranges set out in Table 1, the measurements shall be carried out on three more walk-in cold rooms. The arithmetic mean of the measured values of these three wlak-in cold rooms shall meet the values declared by the manufacturer within the range defined in Table 1.

Kommentar [LB6]: This is the usual verification procedure, but given the size (and price) of most walk-in cold rooms, some adaptation may have to be considered by the Members of the Consultation Forum

Otherwise, the model and all other equivalent walk-in cold room models shall be considered not to comply with the requirements laid down in Annex I (Ecodesign requirements).

Member States authorities shall use reliable, accurate and reproducible measurement procedures, which take into account the generally recognised state-of-the-art measurement methods, including methods set out in documents the reference numbers of which have been published for that purpose in the Official Journal of the European Union.

Table 1.

Measured parameter	Verification tolerances
Storage volume	The measured value shall not be lower than the declared value by more than 5 %.
U of all relevant surfaces	The measured value shall not be greater than the declared value of *U* by more than 5 % and shall not exceed the maximum *U* allowed in Annex 1 by 5%
ψ of all linear thermal bridges	The measured value shall not be greater than the declared value ψ of by more than 5 % and shall not exceed the maximum ψ allowed in Annex 1 by 5%
χ of all punctual thermal bridges	The measured value shall not be greater than the declared value of χ by more than 5 % and shall not exceed the maximum χ allowed in Annex 1 by 5%
Cooling capacity of the refrigeration unit or system	The measured value shall not be lower than the declared value by more than 5 %.
Power input of the refrigeration unit or system	The measured value shall not be greater than the declared value by more than 5 %.
Energy consumption of electrical components integrated into the insulated envelope	The measured value shall not be greater than the declared value by more than 5 %.