Annex 2

Working document on possible ecodesign and energy labelling requirements for room air conditioning appliances, local air coolers and comfort fans

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Subject matter

Under Directive 2005/32/EC ecodesign requirements should be set by the Commission for energy-using products representing significant volumes of sales and trade, having significant environmental impact and presenting significant potential for improvement in terms of their environmental impact without entailing excessive costs.

Article 16(2), first indent, of Directive 2005/32/EC provides that in accordance with the procedure referred to in Article 19(3) and the criteria set out in Article 15(2), and after consulting the Ecodesign Consultation Forum, the Commission shall, as appropriate, introduce an implementing measure for domestic appliances, including room air-conditioning appliances, local air coolers, comfort fans and domestic ventilation appliances, including kitchen hoods. These appliances are considered as EuPs within the meaning of Article 2.1 of Directive 2005/32/EC and as household appliances within the meaning of Article 1 of Directive 92/75/EEC.

The Commission has carried out a preparatory study to analyse the technical, environmental and economic aspects of room air-conditioning appliances, local air coolers, comfort fans and domestic ventilation appliances, including kitchen hoods. The study has been developed together with stakeholders and interested parties from the Community and third countries, and the results have been made publicly available.

This working document pursuant to 2005/32/EC and 92/75/EEC Directives **establishes ecodesign and energy labelling requirements related to room air conditioning appliances, local air coolers and comfort fans** based on Lot 10 Ecodesign preparatory study. The Lot 10 preparatory study shows that energy in use phase and carbon emissions (including standby energy consumption), noise and possible refrigerant leakages, are the main significant environmental aspects. Ecodesign parameters referred to in Annex I, Part 1 of Directive 2005/32/EC, are not considered as significant. The main potential environmental impact from the use of refrigerants is due to possible refrigerant leakages and losses at the end of the product life, if the refrigerant is not recovered. As this issue is covered by the WEEE directive and by the EC Regulation 842/2006 on fluorinated gases, ecodesign requirements on refrigerants are only set in form of information requirements on equivalent carbon emissions in order to facilitate the avoidance of possible leakages.

Domestic ventilation appliances, including kitchen hoods, have particular characteristics and are therefore exempted from this Working Document. However, considering that they offer similar functionalities as room air-conditioning appliances, local air coolers and comfort fans, they should be addressed as soon as possible in another implementing measure of Directive 2005/32/EC.

The preparatory study shows that requirements regarding other ecodesign parameters referred to in Annex I, Part 1, of Directive 2005/32/EC are not necessary as electricity consumptions of room air-conditioning appliances, local air coolers and comfort fans in the use phase are by far the most important environmental aspect.

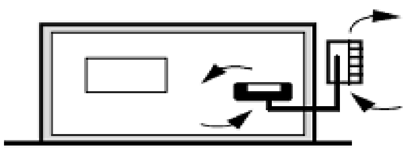
Products definition (scope)

The scope of this document includes room air conditioning appliances, local air coolers and comfort fans. For the purposes of this working document definitions shall apply as defined below and in Annex I ('Definitions'). Domestic ventilation appliances, including kitchen hoods, will be addressed in another Commission Staff Working Document to the Consultation Forum.

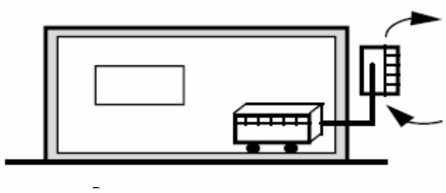
A ***room air conditioner*** (RAC) is a multiple package, air cooling and/or heating device designed to perform its *primary function* for a single space (‘*room*’), using the thermal capacity of ambient heat (usually outdoor air) and an electric compressor driven vapour compression refrigeration cycle to generate cooling output and/or - if the refrigeration cycle is reversed - heating output. A RAC consists of at least one separate outdoor unit and one (‘*split*’) or more (‘*multi-split*’) separate indoor unit(s), to be connected through refrigerant lines. In case the reversed refrigeration cycle is used for air heating the product is referred to as ‘*reversible’* or as a *‘reversible heat pump’*.

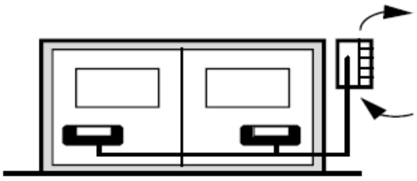
Room air conditioners are illustrated below based on the preparatory study (www.ecoaircon.eu) as follows:

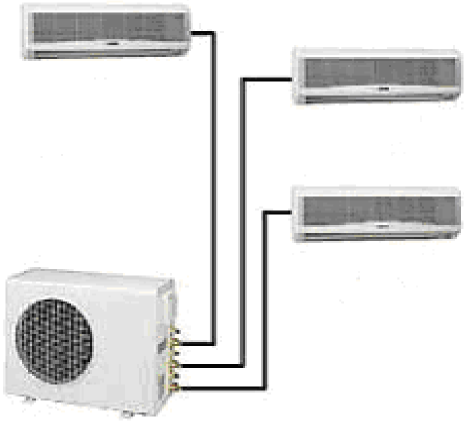
Split-unit with fixed outdoor and indoor unit, wall or ceiling hung; not ducted:



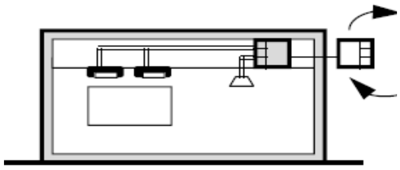
Split-unit with fixed outdoor and mobile indoor unit; not ducted:

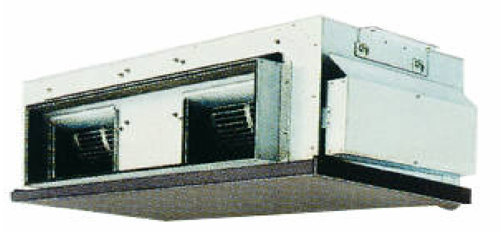






Multi split, ducted:



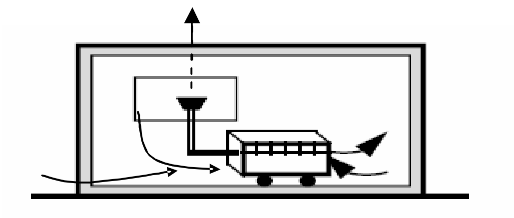


A ***local air cooler*** (LAC) is a single-package air cooling device designed to perform its *primary function* of air cooling for a limited area inside a room, using the thermal capacity of ambient heat (usually outdoor air) and an electric compressor driven vapour compression refrigeration cycle to generate cooling output and/or evaporative cooling. Its designated position is indoors and it is equipped with - at least - a single duct outdoors for condenser outlet air. A defining characteristic of a local air cooler is its usage of a temporary and/or additional nature and its ability to be easily transported (portable).

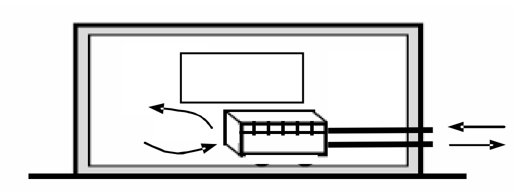
For the purpose of this measure, *all single package units*, also the ones with double duct (local air cooler including a condenser inlet air duct) and the packages like window and through-the-wall units where condenser and evaporator are factory mounted on a single common frame, shall be classified as local air coolers.

In case the local air cooler contains also a heating function it will be considered not in line with its defining characteristic and will be subject to measures relating to RACs. Local air coolers are illustrated below based on the preparatory study (www.ecoaircon.org) as follows:

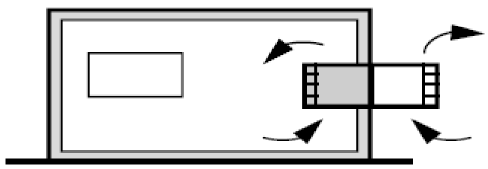
Single duct, integrated indoor unit with (flexible) condenser air outlet duct:



Other single package units (rare in the EU) for the purpose of the regulation considered, as local air coolers, if they feature a cooling mode only:



Double duct, single package indoor unit with ducts for condenser air outlet and inlet (rare in the EU)



Through-the-wall or ***window units***, single package (rare in the EU)

A c***omfort fan*** is an air-moving device intended to locally increase the flow rate of ambient air aiming to increase the personal cooling comfort of persons located within its range. Three types of comfort fans are distinguished: tower fans, ceiling fans and other comfort fans.

Tower fan is a fan or fan-assembly with a vertical, rectangular air-outlet with a height/depth ratio of 2 or more. Ceiling fan is a fan or fan-assembly with a designated position on the ceiling. Following definitions apply:

- Table fan means a propeller bladed appliance intended for a free inlet and a free outlet of air that can be put on a table or bracket mounted for wall or ceiling mounting;
- Box fan means a propeller bladed appliance with a parallel exterior envelope of air that can be put on a table or on any other horizontal surface;
- Pedestal fan means a propeller bladed appliance intended for a free inlet and a free outlet of air that is mounted on a pedestal of fixed or variable height;
- Ceiling fan means a propeller bladed appliance that is provided with a device for suspension from the ceiling of a room so that the blades rotate in an horizontal plane;
- Tower fan means a tangential (or cross flow) appliance that can be put on a table or bracket mounted for wall or ceiling mounting.

Comfort fans are illustrated below based on the preparatory study (www.ecoaircon.eu) as follows:

Tower fan:

Ceiling fan:

Other fans *(table fan, pedestal fan, floor-standing, boxed fan, etc.):*

The following *products* are ***excluded from the scope***:

appliances that can also use non-electric energy sources;

air-to-water and water-to-water heat pump and air-conditioning appliances;

water-to-air heat pump and air-conditioning appliances, except where water is an intermediate heat transfer medium in an otherwise air-to-air appliance;

RACs with a nominal cooling output power greater than 12 kW or smaller than 0,75 kW, if the RAC performs a cooling function or a nominal heating output power greater than 12 kW, or smaller than 0,75 if the unit performs only a heating function;

LACs with a maximum (nameplate) electric power input greater than 2,2 kW or smaller than 250 W. LACs that fail this criterion but feature a nominal cooling output power smaller than 12 kW will be treated as RACs;

Comfort fans consuming an electric power input greater than 125 W, when operating with ventilation function only and at maximum capacity;

Ventilation fans, i.e. fans for (ducted) air transport especially during the heating season between an indoor space and outdoors and/or between one indoor space and another, and with the aim to bring and maintain the indoor air quality at a desired level[1].

The following *functionality* is explicitly not regulated within the scope of the underlying measure (but may be subject to other current or future regulations):

1 These fans will be regulated under the domestic ventilation measures currently under preparation.

air treatment such as filtration, ionisation, purification, humidification and dehumidification or any other treatment that is intended to actively change the composition of the air[2];

ventilation, both comfort ventilation (re-circulation of ambient air) in the cooling season and domestic ventilation (replacing indoor air by fresh outdoor air) in the heating season, except where the 'ventilation only' mode of the appliance features an electric power consumption lower than 125 W[3];

air heating not based on a reversed (Carnot-type) refrigeration cycle[4];

lighting, i.e. where the product incorporates a light source for ambient lighting[5].

Ecodesign requirements

Products falling in the scope as indicated in Annex I of this document shall meet the ecodesign requirements (2005/32/EC) set out in Annex III, in accordance with Annex I and Annex II. A summary of the main requirements is given in the below table.

Minimum energy efficiency performance requirements				
Requirements to apply	**RAC**		**LAC**	**Comfort Fans**
	SEER	SCOP	EER	SFP
				$W/(dm^3/s)$
2 years after entry into force	**3,6**	**3,2**	**2,3**	**11-41**
4 years after entry into force	**4,3**	**3,5**	**2,6**	

Additionally, requirements are set on noise and energy use in standby, off-mode and in other relevant modes for RACs, LACs and comfort fans as specified in Annex III.

2 There are currently no measures being prepared in the context of 2005/32/EC.

3 Subject to measures for comfort fans treated elsewhere in this document, as appropriate.

4 Subject to Ecodesign measures that are currently under the development for local electric heaters.

5 Subject to Ecodesign measures for light sources and luminaires.

Energy labelling requirements

Products falling under the definitions of paragraph "Definitions" above in this document shall meet the energy labelling requirements (92/75/EEC) set out below two years after entry into force of the Regulation.

RAC lower class limits			LAC lower class limits
SEER	**SCOP**		**EER**
(cooling)	(heating)		(cooling)
6,8	4,6		
5,7	4		3,6
4,6	3,4		3,1
4	3,1		2,6
3,4	2,8		2,4
2,8	2,5		2,2
2,4	2,2		2
2	1,9		1,8
2	1,9		1,6

The specific labelling format and class denomination is under discussion and may be subject to change. Consequently, only the class limits are presented above without reference to class names.

Measurement and calculation method

Measurement methods are specified in Annex II and calculation methods are given in Annexes I and II.

Information requirements for components and sub-assemblies

Information requirements are set in Annexes III and IV.

Conformity assessment

Conformity assessment shall be carried out according to Article 8(2), and Annex IV (Internal design control) or Annex V (Management system for assessing conformity) of Directive 2005/32/EC.

Market surveillance

When performing the market surveillance checks referred to in Directive 2005/32/EC, Article 3 (2), Member State authorities shall apply the verification procedure in line with what is set out in Ecodesign implementing measures.

Benchmarks

Benchmarks for **residential cooling products** within the scope are given below.

Benchmarks for residential cooling comfort products			
RAC		LAC	Comfort Fans
SEER	SCOP	EER	SFP
			W/(dm^3/s)
7	**4,8**	**3,5**	**2**

Review

A review of the foreseen implementing measure shall be presented to the Consultation Forum depending on technological progress and not later than 5 years after its entry into force with the objective of aiming at minimum energy performance requirements in line with least life cycle cost levels.

Annex I: Definitions

A) Room air conditioner

<u>*Functional definition for room air conditioner(RAC)*</u>

The ***primary function*** of a RAC is to reach and maintain the indoor temperature of a room at a desired level under *normal* and *extreme reference conditions* through air cooling and possibly air heating in the appropriate season(s).

A ***room*** is an indoor space requiring no more than a maximum cooling power of 12 kW under extreme reference conditions. In other words, air-cooling devices with a maximum cooling power larger than 12 kW are not in the scope.

Normal reference cooling conditions are defined by a representative climate profile for the EU. The climate profile has the format of '*bins*' for the cooling season. A '*bin*' is the sum of all hours for a given temperature, rounded to a whole number, which has occurred in a specific location. The relevant table is given below:

Table 1. Cooling season EU reference climate, with bin number j, outdoor temperature T_j in oC and number of hours per bin n_j and normalized load fraction $frac_j$ in %

j	**#**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
T_j	**oC**	17	18	19	**20**	21	22	23	24	**25**	26	27	28	29	**30**	31	32	33	34	**35**	36	37	38	39	40
n_j	**hrs**	205	227	225	225	216	215	218	197	178	158	137	109	88	63	39	31	24	17	13	9	4	3	1	0
$frac_j$	**%**	1,1	2,5	3,7	5,0	6,0	7,1	8,4	8,7	8,8	8,7	8,3	7,2	6,3	4,9	3,2	2,7	2,3	1,7	1,4	1,0	0,5	0,4	0,1	0,0

The *number of bin-hours* n_j stems from representative weather data over the 1982-1999 period.

The *load fraction* $frac_j$ indicates the fraction of the total cooling demand ('load') occurring in a specific bin. It is determined by the number of bin-hours n_j and a part load ratio pl_j. The part-load ratio indicates the fraction of the reference cooling demand - characterised by the reference outdoor temperature *Tdesignc* - that is needed to meet the cooling demand in a specific bin. The expression is $pl_j = (T_j - 16)/(Tdesignc - 16)$ with *Tdesignc* is 35.

For each bin, the part load ratio is multiplied with the number of bin hours and then normalized, i.e. divided by the total of all thus calculated bin-values. This results in the value of $frac_j$ as a percentage of the total load. Expression:

$$frac_j = \frac{n_j * pl_j}{\sum_{j=1}^{24} n_j * pl_j}$$

Normal reference heating conditions are defined by climate profiles for the EU *average* climate (Strassbourg), to be used for heating compliance assessment, and a *warmer* (Athens) and *colder* (Helsinki) climate, to be used for information purposes only, if the manufacturer claims that its device is suitable for either the warmer, the colder or both colder and warmer climates. The climate profiles use the '*bins*' format as above.

The *number of bin-hours nj* stems from representative weather data over the 1982-1999 period.

The *load fractions* $fracA_j$, $fracW_j$ *and* $fracC_j$ for the average, warmer and colder climate respectively indicate the fraction of the total heating demand ('load') occurring in a specific bin for a specific climate. They are determined as for the cooling season, but using the heating reference outdoor *Tdesignh* resulting in the expression of $pl_j = (T_j - 16)/(Tdesignh-16)$. Values of *Tdesignh* are –10, +2 and –22 for the average, warmer and colder climates respectively. The expression for $fracA_j$ is given below:

$$fracA_j = \frac{nA_j * pl_j}{\sum_{j=1}^{40} nA_j * pl_j}$$

Expressions for $fracW_j$ and $fracC_j$ are as for $fracA_j$ but substituting nA_j for nW_j and nC_j respectively in the above expression.

Table 2. Heating season reference climates, with outdoor temperature T_j, number of hours per bin N_j and load fraction $frac_j$ per bin number j and for the average, warmer and colder climate.

		hours			load fractions		
bin nr.	*tempe-rature*	**Warmer** *Athens*	**Average** *Stras-bourg*	**Colder** *Helsinki*	**Warmer** *Athens*	**Average** *Stras-bourg*	**Colder** *Helsinki*
j	**T_j**	**nW_j**	**nA_j**	**nC_j**	**$fracW_j$**	**$fracA_j$**	**$fracC_j$**
#	°C	hrs	hrs	hrs	%	%	%
1 to 8	-30 to -23	0	0	0	0	0	0
9	-22	0	0	1	0	0	0,04
10	-21	0	0	6	0	0	0,2
11	-20	0	0	13	0	0	0,5
12	-19	0	0	17	0	0	0,6
13	-18	0	0	19	0	0	0,7
14	-17	0	0	26	0	0	0,9
15	-16	0	0	39	0	0	1,3
16	-15	0	0	41	0	0	1,4
17	-14	0	0	35	0	0	1,1
18	-13	0	0	52	0	0	1,6
19	-12	0	0	37	0	0	1,1
20	-11	0	0	41	0	0	1,2
21	-10	0	1	43	0	0,05	1,2
22	-9	0	25	54	0	1,2	1,4
23	-8	0	23	90	0	1,0	2,3
24	-7	0	24	125	0	1,0	3,1
25	-6	0	27	169	0	1,1	4,0
26	-5	0	68	195	0	2,7	4,4
27	-4	0	91	278	0	3,4	5,9
28	-3	0	89	306	0	3,1	6,2
29	-2	0	165	454	0	5,5	8,7
30	-1	0	173	385	0	5,5	7,0
31	0	0	240	490	0	7,2	8,4

32	1	0	280	533	0	7,8	8,5
33	2	3	320	380	0,2	8,3	5,7
34	3	22	357	228	1,5	8,6	3,2
35	4	63	356	261	4,0	8,0	3,3
36	5	63	303	279	3,7	6,2	3,3
37	6	175	330	229	9,4	6,1	2,4
38	7	162	326	269	7,8	5,5	2,6
39	8	259	348	233	11,1	5,2	2,0
40	9	360	335	230	13,5	4,4	1,7
41	10	428	315	243	13,7	3,5	1,6
42	11	430	215	191	11,5	2,0	1,0
43	12	503	169	146	10,8	1,3	0,6
44	13	444	151	150	7,1	0,8	0,5
45	14	384	105	97	4,1	0,4	0,2
46	15	294	74	61	1,6	0,1	0,1
total		3590	4910	6446	100	100	100

Extreme reference conditions for the cooling season are defined by a dry bulb (wet bulb[6]) temperature of 35(24) ºC for outdoor inlet air and 27(19) ºC for indoor unit inlet air.

Extreme reference conditions for the heating season are defined by a dry bulb (wet bulb) temperature of –10(-11)ºC for outdoor inlet air and 20(maximum15)ºC for indoor unit inlet air, whereby for compliance with the declared nominal heating capacity hereafter it is assumed that insufficient capacity of the RAC to meet this condition will be supplemented by the calculated capacity of an electric resistance heater with a Coefficient of Performance (defined hereafter) of 1.

Designated climates (heating mode): Climates for which the manufacturer declares the product fit for purpose in heating mode. Options are average, warmer and colder climate, corresponding to the heating season reference climates as described in Table 2. Declaration of the average climate is mandatory. Declaration of the warmer and/or colder climate is optional. For climates where the manufacturer declares the product not fit for purpose, no efficiency data and climate-specific tests are needed and the manufacturer will declare an "X" in positions where product information according to Annexes III and IV is required.

Binlimit (heating mode): Minimum outdoor temperature required for operation, declared by the manufacturer.

Turndown ratio cooling Ctd: Ratio ($\leq$1) of the lowest steady state (non cycling) cooling power output and the maximum cooling power output of the product, determined at the *extreme reference conditons for the cooling season.*

Turndown ratio heating HPtd: Ratio ($\leq$1) of the lowest steady state (non cycling) heating power output and the maximum heating power output of the product, determined at 'D' test conditions as defined in Annex II.

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[6] Note that in engineering the dry bulb temperature it is the air temperature measured directly by a conventional sensor. Wet bulb temperature can also be measured, but here it is just intended as shorter way to prescribe the relative humidity of the air.

Definition of performance (RAC)

The ***nominal cooling capacity*** *(cooling power Pdesignc)* is the maximum output in kW at extreme reference conditions for the cooling season. The output in kW is defined as the multiplication of evaporator outgoing flow rate (in kg/h), specific capacity of the outgoing air (in kWh/kg.K) and the temperature difference between air going in and out of the evaporator (in K).

The ***nominal heating capacity*** *(heating power, Pdesignh)* is a declared heating output power value in kW. The value for *Pdesignh* can be declared freely between the heating power output at dry bulb (wet bulb) inlet temperature of -7 (-8) ºC and the heating power output at dry bulb (wet bulb) inlet temperature of +2 (+1) ºC for the outdoor unit, both at a temperature for the indoor unit of 20(max. 15) ºC. The penalty for a manufacturer in overstating the actual heating capacity is in the provision that any capacity not supplied by the product is assumed to be supplied by the calculated capacity of an electric resistance heater with a relatively unfavourable Coefficient of Performance of 1. Output power is defined as above.

The nominal heating capacity is to be reported on the energy label both as a value and as the load profile to which it pertains. The lower limits of the load classes are given below:

Table 3. Space heating profiles* with their lower output power limits in kW

heating load profile	**4XS**	**3XS**	**XXS**	**XS**	**S**	**M**	**L**	**XL**	**XXL**
lower limit in kW	0,75	1,1	1,7	2,5	3,8	5,7	8,5	12,8	19,2

**=Note that for RACs no reheat and temperature corrections are applied (as in Lot 1), because night setback is not an option and it is by definition a single zone appliance.*

The ***reference annual cooling demand*** Q_{CE} in kWh follows from *Pdesignc* multiplied by the number of *equivalent cooling hours* H_{CE}, set at 350 hrs for the reference conditions, using the expression:

$$Q_{CE} = H_{CE} * Pdesignc$$

The ***reference annual heating demand*** Q_{HE} in kWh is specific for the average(A), warmer (W) and colder (C) reference climates and follows from *Pdesignc* multiplied by the annual number of full load heating hours H_{HEA}, H_{HEW} and H_{HEC} set at 1400, 1400 and 2100 hours, using the expressions

$$Q_{HEA} = H_{HEA} * Pdesignh$$
$$Q_{HEW} = H_{HEW} * Pdesignh$$
$$Q_{HEC} = H_{HEC} * Pdesignh$$

Definition of energy efficiency (RAC)

The cooling energy efficiency at specific outdoor and indoor inlet air temperature, air humidity and part load is referred to as the ***Energy Efficiency Ratio (EER)***, being the ratio between the cooling power output and the electric power input at the specific conditions.

The heating energy efficiency at specific outdoor and indoor inlet air temperature, air humidity and part load is referred to as the ***Coefficient of Performance (COP)***, being the ratio between the heating power output and the electric power input at the specific conditions.

Seasonal Energy Efficiency Ratio SEER is the cooling season annual efficiency expressed as the ratio between the reference annual cooling energy demand Q_{CE} and the appliance specific annual electricity consumption taking into account the seasonally corrected average EER value $SEER_{on}$ as well as the power consumption in thermostat off mode P_{TO}, standby mode P_{SB}, off mode P_{OFF} (and crankcase heater consumption P_{CK}) multiplied with the time-period for each mode H_{TO}, H_{SB}, H_{OFF} and H_{CK}., respectively. Values for P_{TO}, P_{SB}, P_{CK} and P_{OFF} result from specific tests given in Annex II. Values of the time-periods, depending on whether the appliance also has a heating function, are given in Table 4.

Table 4. Time periods in hrs./cooling season for each mode for cooling only and cooling & heating appliances									
Cooling only					Cooling and Heating				
H_{CE}	H_{TO}	H_{SB}	H_{CK}	H_{OFF}	H_{CE}	H_{TO}	H_{SB}	H_{CK}	H_{OFF}
350	221	2142	7760	5088	350	221	2142	2672	0

The expression for SEER is given by the expression as follows:

$$SEER = \frac{Q_{CE}}{\frac{Q_{CE}}{SEER_{on}} + \mathrm{H}_{\mathrm{TO}} \times \mathrm{P}_{\mathrm{TO}} + \mathrm{H}_{SB} \times \mathrm{P}_{SB} + \mathrm{H}_{\mathrm{CK}} \times \mathrm{P}_{\mathrm{CK}} + \mathrm{H}_{OFF} \times \mathrm{P}_{OFF}}$$

The ***Seasonal Energy Efficiency Ratio in on-mode ($SEER_{on}$)*** is the weighted average of EER values at outdoor temperature bins for the normal cooling season reference climate at an indoor dry bulb(wet bulb) inlet temperature of 27(19) ºC .

Testing provides 4 EER values at outdoor air (inlet) temperatures of 35, 30, 25 and 20 ºC, denominated as test conditions 'A', 'B', 'C' and 'D' respectively. These EER results are subject to specific part load requirements (see Annex II).

The remaining EER values are established through linear interpolation with outdoor air (inlet) temperatures between test point values (see also Annex II). EER values in bins above 35 ºC are assumed identical to EER values for a 35 ºC outdoor temperature. EER values in bins below 20 ºC are assumed identical to EER values for a 20 ºC outdoor temperature. The weighting factor is the load fraction $frac_j$

The expression for $SEER_{on}$ is:

$$SEER_{on} = \sum_{j=1}^{24} frac_j * EER(T_j)$$

Seasonal Coefficient of Performance SCOP is the heating season annual efficiency expressed as the ratio between the reference annual heating energy demand Q_{HE} and the appliance specific electric annual energy consumption taking into account the seasonally corrected average COP value SCOPon, as well as the power consumption in thermostat off mode P_{TO}, standby mode P_{SB}, off mode P_{OFF} (and crankcase heater consumption P_{CK}) multiplied with the time-period for each of these modes H_{TO}, H_{SB}, $H_{OFF,}$ $H_{CK,}$ respectively. Values for P_{TO}, P_{SB}, P_{CK} and P_{OFF} result from specific tests (see relevant definitions later). Values of the time-periods, depending on whether the appliance also has a cooling function, are given in Table 5.

Table 5. Time periods in hrs./heating season for each mode for heating only and cooling&heating appliances *(Ecoaircon, Task 7, pp. 51)*

cli-mate	Heating Only				Cooling and Heating			
	H_{HE}	H_{TO}	H_{CK}	H_{OFF}	H_{HE}	H_{TO}	H_{CK}	H_{OFF}
A	1400	179	3851	3672	1400	179	179	0
W	1400	755	2944	2189	1400	755	755	0
C	2100	131	4476	4345	2100	131	131	0

The general expression for SCOP is given by:

$$SCOP = \frac{Q_{HE}}{\frac{Q_{HE}}{SCOP_{on}} + \mathrm{H}_{\mathrm{TO}} \times \mathrm{P}_{\mathrm{TO}} + \mathrm{H}_{SB} \times \mathrm{P}_{SB} + \mathrm{H}_{\mathrm{CK}} \times \mathrm{P}_{\mathrm{CK}} + \mathrm{H}_{OFF} \times \mathrm{P}_{OFF}}$$

This expression should be made specific for each climate with parameter extensions A (average climate), W (warmer climate) and C (colder climate), as appropriate. For example *SCOPA*, *SCOPW*, *SCOPC*, QA_{HE}, $SCOPA_{on}$, HA_{TO}, etc.

The ***Seasonal Coefficient of Performance in on-mode (SCOPon)*** is the weighted average of COP values at outdoor temperature bins for the normal heating season reference climate at an indoor dry bulb(wet bulb) inlet temperature of 20(max. 15) ºC .

Testing provides 4 COP values at outdoor air dry bulb (wet bulb) temperatures of +2 (+1), +7(+6), -7 (-8) and +12 (+11) ºC, denominated as test conditions ‘A’, ‘B’, ‘C’ and ‘D’, respectively. In case the Colder climate is one of the designated climates an extra test at ‘E’ conditions, i.e. at –15(-17) ºC outdoor temperature, shall be performed These COP results are subject to specific part load requirements (see Annex II).

The remaining COP values are established through linear interpolation with outdoor air (inlet) temperatures between test point values, at least if the outdoor temperature of the bin is not lower than the *binlimit*. COP values in bins above 12 ºC are extrapolated linearly from COP values at test points ‘B’ and ‘D’. COP values in bins below -7 ºC are extrapolated linearly from COP values at test points ‘A’ and ‘C’ for the average climate in case the colder climate is not one of the designated climates and results from test point ‘E’ are not available. Otherwise results from test point ‘E’ shall be used for inter-/extrapolation with point ‘C’ results to find COP values between –7 and –10 ºC in the average climate and between –7 and –22 ºC in the colder climate. The weighting factor is the load fraction fracAj, fracWj, fracCj depending on the climate (average, warmer or colder climate respectively). In case the RAC cannot meet the heat demand in a bin j, then the calculated, load-weighted contribution of the required supplementary heating is taken into account through parameter res_j. The value of res_j. is 0 (zero) if the RAC fully meets the demand and res_j. is 1 (and COP_j =0) if the RAC makes no contribution. If the RAC meets only part of the demand and another part has to be met through supplementary electric heating, then COP_j and res_j. (at COP=1) are weighted according to their relative share. Only in that case the value of COP_j --as is the value res_j-- is climate specific. More details of the inter-/extrapolation and the calculation of res_j. and COP_j are given in Annex II.

The expression for $SCOP_{on}$ in an average climate is:

$$SCOPA_{on} = \sum_{j=1}^{40} fracA_j * (COPA_j + resA_j)$$

Thermostat-off mode [7] is an active mode where the cooling and/or heating power output is zero (0). *Active mode* means a condition in which the equipment is connected to the mains power source and at least one of the main function(s) providing the intended service of the equipment has been activated.

Standby mode [8] means a condition where the equipment is connected to the mains power source, depends on energy input from the mains power source to work as intended and provides *only* the following functions, which may persist for an indefinite time: reactivation function, or reactivation function and only an indication of enabled reactivation function, and/or information or status display.

Reactivation function means a function facilitating the activation of other modes, including active mode, by remote switch including remote control, internal sensor, timer to a condition providing additional functions, including the main function.

Information or status display function means a continuous function providing information or indicating the status of the equipment on a display, including clocks.

Off mode [9]means a condition in which the equipment is connected to the mains power source and is not providing any function. The following shall also be considered as off mode:

- conditions providing only an indication of off mode condition;
- conditions providing only functionalities intended to ensure electromagnetic compatibility pursuant to Directive 2004/108/EC of the European Parliament and of the Council[10].

Crankcase heater operation[11] means an auxiliary heating device that is activated when the compressor is off avoiding refrigerant to migrate to the compressor to limit refrigerant concentration in oil at compressor start.

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7 The impact of thermostat-off mode is included in the cycling low and additionally in the thermostat-off consumption corresponding to hours with no cooling or heating load while cooling (or heating) is required by the user. Average electric power in this mode is denominated P_{TO} and hours of operation in this mode are H_{TO}.

8 Standby mode corresponds to hours with no occupancy in the building during the cooling or heating season. Average electric power in this mode is P_{SB} and hours of operation in this mode are H_{SB}.

9 Off mode corresponds to hours outside the cooling and/or heating season. Average electric power in this mode is P_{OFF} and hours of operation in this mode are H_{OFF}.

10 OJ L 390 of 31.12.2004, p. 24.

Definition of annual electricity consumption and emissions

Annual electricity consumption Q in kWh/a is the electricity consumption of the product to meet the reference cooling and/or heating demand. In heating mode - if applicable - *Q* is denominated depending on the climate *QA* (average climate), *QW* (warmer) and *QC* (colder).

The following expressions apply for:

- Cooling mode: $Q = Q_{CE}/SEER$

- Heating mode: $QA = Q_{HEA}/SCOPA$

  $QW = Q_{HEW}/SCOPW$

  $QC = Q_{HEC}/SCOPC$

- Labelling purposes, the relative decrease of *Q* in the warmer climate with respect to the average climate, expressed in %, is given by:

  $$dQW = (QA-QW)/QA$$

- Relative decrease of *Q* in the warmer climate with respect to the average climate, expressed in %, is given by:

  $$dQC = (QA-QC)/QA$$

Annual electricity consumption fraction for supplementary heating RES is the calculated annual electricity consumption fraction for supplementary heating, as a part of Q in heating mode. *RES* is denominated depending on the climate *RESA* (average climate), *RESW* (warmer) and *RESC* (colder). As supplementary heating is assumed at a COP of 1, the value of res_j defined earlier can be (re)used. The expression for *RES* in an average climate is:

$$RESA = \sum_{j=1}^{40} fracA_j * resA_j$$

Annual carbon emissions C in kg CO2 equivalent means the total estimated amount of direct and indirect carbon emissions during use and - with emissions discounted on an annual basis - end-of-life phase of the product. Direct carbon emissions depend on leakage of the refrigerant to the ambient during the use phase expressed as a fraction of the nominal refrigerant mass m_{refrig} in kg, set at 3%/year for 'split' products and 5%/year for 'multi-split' products. Direct carbon emissions at end-of-life are set at 5%; discounted over a 12 year product life set at 0,4%/year. Indirect carbon emissions are set at 0,43 kg/kWh annual electricity consumption. Depending on the reference climate for heating - in case the product features a heating function - *C* is denominated *CA* (average climate), *CW* (warmer climate) and *CC* (colder climate).

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[11] The crankcase heater operates when the compressor is off and the outdoor temperature – measured directly or indirectly - is lower than a given value. Other parameters such as the compressor or the heat exchanger temperature may also be included into the control and have an impact on its energy consumption. Average electric power in this mode is noted PCK and hours of operation in this mode are noted HCK.

The following expressions apply for:

- ‘S*plit*’ units:

$C = 0,43*Q + 0,034*GWP^{12}* m_{refrig}$
$CA = 0,43*QA + 0,034*GWP* m_{refrig}$
$CW = 0,43*QW + 0,034*GWP* m_{refrig}$
$CC = 0,43*QC + 0,034*GWP* m_{refrig}$

- ‘M*ulti-split*’ units:

$C = 0,43*Q + 0,054*GWP* m_{refrig}$
$CA = 0,43*QA + 0,054*GWP* m_{refrig}$
$CW = 0,43*QW + 0,054*GWP* m_{refrig}$
$CC = 0,43*QC + 0,054*GWP* m_{refrig}$

Definition of other reported variables

Nominal flow rate means the (combined) air flow rates of the indoor and outdoor units in m^3/h during nominal cooling power output. For appliances without cooling function, the nominal flow rates are determined by the maximum flow rate during the test at +2 oC outdoor (dry bulb) temperature (Test condition ‘C’ in heating mode).

Noise is the A-weighted sound power level measured during nominal flow rate conditions.

Minimum operational outdoor temperature means the lowest outdoor temperature at which the unit is designed to operate in heating mode according to the manufacturer’s instructions.

(B) Local air cooler

Definitions for reported variables

The ***primary function*** of a local air cooler is to supply air cooling, expressed by flow rate and temperature of the evaporator outlet air, under (close to) extreme cooling conditions.

Extreme cooling conditions are defined as an operation with a dry bulb (wet bulb) temperature of 35(24)ºC for condenser inlet air and 27(19) ºC for evaporator inlet air.

The ***nominal cooling capacity*** P_{CE} *(cooling power)* is the maximum output in kW in extreme cooling conditions. The output in kW is defined as the multiplication of evaporator outgoing air flow rate (in kg/h), specific capacity of the outgoing air (in kWh/kg.K) and the temperature difference between air going in and out of the evaporator (in K).

The cooling energy efficiency at a specific outdoor and indoor inlet air temperature and air humidity is referred to as the ***Energy Efficiency Ratio (EER)***, being the ratio between the nominal cooling capacity Pnom and the electric power input at nominal cooling capacity.

[12] As defined in the REGULATION (EC) No 842/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on certain fluorinated greenhouse gases

Annual electricity consumption Q in kWh/a is the electricity consumption of the product during 350 h operation, increased with electricity consumption during a time-period of 221 h thermostat-off mode and a time-period of 2142 h standby-mode. Thermostat-off mode and standby-mode are as defined for RACs.

The specific power consumption in thermostat-off mode P_{TO} and in standby-mode P_{SB} result from tests (see Annex II). The following expression applies:

$$Q = 350 * \boldsymbol{P_{CE}} + 221 * P_{\boldsymbol{TO}} + 2142 * P_{\boldsymbol{SB}}$$

Annual carbon emissions C in kg CO2 equivalent is the total estimated amount of direct and indirect carbon emissions during use and - with emissions discounted on an annual basis - end-of-life phase of the product. Direct carbon emissions depend on leakage of the refrigerant to the ambient during the use phase expressed as a fraction of the nominal refrigerant mass m_{refrig} in kg, set at 1%/year. Direct carbon emissions at end-of-life are set at 5%; discounted over a 12 year product life set at 0,4%/year. Indirect carbon emissions are set at 0,43 kg/kWh annual electricity consumption. The following expression applies:

$$C = 0{,}43 * Q + 0{,}014 * m_{refrig}$$

Nominal flow rates are the evaporator and condenser air flow rates in m³/h during nominal cooling power output.

Noise is the A-weighted sound power level measured during nominal flow rate conditions.

(C) Comfort fan

<u>*Definitions for reported variables*</u>

The ***primary function*** of a comfort fan is to locally increase the flow rate of ambient air.

The ***nominal flow rate F*** in m³/h is the maximum air flow rate measured at the fan outlet.

The ***nominal electric power consumption P*** in W is the electricity consumption of the comfort fan operating at nominal flow rate.

The ***Specific Fan Power SFP*** in W/(dm³/h) is the ratio of the nominal electric power input and the nominal capacity with expression $SFP=P/F$.

Standby mode and ***off-mode*** are as defined for LACs.

Annual electricity consumption *Q* is defined with a number of x hours of equivalent fan hours H_{FE}, y hours of standby mode H_{SB} and z hours of off-mode H_{OFF}. The Power consumption for standby mode P_{SB} and off-mode P_{OFF} result from tests given in Annex II.

The following expression applies:

$Q = P*H_{FE} + P_{SB}*H_{SB} + P_{OFF}*H_{OFF}$

Noise is the A-weighted sound power level measured during the nominal flow rate.

Annex II: Measurement and calculation methods

I. EFFICIENCY TESTING

For the assessment of *SEERon* (part of the efficiency assessment in cooling mode) 4 EER and power output values at outdoor air (inlet) temperatures of 35, 30, 25 and 20 ºC, denominated as test conditions ‘A’, ‘B’, ‘C’ and ‘D’ respectively, have to be provided. These measurements are performed at an indoor air dry bulb (wet bulb) temperature of 27(19) ºC.

For the assessment of *SCOPon* (part of the efficiency assessment in heating mode) 4 COP and power output values at outdoor air dry bulb (wet bulb) temperatures of +2 (+1), +7(+6), -7 (-8) and +12 (+11) ºC, denominated as test conditions ‘A’, ‘B’, ‘C’ and ‘D’ respectively, are always to be provided. In case the colder climate is one of the designated climates an extra test, denominated ‘E’, at outdoor air dry bulb (wet bulb) temperatures of -15 (-17) ºC has to be performed. These measurements are done at an indoor air dry bulb (wet bulb) temperature of 20(max. 15) ºC. If the product has a supplementary (resistance) heating facility this shall be disabled during all tests.

The *EER* and *COP* results are not only specific for the in- and outdoor temperatures mentioned above, but also for the cooling or heating demand (‘load’) that can be expected at the specific outdoor temperatures. Thus, in the case of overcapacity at a certain test point the extra losses for on/off cycling (for fixed capacity units) or the possible performance degradation at part load (for variable capacity units) is taken into account.

In case of insufficient capacity for a bin j, which by definition can only occur for test condition ‘C’ (outdoors –7 ºC) or ‘E’ (outdoors –15ºC) in the heating mode, supplementary heating shall be calculated, at COP=1, and reported.

To determine the part load for a specific bin j the climate-specific part load factor,

$pl_j = (T_j\text{-}16)/(\text{Tdesign-16})$

is used (see above definition of functionality), where for *Tdesign* the appropriate values of *Tdesignc* for the cooling mode (35 ºC) and *Tdesignh* (-10 ºC in average climate, +2 ºC in warmer and –22 ºC in colder climate) for the heating mode are used. T_j is the outdoor temperature of bin j.

The table below gives the outcomes.

Table on outdoor temperature and climate-specific part load factor for test points							
Cooling mode			**Heating mode**				
test	**T_j**	**pl_j**	**test**	**T_j**	**pl_j (A)**	**pl_j (W)**	**pl_j (C)**
	oC	**%**		**oC**	**%**	**%**	**%**
A	35	100%	E	-15			82%
B	30	74%	C	-7	88%		61%
C	25	47%	A	2	54%	100%	37%
D	20	21%	B	7	35%	64%	24%

			D	12	15%	29%	11%

Multiplying the part load factors above with the appropriate values of *Pdesignc* (for cooling) and *Pdesignh* (for heating, climate-specific) gives the heat demand per bin P_j in kW.

For testing, 3 types of units are distinguished:

- A *fixed capacity* unit, which operates at a fixed refrigerant flow rate through the indoor unit(s) in on-mode;
- A *staged capacity* unit, where the unit is able to vary the refrigerant flow rate through the indoor unit(s) in two steps in on-mode;
- A *variable capacity* unit, where the unit can vary the refrigerant flow rate through the indoor unit(s) in 3 or more steps in on-mode.

TEST METHOD

The following procedure applies for ***fixed capacity units****:*

1. Determine the $EERmax_j$ (or $COPmax_j$) and the $Pmax_j$, i.e. the efficiency and power output at steady state on-mode, for each test point (4 tests cooling mode, 4 tests heating mode). In case the colder climate is one of the designated climates an extra test has to performed in heating mode.

2. In cooling mode perform one cyclic test at an outdoor dry bulb temperature of 35°C coil[13]; with dry indoor coil. One cycle is 6 minutes in on-mode and 24 minutes in off mode, corresponding to approximately 20% part load conditions. Measure de *EER* value $EERcyc_j$ and the average cooling power output over the test period $Pcyc_j$.

In heating mode perform one cyclic test at an outdoor dry bulb temperature of 7 or 12 °C[14]. One cycle is 6 minutes in on-mode and 24 minutes in off mode, corresponding to approximately 20% part load conditions. Measure de *COP* value $COPcyc_j$ and the average heating power output over the test period $Pcyc_j$.

3. Determine the efficiency degradation between cycling and steady state mode for cooling (bin 24= 35 °C): $dEER_{24} = EERmax_{24} - EERcyc_{24}$ and for heating (bin 43=12 °C[15]): $dCOP_{43} = COPmax_{43} - COPcyc_{43}$.

4. Determine the difference in power output between cycling and steady state mode for cooling: $dP_{24} = Pmax_{24} - Pcyc_{24}$ and for heating: $dP_{43} = Pmax_{43} - Pcyc_{43}$.

5. Determine efficiency loss per kW of output power for cooling: $Cd = dEER_{24} / (Pmax_{24} - Pcyc_{24})$ and for heating: $Cd = dCOP_{43} / (Pmax_{43} - Pcyc_{43})$.

[13] Represents the maximum cooling capacity, therefore at lower outdoor temperatures the unit will cycle.

[14] Represent roughly the maximum heating capacity.

[15] Can also be bin 38= 7 oC outdoor temperature).

6. Determine the efficiency values to be used as input for *SEERon* and *SCOPon* for each test point (including all reference climates), using Cd and the difference between the steady state power Pmaxj and the heat demand in the bin Pj. Following applies: $EER_j = EERmax_j * (Pmax_j - P_j) * Cd$ and $COP_j = COPmax_j * (Pmax_j - P_j) * Cd$.

7. In heating mode and with test conditions 'C' (-7 ºC outdoor) or 'E'(-15 ºC outdoor), if the maximum heat output of the heat pump $Pmax_j$ is smaller than the required heat demand ('load') P_j then for those test points in bin *j*:

$COP_j = (COPmax_j * Pmax_j) / P_j$
$res_j = (P_j - Pmax_j) / P_j$

The maximum heat pump output $Pmax_j$, the value of $COPmax_j$ as well res_j shall be reported under the information requirements in Annex III.

8. In heating mode, if the outdoor temperature of bin *j* is below the *binlimit* then $Pmax_j=0$ so $COP_j=0$, $res_j = 1$. *In all other cases*, unless the condition under point 7 above applies, $res_j= 0$.

9. Interpolation: EER(COP), power output and - in heating mode - res_j values for intermediate (not test point) outdoor temperature *bins* shall result from linear interpolation with the outdoor temperature between test point results. In case the colder climate is one of the designated climates, test results at 'E' test condition shall also be used for linear interpolation in the average climate to obtain test results for bins with outdoor temperature of –8, -9 and –10 ºC, unless the condition under point 8 above applies.

Beyond testpoints in cooling mode: For *bins* with outdoor temperature temperature above 35 ºC, the same EER values as for test condition 'A' apply. For *bins* with outdoor temperature temperature below 20 ºC, the same EER values as for test condition 'D' apply.

Beyond test points in heating mode: For the average climate, in case the colder climate is <u>not</u> one of the designated climates, COP and power output values for bins with outdoor temperatures below –7 ºC result from linear extrapolation with the outdoor temperature of values at 'A' condition (+2 ºC outdoors) and 'C' (-7 ºC outdoors) test conditions, unless the condition under point 8 above applies.

The following procedure applies for ***staged capacity units***:

1. Determine the cooling(heating) power output *Pc* in kW and the electric power consumption *Pe* in kW at each of the two 'stages' of capacity control of the unit. The higher values are denominated Pc_1 and Pe_1. The lower values are Pc_2 and Pe_2. For a specific test point with heating power demand ('load') P_j, the fractions of Pc_1 and Pc_2 needed to reach P_j are t_1 and t_2 respectively, determined by the expressions

$t_1 = (Pc_2 - P_j)/(Pc_2 - Pc_1)$ and
$t_2 = 1 - t_1$

The aggregated EER(COP) value is then EER(COP)= $(t_1 * Pc_1 + t_2 * Pc_2)/(t_1 * Pe_1 + t_2 * Pe_2)$

2. If the turndown ratio for cooling (heating) is higher than the required part load ratio (D and/or C and/or B), the *EER*(*COP*) at the required part load ratio is determined as for fixed capacity units.

3. In heating mode and with test conditions ‘C’ (-7 ºC outdoor) or ‘E’(-15 ºC outdoor), if the maximum heat output $Pmax_j$ is smaller than the required heat demand P_j then for those test points the methodology as for fixed capacity units (point 7) is applied.

4. In heating mode, if the outdoor temperature of bin *j* is below the *binlimit* then the methodology as for fixed capacity units (point 8) is applied

5. Interpolation: At part loads Pj that are between the two discrete power levels Pc1 and Pc2 the intermediate EER(COP) values cannot correctly be determined directly from a linear interpolation with the outdoor temperature of the EER(COP) values at the 4 or 5 test points. Instead, for each ‘bin’ with heat demand Pj and the fractions t1 and t2 have to be determined as indicated under point 1 above. The outcome is a curve, not a straight line of EER(COP) points between the EER(COP) values at Pc1 and Pc2.

Alternatively, because the interpolation is close to linear, in the heating mode the manufacturer can also choose to make a linear interpolation between the 4 or 5 COP values, but then with each value corrected with a default correction factor 0,975 (COP minus 2,5%).
At part loads where Pj<Pc2 a linear interpolation with the outdoor temperature of EER(COP) values shall be applied.

The following procedure applies for ***variable capacity units:***

1. Perform the tests at the required part load ratios with the corresponding setting of the capacity control of the unit.

2. If the electronic control of the unit does not allow obtaining the required part load ratio, the calculation procedure given for staged capacity units shall be applied.

3. If the smallest setting of the capacity control does not allow reaching one or several part load ratios, the EER(COP) at the required part load ratio(s) shall be calculated as for fixed capacity units.

4. In heating mode and with test conditions ‘C’ (-7 ºC outdoor) or ‘E’(-15 ºC outdoor), if the maximum heat output $Pmax_j$ is smaller than the required heat demand P_j then for those test points the methodology as for fixed capacity units (point 7) is applied

5. In heating mode, if the outdoor temperature of bin *j* is below the *binlimit* then the methodology as for fixed capacity units (point 8) is applied

6. Interpolation: As for fixed capacity units, point 9.

II. SUPPLEMENTARY TESTS

Standby mode power

After the 'A' test condition in cooling mode and 'C' condition in heating mode for reversible heat pumps (standard rating condition for single duct unit), the unit is stopped and put in standby mode. After 10 minutes, the residual energy power is measured and assumed to be the standby mode consumption. In case of multi-split units, all the indoor units shall be stopped and put in standby mode.

Off mode power

Following the standby mode power test, the unit should be switched in off mode while remaining plugged. After 10 minutes, the residual energy power is measured and assumed to be the off mode consumption. In case no off mode switch is available on the unit (on the indoor unit(s) for split units), the standby mode power is supposed equal to the standby mode power.

Crankcase heater operation power

The energy consumption of the unit shall be measured after the compressor reached stable temperature for the 'A' temperature conditions test in heating mode and stopped with the control device. Ambient temperature of compressor unit shall be maintained at 2 ± 2 K for at least 8 hours. During this 8 hours period from stop of the compressor, the power input for crankcase heater shall be measured and averaged. The standby power consumption is deducted from this measured total energy consumption of the unit to determine the crankcase heater power.

In addition, if there is an outdoor temperature control with a declared Tck value lower than 16 °C, it can be checked as follows. After this 2 °C test for crankcase, room temperature is raised to T_{CK}. 1 hour after the room temperature has been stabilized, crankcase heater power is measured over 30 minutes and this gives the power consumption to be used P_{CK} in the calculation of crankcase energy consumption in cooling mode.

Thermostat-off mode power

When there is a cooling/heating demand, the compressor is on and the total power consumption includes all electrical auxiliary devices. Once the set point is reached, the cooling/heating demand is satisfied. The compressor is then off but there is still a remaining power consumption due to the other auxiliary devices (electronics, fans, …). This state of the unit is called "thermostat off" state.
If a cyclic test is made to determine the Cd coefficient, the "thermostat-off" power shall be measured during this test. In case two cycling tests are realized, in cooling and in heating mode, the cooling mode result shall be used.

If no cyclic test is performed, after the 'D' test condition, in cooling mode for reversible air conditioner (standard rating condition for single duct unit), the thermostat set point is increased until the compressor stops. The standby power consumption is deducted from the measured total energy consumption of the unit to determine the thermostat off power on a time period not inferior to one hour.

III. TOLERANCES

Tolerances for compliance assessment are for:

- Ø declared capacities 8% and

- Ø declared *SEER, SCOP* (for RACs), *EER* (for LACs) and *SPF* (comfort fans) 8%.

All reported data shall have been attained by applying best testing practice, to be subject by spot-checks by market surveillance authorities, appointed by the national authorities in EU Member States.

If a product fails compliance at a first round of testing with a single sample, a second round of testing will take place using 3 test samples and the average of measurements will be used to assess compliance.

IV. TEST REPORTS

For the purposes of conformity assessment, test reports in electronic format shall be kept on file by the manufacturer that are immediately accessible to market surveillance authorities at their request. Failure of the manufacturer to produce the test reports within three working days after receipt of the request shall lead to non-compliance. As opposed to the Product Information test reports are not public domain. Market surveillance authorities shall treat the information confidentially and solely to assess compliance of the product under scrutiny. Publication of detailed and/or aggregated quantitative data from the test reports in the public domain is only possible through written authorisation by the manufacturer.

The test reports shall contain all relevant measurement information including but not limited to:

- Ø relevant charts and sampled value tables of temperatures, relative humidity values, part loads, flow rates, electric voltage/ frequency/ harmonic distortion during the test period(s);
- Ø description of the test method(s) as applicable, laboratory space and ambient conditions, physical test rig set up specifying position of data capturing devices (e.g. sensors) and data processing equipment, as well as the operating range and measurement accuracy;
- Ø settings of the unit being tested, description of the function of automatic switching of settings (e.g. between off mode and standby mode);
- Ø description of the test sequence followed, e.g. to arrive at equilibrium conditions as applicable.

In order to establish whether best testing practice has been applied, the following standards serve as a guidance for whole or parts of the tests involved:

RACs and LACs:

- Ø EN 14511:2004, Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling;

- Ø ISO 5151-2005, Non-ducted air conditioners and heat pumps – Testing and rating for performance;

- Ø EN 62301:2005. Household Electrical Appliances: Measurement of standby power;

- Ø EN 12102 :2008. Air conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling - Measurement of airborne noise - Determination of the sound power.

Comfort fans

- Ø IEC 60879: 1986 (corr. 1992). Performance and construction of electric circulating fans and regulators;

- Ø 10302:1996 Acoustics -- Method for the measurement of airborne noise emitted by small air-moving devices [applicability up to 1 m3/s];

- Ø ISO 10302:1996 and EN 60704-2-7:1997 Household and similar electrical appliances - Test code for the determination of airborne acoustical noise - Part 2: Particular requirements for fans;

- Ø EN 62301:2005. Household Electrical Appliances: Measurement of standby power.

Annex III: Ecodesign requirements

Air conditioning and comfort fan appliances shall meet the ecodesign requirements set out in this Annex.

I) Specific ecodesign requirements

Minimum energy efficiency and maximum noise requirements

Minimum energy efficiency performance requirements for RACs and LACs and their date of entry into force are given in the table below:

Ecodesign Minimum Energy Efficiency Performance Standards			
Requirements to apply	RAC		LAC
	SEER	SCOP	EER
2 years after entry into force	**3,6**	**3,2**	**2,3**
4 years after entry into force	**4,3**	**3,5**	**2,6**

Minimum energy efficiency performance requirements for comfort fans shall apply 2 years after entry into force of the Regulation, as given in the table below.

Fan type	**Fan diameter [cm]**	**Maximum Specific Fan Power [W/(dm³/s]**	**Maximum acceptable Noise in dB-A**
Tower fans	**All**	42	50
Ceiling fans	0-60	31	62
	60-90	19	62
	90-120	14	65
	120-130	11	67
	130-140	11	70
	140-150	11	72
	150+	11	75
Other comfort fans	0-20	31	59
	20-23	31	59
	23-25	26	60
	25-30	23	61
	30-35	21	63
	35-40	19	65
	40-45	17	67
	45-50	15	68
	50-60	15	70
	60+	13	73

Maximum noise requirements for RACs and LACs introduced two years after entry into force of the Regulation, as given in the table below

Sound power level	RAC • 6 kW		RAC 6 - 12 kW		LAC	
	Indoor	Outdoor	Indoor	Outdoor	• 6 kW	6 • 12 kW
Db-A (EN 12102)	60	65	65	70	65	70

Minimum standby and off-mode requirements

1) Minimum standby and off-mode requirements on **RACs** will apply as of 2 years after entry into force of the Regulation. The standby and off-mode requirements are included in the values for minimum energy performance requirements.

2) The following minimum standby and off-mode requirements for **LACs** and **Comfort Fans** are based on the Ecodesign requirements of Commission Regulation 1275/2008/EC:

a) Power consumption in "off mode":

Power consumption of equipment in any off mode condition shall not exceed 1,00 W as of 2 years, and 0,5 W as of 4 years after the entry into force of the Regulation

b) Power consumption in "standby mode(s)":

The power consumption of equipment in any condition providing only a reactivation function, or providing only a reactivation function and a mere indication of enabled reactivation function, shall not exceed 1.00 W as of 2 years, and 0,5 W as of 4 years after the entry into force of the Regulation.

The power consumption of equipment in any condition providing only information or status display, or providing only a combination of reactivation function and information or status display, shall not exceed 2.00 W as of 2 years, and 1 W as of 4 years after the entry into force of the Regulation

c) Availability of off mode and/or standby mode

As of 2 years after entry into force of the Regulation, equipment shall, except where this is inappropriate for the intended use, provide off mode and/or standby mode, and/or another condition which does not exceed the applicable power consumption requirements for off mode and/or standby mode when the equipment is connected to the mains power source.

d) Power management

As of 4 years after entry into force of the Regulation, when equipment is not providing the main function, or when other energy-using product(s) are not dependent on its functions, equipment shall, unless inappropriate for the intended use, offer a power management function, or a similar function, that switches equipment after the shortest possible period of time appropriate for the intended use of the equipment, automatically into

– standby mode, or

– off mode, or

– another condition which does not exceed the applicable power consumption requirements for off mode and/or standby mode when the equipment is connected to the mains power source. The power management function shall be activated before delivery.

II) Product information requirements

As of two years after entry into force of the Regulation, the information on room air conditioning appliances, local air coolers and comfort fans set out in points below shall be visibly displayed on:

(a) the technical documentation of the product;

(b) free access websites of manufacturers of room air conditioning appliances, local air coolers and comfort fans;

As regards to the technical documentation, the information as specified in Annex IV must be provided.

In addition the data below must be reported in the technical documentation as specified below. The exact wording used in the list does not need to be repeated. It may be displayed using graphs, figures or symbols rather than text.

For room air conditioning appliances, local air coolers and comfort fans:

(1) the year of manufacture;

(2) the rated voltage(s) or range of rated voltage (V);

(3) the rated input frequency(s) (Hz);

(4) information relevant for disassembly, recycling or disposal at end-of-life;

For room air conditioning appliances:

(5) The Seasonal Energy Efficiency Ratio *EER* of the appliance in cooling mode, determined in accordance with definitions and test procedures in Annex I and II;

(6) The Seasonal Coefficient of Performance *SCOP* of the appliance in heating mode, determined in accordance with definitions and test procedures in Annex I and II;

(7) Cooling mode *EER* and cooling output power values for four test conditions A, B, C, D as defined in Annex II;

(8) Heating mode *COP* and cooling output power values for four test conditions A, B, C, D and –if appropriate- E as defined in Annex II for the designated climates. For not designated climates no testing is necessary and an "X" shall be used instead of the COP and power values to indicate that the product is unfit for application in those climates.

(9) In case of indirect method for determination of $SEER_{on}$ and $SCOP_{on}$, the following additional measurement results in accordance with Annex I and II shall be given:

(a) measured *EER*(*COP*) values and cooling(heating) power in steady state at test conditions A, B, C, D and –if appropriate-- E;

(b) measured *EER*(*COP*) values and cooling(heating) power in cyclic test conditions A, B, C, D and –if appropriate-- E;

(c) For test points where the heat pump output is zero or provides only part of the required part load, the maximum heat pump output $Pmax_j$, the value of $COPmax_j$ as well as the missing load fraction res_jpertaining to the test points shall be reported;

(d) Annual electricity consumption fraction for supplementary heating RES as defined in Annex I and II for all designated climates..

(10) The *binlimit* , the turndown ratio cooling *Ctd* and the turndown ratio heating *HPtd* in accordance with definitions in Annex I.

(11) Electric power consumption values in thermostat-off P_{TO}, standby P_{SB}, crankcase heater P_{CK} and off mode P_{OFF} in accordance with Annex II;

(12) Nominal flow rates, in accordance with Annex I and II;

For local air coolers:

(13) The Energy Efficiency Ratio *EER* of the appliance in cooling mode at full load, determined in accordance with definitions and test procedures in Annex I and II;

(14) Nominal flow rates, in accordance with Annex I and II;

(15) Power consumption in W in off mode and standby mode as defined in Commission Regulation 1275/2008[16];

For comfort fans:

(16) Electric power consumption *P* in W during nominal (maximum fan speed) operation;

(17) Specific Fan Power *SFP* in W/(dm^3/s) during nominal (maximum fan speed) operation;

(18) Power consumption in W in off mode and standby mode as defined in Commission Regulation 1275/2008[19].

16 COMMISSION REGULATION (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment.

For all products **Test Reports** are to be kept on file for compliance assessment as stipulated in Annex II.

III) Benchmarks for best products

Benchmarks for best products are given below:

Benchmarks for residential cooling comfort products			
RAC		**LAC**	**Comfort Fans**
SEER	SCOP	EER	SFP[17]
			W/(dm3/s)
7	**4,8**	**3,6**	**2**

Benchmark for noise on RAC indoor units and LACs is 46 dB-A.

[17] Note: Benchmark is taken from SPF1 class as in EN 13779.

Annex IV: Energy labelling requirements

Energy labelling requirements are proposed on RACs and LACs under the 1992/75 EEC Directive. No such requirements are proposed on comfort fans in line with the preparatory study.

As of two years after entry into force of the Regulation, energy labelling requirements for RACs and LACs will apply using the following labelling classes:

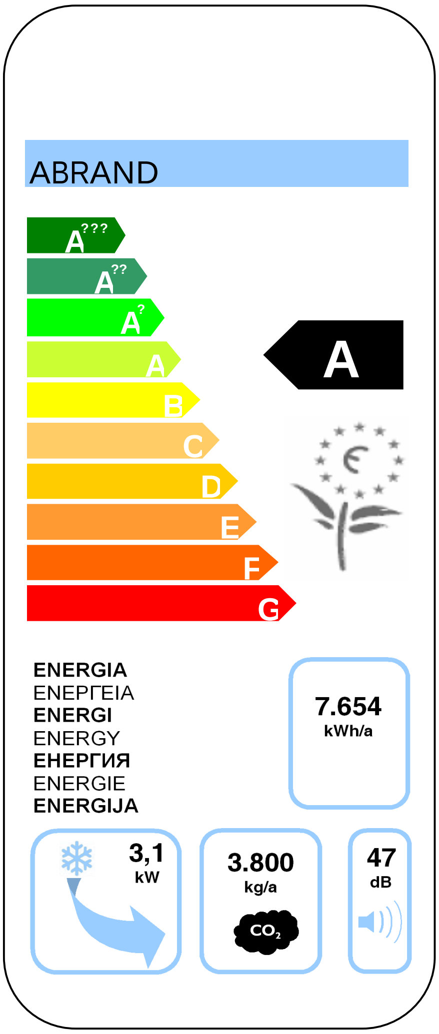
RAC lower class limits		LAC lower class limits
SEER (cooling)	**SCOP** (heating)	**EER** (cooling)
6,8	4,6	
5,7	4	3,6
4,6	3,4	3,1
4	3,1	2,6
3,4	2,8	2,4
2,8	2,5	2,2
2,4	2,2	2
2	1,9	1,8
2	1,9	1,6

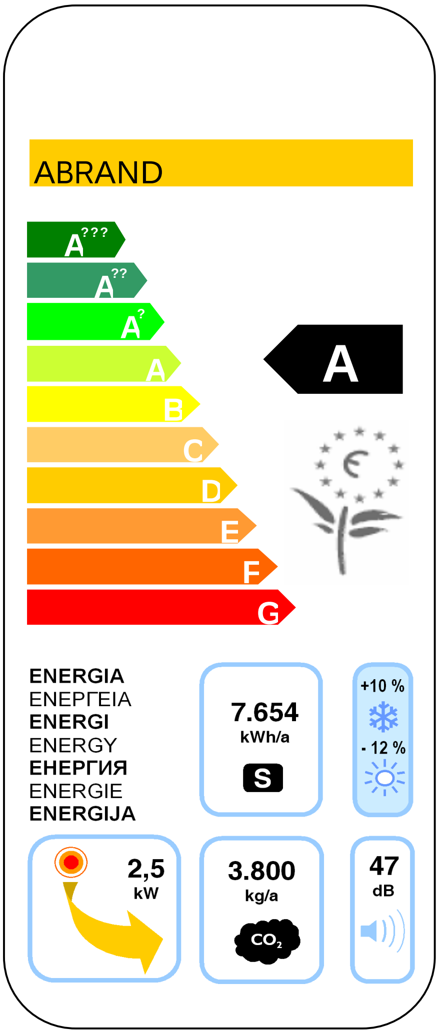
The specific labelling format and class denomination is under discussion and may be subject to change. This is why labelling categories will be assigned to the above values at a later stage; stipulations as to the use of the energy label will be as for other domestic appliances and will thus not be repeated here.

The possible lay-outs for RAC and LAC are as presented below.

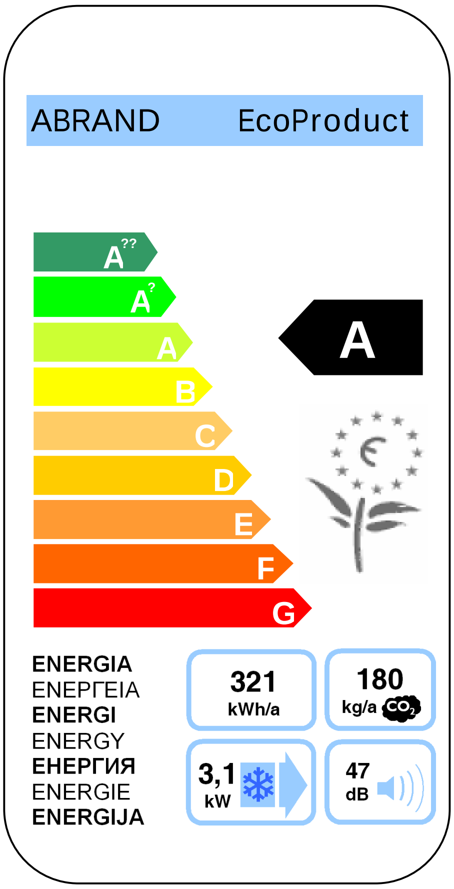
RAC label possible lay-out[18].

[18] Header omitted. Lay out and denominations to be decided. Numbers are fictitious.


ABRAND
A???
A??
A?
A
B
C
D
E
F
G
A
ENERGIA
ENEPΓEIA
ENERGI
ENERGY
EHEPΓИЯ
ENERGIE
ENERGIJA
7.654
kWh/a
3,1
kW
3.800
kg/a
CO2
47
dB


ABRAND
A???
A??
A?
A
B
C
D
E
F
G
A
ENERGIA
ENEPΓEIA
ENERGI
ENERGY
EHEPΓИЯ
ENERGIE
ENERGIJA
7.654
kWh/a
S
+10 %
- 12 %
2,5
kW
3.800
kg/a
CO2
47
dB

LAC label possible lay-out[19].



[19] Header omitted. Lay out and denominations to be decided. Numbers are fictitious

The following notes define the information to be included in the energy label on the cooling mode:

I. Supplier's name or trade mark;

II. Supplier's model identifier, i.e. the model identifier of the indoor and of the outdoor elements of the combination to which the figures quoted below apply;

I. The energy efficiency class of the model, or combination, determined in accordance with definitions and test procedures in Annex I and II for the cooling mode as well as the class limits defined previously in the underlying Annex IV;

III. Without prejudice to any requirements under the Community eco-label scheme, where a model has been granted a 'European Union eco-label' under Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community eco-label award scheme (1), a copy of the eco-label may be added;

IV. The indicative annual electricity consumption *Q* in kWh/a during the cooling season, determined in accordance with definitions and test procedures in Annex I and II;

V. The indicative annual carbon emissions *C* in kg CO2 equivalent/a during the cooling season, determined in accordance with definitions and test procedures in Annex I and II respectively;

VI. The cooling power defined as the nominal cooling capacity *Pdesign* in kW of the appliance in cooling mode determined in accordance with definitions and test procedures in Annex I and II;

VII. Inside and outside noise during standard function, determined in accordance with Directive 86/594/EEC.

The following notes define the information to be included in the energy label on the heating mode label:

II. Supplier's name or trade mark;

III. Supplier's model identifier, i.e. the model identifier of the indoor and of the outdoor elements of the combination to which the figures quoted below apply;

IV. The energy efficiency class of the model, or combination, in heating mode determined in accordance with definitions and test procedures in Annex I and II as well as the class limits defined previously in the underlying Annex IV;

V. Without prejudice to any requirements under the Community eco-label scheme, where a model has been granted a 'European Union eco-label' under Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community eco-label award scheme (1), a copy of the eco-label may be added;

VI. The indicative annual electricity consumption mode for an average climate *QA* in kWh/a in the heating season, determined in accordance with definitions and test procedures in Annex I and II;

VII. Designated heating climates for which the unit is declared suitable, with options average (mandatory), warmer (optional) or colder (optional) climate as defined in Annex I;

VIII. The relative increase in annual electricity consumption during the heating season for a colder climate *dQC* versus an average climate in %, determined in accordance with definitions and test procedures in Annex I and II. If the colder climate is not a designated heating climate the symbol '*X*' in color red will be used on the label instead of the value of *dQC*;

IX. The relative decrease in annual electricity consumption during the heating season for a warmer climate *dQW* versus an average climate in %, determined in accordance with definitions and test procedures in Annex I and II. If the warmer climate is not a designated heating climate the symbol '*X*' in color red will be used on the label instead of the value of *dQW*;

X. The indicative annual carbon emissions *C* in kg CO2 equivalent/a during the heating season for an average climate, determined in accordance with definitions and test procedures in Annex I and II respectively;

XI. The heating power defined as the nominal heating capacity *Pdesignh* in kW of the appliance in heating mode determined in accordance with definitions and test procedures in Annex I and II;

XII. The denomination ('M', 'S', etc.) of the heating load profile pertaining to the heating power defined as the nominal heating capacity *Pdesignh* in kW of the appliance in heating mode determined in accordance with definitions and test procedures in Annex I and II;

XIII. Inside and outside noise during standard function, determined in accordance with Directive 86/594/EEC.

The following notes define the information to be included in the energy label of local air conditioners:

I. Supplier's name or trade mark;

II. Supplier's model identifier;

XIV. The energy efficiency class of the model, or combination, determined in accordance with definitions and test procedures in Annex I and II as well as the class limits defined previously in the underlying Annex IV;

III. Without prejudice to any requirements under the Community eco-label scheme, where a model has been granted a 'European Union eco-label' under Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community eco-label award scheme (1), a copy of the eco-label may be added here;

IV. The indicative annual electricity consumption in kWh/a determined in accordance with definitions and test procedures in Annex I and II;

V. The indicative annual carbon emissions in kg CO2 equivalent/a determined in accordance with definitions and test procedures in Annex I and II respectively;

VI. The cooling power defined as the nominal cooling capacity *Pdesign* in kW of the appliance in cooling mode determined in accordance with definitions and test procedures in Annex I and II;

VII. Inside and outside noise during standard function, determined in accordance with Directive 86/594/EEC.

Annex V: Explanatory Notes

The preparatory study on 'Lot 10' focused on residential room conditioning appliances (airco and ventilation)'. The appliances covered were room air conditioning appliances, local air coolers, comfort fans and domestic ventilation appliances, including kitchen hoods. This working document is meant to contribute to achieving the requirements of Article 16.2 of Directive 2005/32/EC in relation to room air conditioning appliances, local air coolers and comfort fans. The proposed ecodesign requirements are set out based on the recommendations of the preparatory study. Due to the specific characteristics of domestic ventilation appliances, including kitchen hoods, they will be addressed in a separate working document.

Form of the implementing measure

The intention is to give to the Ecodesign implementing measure the form of a directly applicable decision or regulation and for the Energy Labelling implementing measure the form of a Directive.

Definitions

For appliances covered by this working document, the definitions are restricted to commonly agreed technical parameters.

Scope

The scope of the working document includes room air conditioning appliances (RACs) up to 12 kW, local air coolers (LACs) up to 2,2, kW and comfort fans below 125 W in line with the preparatory study and as specified above. The upper level of 12 kW for RACs divides a generally accepted borderline between 'domestic' and 'residential' RACSs. Residential RACs are subject to a separate preparatory study. The upper level of 2,2 kW for LACs was set based on the size of the typical domestic fuses in the Member States with weakest electricity grids (maximum 10A, 230V). As a typical LAC model is around 1 kW, this upper power limit will ensure that all LACs in the European markets are covered. The maximum power level of 125 W for comfort fans is the agreed limit between 'domestic' and 'industrial' fans. Industrial fans are covered by a separate Working Document based on LOT 11 preparatory study. Other related appliances, such as air conditioning appliances combined with ventilation (fresh air), air purification (clean air), humidity control (humidifying and dehumidifying) or chillers (air-water, water-water) are included in the Working Plan 2009-2011 and hence covered by separate preparatory studies.

Common denominator of these products is the fact that they all provide air cooling comfort (mainly) in the domestic sector. This working document proposes setting minimum requirements on these appliances, including the revision of the existing energy labelling implementing Directive on room air conditioning appliances and local air coolers.

Regarding RACs and comfort fans the working document largely follows the results of the preparatory study, specifically regarding minimum efficiency requirements and energy labelling. The final reports can be downloaded from www.ecoaircon.eu.

However, the Working Document proposes to distinguish a separate category of local air coolers, which have in common with RACs that they provide air cooling but are different in the sense that they target only a limited area inside the room. Also, their use is typically of a temporary nature with high priority for portability. All functionality is packed in one compact single package with minimal connections to outside (usually only through a flexible single condenser outlet air duct).

Compared to room air conditioning appliances (split and multi-split), a local air cooler has the disadvantage of:

- lower cooling comfort: high air speed, large local temperature differences and fluctuations, suboptimal control, noise close to the user, etc.;
- lower energy efficiency, due to the inherent technical challenge of combining 'hot' and 'cold' areas in a single small volume and
- limited capacity, inherent from usage in countries with low capacity electricity grids.

Consequently, if the same ecodesign requirements were applied for local air coolers as for air-conditioners, this type of appliances would be banned from the European market due to their lower efficiency.

However, from a perspective of overall energy consumption its lower cooling comfort and limited capacity can be an advantage, resulting in targeted use, i.e. only when indoor temperatures reach unacceptable values and only applied where there are people and equipment (e.g. computers).

Unlike the majority of split and multi-split room air conditioners, most local air coolers are cooling-only, i.e. there is no space heating function and no competition with other (e.g. more efficient but perhaps more expensive to purchase) forms of space heating in the Southern European climate zones.

The direct CO2 emissions (leakage) from the factory-sealed refrigerant connections are significantly lower than those of room air conditioners. The preparatory study estimates 1% versus 3-5% per year. Furthermore, the factory-sealed connections allow the use of alternative low-GWP refrigerants such as propane. All in all, from the point of view of overall carbon emissions, local air coolers show a more favourable profile than when only looking at energy efficiency. Finally, there is a significant potential for energy saving, if appropriate measures can trigger manufacturers to invest more in energy efficiency.

There is a significant potential for energy saving if appropriate measures can trigger manufacturers and consumers alike to invest more in energy efficiency. For the latest generation of 'water-air' spot coolers - using evaporative cooling to an extend[20] - energy efficiency ratios of close to 3,6 are claimed by the manufacturer. However, test procedures will have to be adapted to accommodate these types through a mandate to ESOs.

On the downside, in the Middle and Northern Europe, the installation of local air coolers, and thereby also their distribution through non-specialist commercial channels, such as DIY-

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20 Compare US 'swamp coolers' which are based solely on evaporative cooling, drawing water into cellulose pads and using the fan for evaporative cooling with reportedly significantly better energy efficiency and higher comfort than dry coil room air conditioners. On the downside swamp coolers cannot be used with 100% relative humidity inlet air (very humid and hot climates).

chains and warehouses, has lowered the threshold for purchase of these devises. In part this may also be due to their - not regulated - capacity as a dehumidifier and partly due to misunderstanding by the consumer about their functionality vis-à-vis split and multi-split room air conditioning appliances. This is why, apart from setting ambitious minimum energy efficiency requirements, it is necessary to set requirements as to the naming and language used in the packaging and technical documentation of these devices.

On top of the proposed eco-design and energy labelling requirements the Commission recommends complementary measures to be taken at national, regional and local authorities: in their public procurement procedures, they would be encouraged to require for these appliances the minimum energy efficiency values of the second introduction already from the beginning of this measure.

Ecodesign requirements

The EU market is a rather 'young', non-saturated, market, as it comes to the appliances covered by this working document, and there is a wide disparity of appliances on the market. Thus, ecodesign requirements can have an important impact on the environmental impact of these appliances, including in reducing the life cycle cost for consumer. A preliminary estimate of the authors of the preparatory study shows that measures proposed in this Working Document, followed by an ambitious review, may lead to an energy saving of **44** TWh/a electricity and **13** Mt CO2-equivalent emissions in 2020 with respect of the baseline (BaU). In 2025 projected savings are 50 TWh/a and 20 Mt respectively. With respect of the baseline these are savings of over 25%. In absolute terms, this means that despite double-digit annual growth rates the overall energy consumption will be contained.

Lot 10 preparatory study shows that energy consumption in the use-phase and carbon emissions (including standby energy consumption), noise and possible refrigerant leakages, are the main significant environmental aspects. Ecodesign parameters referred to in Annex I, Part 1 of Directive 2005/32/EC, are not considered as significant.

The main potential environmental impact from the use of refrigerants is due to possible refrigerant leakages and losses at the end of the product life, if the refrigerant is not recovered. As this issue is covered by the WEEE directive and by the EC Regulation 842/2006 on fluorinated gases, ecodesign requirements on refrigerants are only set in form of information requirements on equivalent carbon emissions in order to facilitate the avoidance of possible leakages.

Accordingly, the working document sets ecodesign requirements and benchmarks in form of minimum energy efficiency and noise requirements, including information requirements on relevant parameters, such as on disassembly, recycling or disposal at end-of-life end of life treatment.

In the EU Decision regarding Ecolabel criteria for heat pumps (CEC, 2007), energy efficiency targets are lowered by 15 % for units using low GWP (<150) refrigerants. The appropriateness of such an approach in the context of the energy label should be considered, as the impact of the approach varies depending on the type of appliances, mode of functioning (cooling, heating or reversible) and on the climate in which the appliance is used. It would also be necessary to consider possible trade-offs between more energy consumed vs. lower

GHG impact. However, e.g. propane-using LACs can already reach 7 % better energy efficiency than appliances with R410A at equal effort.

The Lot 10 preparatory study has shown that the proposed minimum energy efficiency requirements at LLCC levels allow cutting energy consumption of room air conditioners by about 40%, reversible air conditioning appliances by up to 45%, local air coolers by close to 60% in comparison with the base case. These levels lead to considerable reduction in least life cycle cost to the consumer across all appliances covered by this working document. The study also shows that there are no technical barriers to achieving these efficiency levels. The requirements are introduced in stages in order to allow the industry to adapt.

The preparatory study shows that it is necessary to include electric power consumption of auxiliary power modes into the total efficiency of the air conditioning appliances. For LACs and comfort fans, standby and off mode requirements will be set in line with the Ecodesign implementing Regulation on standby and off mode.

Lot 10 preparatory study did not identify needs to regulate, or make recommendations on, engineering or end-of-life treatment practices, nor were these recommendations made by stakeholders.

The preparatory study shows that installation and maintenance are of major importance for the efficiency of room air conditioning appliances and must be taken into account when defining and installing the system. No installation requirements are identified for the appliances themselves.

The appliances covered by this working document are mainly built with materials that are recyclable and that have a very high value (e.g. steel, aluminium, copper). Therefore the majority of materials of air conditioning appliances and local air coolers, and to a lesser degree of comfort fans, are recycled at the end-of-life.

As to the environmental impacts of refrigerants, the main potential impact is due to possible refrigerant leakages and losses at the end of the product life, if the refrigerant is not recovered. However, as this issue is covered by the WEEE directive and by the EC Regulation 842/2006 on fluorinated gases, ecodesign requirements on refrigerants are set in form of information requirements on equivalent carbon emissions.

Energy labelling requirements

The scope of the Energy Labelling Directive 92/75/EEC allows setting labelling schemes on household appliances. The preparatory study shows that energy labelling requirements should be set on room air conditioning appliances and on local air coolers. No such requirements are appropriate on comfort fans after having set ecodesign requirements.

On reversible air conditioning appliances, i.e. RACs with (also) a heating mode, two energy labels are proposed, one for cooling and one for heating. This is necessary in order to allow fair comparison of the heating mode with other heating appliances. The energy labelling classification of RACs has been harmonised with the hydronic heating appliances in Lot 1 (CH-Boilers), taking into account the different nature of the appliances both in heating comfort, capacity and - as appropriate - power generation.

The lower limits of energy labelling classes do not correspond with the levels of the minimum energy performance requirements. This allows setting the level of ambition of the ecodesign requirements higher independent from the scale of the energy labelling.

It is proposed to indicate the level of annual carbon emissions (CO2) on the label of the RACs (split and multi-split), as leakages could happen, when connected by installers. That is, as general rule, CO2 'emissions' of RACs are dissimilar from energy efficiency by a given percentage. A similar product could be commercial refrigerators that are also connected by installers. However, local air coolers, such as domestic refrigerators or freezers too, are factory sealed and leakages are negligible (*"hermetically sealed units"* as referred in the regulation 842 / 2006).

The calculation of the CO2 value depends on many variables. All preparatory studies use the assumption of one kWh emitting 0,43 kg of CO2 based on the MEEUP methodology, as approved by stakeholders. The annual refrigerant leak rates (3% for split and 5% for multi-split) and the emission rate of refrigerant at end of life (5% discounted over a 12-year life set) are a compromise value between various stakeholders proposed by the preparatory study (higher values proposed by e.g. CECED and lower by e.g. EPEE).

The proposed Energy Labelling implementing Directive repeals the Commission Directive 2002/31/EC as of two years after entry into force of the Regualtion. RACs and LACs, which comply with the provisions of this Directive and which are placed on the market or offered for sale, hire or hire-purchase before the entry into force of the requirements, shall be regarded as complying with the requirements of Directive 95/12/EC as of one year prior to the entry into force of the requirements.

In order to facilitate the transition from Directive 2002/31/EC to this new Directive, provisions should be made that RACs and LACs labelled in accordance with this new Directive should be considered as compliant with Directive 2002/31/EC as of one year prior to the entry into force of the requirements.

Auxiliary power modes and secondary functions

For *room air conditioning appliances*, minimum requirements on various auxiliary power modes, such as standby, off mode and crank case heater functions, are set so that the power consumption of all relevant auxiliary power modes are included into the minimum efficiency requirements on the performance of these appliances. The preparatory study shows that setting minimum power consumption requirements at the level of the total consumption of the appliance provides more flexibility for manufacturers to optimize the efficiency of the appliance for the benefit of the end-user.

For *local air coolers* and *comfort fans*, identical standby and off mode requirements are proposed as set in the Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment. The requirements on local air coolers are proposed to be introduced in conjunction with ecodesign requirements on these appliances in order to facilitate the re-design by manufacturers (a number of auxiliary power consumption modes need to be redesign). The requirements on comfort fans are proposed to be introduced in line with the implementing Regulation on standby and off mode electric power consumption of electrical and electronic household and office equipment; requirements on comfort fans do not involve major redesign.

All products in this Working Document are to be regulated for their energy efficiency in cooling and heating mode, as appropriate. However, as indicated in the product scope, the products may contain other features which are not regulated here, but may be subject to other current or future Ecodesign requirements. For instance, some comfort fans include a secondary function with lighting. These comfort fans must comply with the requirements set in the Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps.

Benchmarks

Given that the preparatory study identifies energy consumption in use as the only significant environmental impact benchmark for best product is set in terms of energy efficiency.

Measurement methods and calculation method

For room air conditioners seasonal efficiency (SEER, SCOP) and capacity (Pdesignc, Pdesignh) shall be tested in accordance with the Annex I, Annex II and good testing practice. Compared to Directive 2002/31/EC, which foresees a single test of the EER and SCOP at maximum output, the test and calculation methods proposed here are based on (at least) 4 tests per heating/cooling mode and climate, aggregated to a seasonal efficiency values. This gives more realistic results and is in line with international practice. The proposed SEER and SCOP values can not be compared with EER and COP results established under Directive 2002/31/EC. As a general rule for inverter operated RACs (most common type), SEER values for the cooling mode will be higher than the old EER values, whereas SCOP values for the heating mode will be lower than the old COP value.

For local air coolers, it was deemed acceptable to maintain efficiency (EER) and capacity assessment along the lines and capacities indicated in the Directive 2002/31/EC, i.e. using a single test at extreme cooling conditions. This can be justified from both the nature of their use and from the advantage of a direct comparison between old and new values that enables setting ambitious targets. For instance, the minimum requirement of the second introductory stage is set at the current 'A' class limit (EER 2,6) and new energy classes are added on top of the existing classes, going up to a level of EER 3,6.

Both for RACs and LACs, a mandate shall be issued to ESOs in order to allow incorporating the testing of the new more energy-efficient technologies (evaporative cooling, wet coil, etc.).

Market structure of the products covered

Total sales of RACs (split and multi-split) for domestic use are estimated at 5 million units in 2007. LACs stand for another 1,5 million annual unit sales. Both for RACs and LACs, unit sales in Europe have doubled over the last 7 years with average growth rate of over 8-10%. The EU-27 is a growth market for RACs and LACs compared to the rest of the world where the growth rate is roughly half (4%-5%) and market penetration is much higher. Europe currently represents around 10% of the global market in terms of unit sales and value of RACs. Two thirds of all room air conditioners and local air coolers are sold in four Member States, Spain, Italy, Greece and France.

There is hardly any production of RACs and LACs in the EU-27. On the supplier side, EU employment is mainly limited to commercial and logistic activities and research and development. Total supplier jobs in the EU are estimated to be less than 10-15.000. Main RAC brands are Japanese, South Korean and with a considerably smaller share US. EU RAC market leader is Daikin (Japanese). Main LAC brands are Italian and Chinese. Market leader is DeLonghi (IT). Also US brands have some market share in RACs. Most companies concentrate their production in China, where local manufacturers have also engaged in export of no-brand low-quality products to the EU.

Most important employment in the EU is in installation, servicing and retailing. Data are hard to come by, but a rough estimate is that these activities represent around 100.000 jobs, mainly by SMEs (small and medium-sized enterprises). Total employment in the EU-27, including supplier jobs, is estimated at 110-115.000 jobs. Outside the EU-27, an extra supplier 30-50.000 jobs may be involved working for the EU-27 market.

It is estimated that RACs and LACs represent a value of € 7 to 8 billion in product consumer prices, to which the value for installation, maintenance and retailing must be added. In total, the business activity (excluding) is estimated to represent € 15-20 billion (excluding the energy sector), of which around 10% is to be attributed to LACs.

The above is based on the situation in 2007. It does not take into account possible impacts of the present financial crisis.

For comfort fans, the preparatory study shows annual sales of about 29 million (2005) units and a stock of 176 million, with a peak value for sales in 2004 at 35 million units, the year after the heat wave. Due to the low price, comfort fan sales are subject to strong fluctuations depending on weather conditions. Although reliable figures are scarce, the available evidence suggests no EU-27 production of comfort fans. EU employment, mainly to be attributed to retail and trade, is like wise-expected to be limited to a few 1000 jobs. Economic value in consumer prices is considered to be in the order of € 1 to 2 billion.

Impact on other EU legislation

No impact of the proposed requirements has been identified on other EU legislation. The proposed ecodesign requirements will support the objective of the Energy Performance of Buildings Directive 2002/91/EC (EPBD) in helping to increase the efficiency of the building's cooling appliances.

The considered appliances will have to comply with other relevant EU legislation, such as Low Voltage Directive (LVD) 2006/95/EC, Electromagnetic compatibility Directive (EMC) 89/336/EEC and General Product Safety Directive (GPSD) 2001/95/EC.

As to heat pumps, it will be important to take into account the EU Decision regarding Ecolabel criteria for heat pumps (CEC, 2007), as appropriate.

Voluntary agreements

Eurovent started a certification scheme for air conditioners and local air coolers up to 12 kW cooling capacity in 2004. In the scheme, room air conditioners in Class G, as defined in the

Energy Labelling Directive 31/EC/2002, were eliminated from Eurovent Certification. Since then, no further action has been taken despite of initial intention to eliminate further classes from the Scheme. No further voluntary actions have been proposed to date. There are no voluntary agreements on comfort fans.

International dimension

The preparatory study shows that there is a wide disparity of appliances in terms of energy efficiency and that there are air conditioning appliances and local air coolers on the market that are considerably more efficient than A labelled appliances. The most ambitious minimum energy efficiency requirements in the world are above the A level.

On comfort fans, there is an Energy Star programme for residential ceiling fans since 2006. To be qualified as Energy Star, ceiling fans must meet several specification criteria regarding air flow efficiency, controls, minimum warranty and consumer information. Also, the Federal Trade Commission has published an appliance labeling rule with entry into force on 2009. Taiwan (2002) and India (1979) have energy rating or labeling on the basis of the fan diameter (not on the basis of the air flow rate) programs in place with lower requirements than those in the Energy Star.

China is the only country in the world with minimum energy performance requirements in place since 1989 on certain comfort fans with upgraded values applying from 2007. However, the electric consumption is considered as a function of the diameter of the fan in relation to motor output and not in function of the air flow rate of the fan (efficiency).