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of XXX

implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products, with regard to ecodesign requirements for air heating products, cooling products and high temperature process chillers

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THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products[1] and in particular Article 15(1) thereof,

After consulting the Ecodesign Consultation Forum,

Whereas:

(1) Pursuant to Directive 2009/125/EC, the Commission should set ecodesign requirements for energy-related products for which there are significant volumes of sales and trade, which have a significant effect on the environment and which offer significant potential for reducing this effect by improving their design, without creating excessive costs.

(2) Pursuant to Article 16(2)(a) of Directive 2009/125/EC, the Commission should, where appropriate, introduce implementing measures for products which offer significant potential for reducing greenhouse gas emissions in a cost-effective way, such as air heating products and cooling products. These implementing measures should be introduced in accordance with the procedure referred to in Article 19(3) of Directive 2009/125/EC and the criteria set out in Article 15(2) of the same Directive. The Commission should consult the Ecodesign Consultation Forum on the measures to be introduced.

(3) The Commission has carried out different preparatory studies covering the technical, environmental and economic characteristics of air heating products, cooling products and high temperature process chillers typically used in the EU. The studies were designed in conjunction with interested parties from EU and non-EU countries, and the results have been made publicly available.

(4) The characteristics of air heating products, cooling products and high temperature process chillers that have been identified as significant for the purposes of this Regulation are energy consumption and emissions of nitrogen oxides during use. Direct emissions from refrigerants and noise emissions were also identified as relevant.

(5) The preparatory studies show that it is not necessary to introduce requirements relating to the other ecodesign parameters referred to in Part 1 of Annex I to Directive

[1] OJ L 285, 31.10.2009, p. 10.

2009/125/EC in the case of air heating products, cooling products and high temperature process chillers.

(6) This Regulation should cover air heating products, cooling products and high temperature process chillers designed to use gaseous fuels, liquid fuels or electricity.

(7) As refrigerants are addressed under Regulation (EU) No 517/2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006[2] no specific requirements on refrigerants are therefore set in this Regulation. A bonus is, however, proposed under the ecodesign requirements for space cooling products, the aim of which is to steer the market towards using refrigerants that are less harmful to the environment. The bonus will mean that the minimum energy efficiency requirements for cooling products using low global warming potential (GWP) refrigerants are lower than for other cooling products. A similar bonus is not proposed for high temperature process chillers, as direct emissions account for not more than 2 % of combined direct and indirect emissions from the high temperature process chillers covered by this Regulation. Likewise, a bonus would not be appropriate for space heating products (heat pumps) using refrigerants with a GWP below 150, as, due to the longer operating hours over which heating products are typically in use compared to space cooling products, offering even a small bonus of 5 % would mean that products benefiting from a bonus would produce higher total greenhouse gas emissions than would products not awarded a bonus.

(8) Noise emissions for air heating products, cooling products and high temperature process chillers are also relevant. Nevertheless the environment where air heating products, cooling products and high temperature process chillers are installed has an impact on the maximum noise emissions that can be accepted. In addition, secondary measures can be taken in order to attenuate the impact of noise emissions. In consequence no minimum requirements are set regarding maximum noise emissions. Information requirements regarding sound power level are established.

(9) The combined annual energy consumption of air heating products, cooling products and high temperature process chillers in the EU was estimated at 2 477 PJ (59 Mtoe) per year for 2010, corresponding to 107 Mt of carbon dioxide emissions. Unless specific measures are taken, the annual energy consumption of air heating products, cooling products and high temperature process chillers is expected to reach 2 534 PJ (60 Mtoe) per year by 2030.

(10) The energy consumption of air heating products, cooling products and high temperature process chillers could be reduced, without increasing the combined cost of purchasing and operating these products, using existing, non-proprietary technologies.

(11) Total annual emissions of nitrogen oxides in the EU, primarily emitted by gas-fired warm air heaters, were estimated at 36 Mt SO_x equivalent per year for 2010 (expressed in terms of their contribution to acidification). These emissions are expected to fall to 22 Mt SO_x equivalent per year by 2030.

(12) Emissions from air heating products, cooling products and high temperature process chillers could be further reduced, without increasing the combined cost of purchasing and operating these products, using existing, non-proprietary technologies.

[2] OJ L 161, 14.6.2006, p. 1.

(13) The ecodesign requirements set out in this Regulation are expected to deliver annual energy savings of approximately 203 PJ (5 Mtoe), corresponding to 9 Mt of carbon dioxide emissions, by 2030.

(14) The ecodesign requirements set out in this Regulation are expected to annual reduce nitrogen oxides emissions by 2.6 Mt SO_x equivalent by 2030.

(15) Ecodesign requirements should harmonise the requirements relating to energy efficiency and nitrogen oxides emissions that apply to air heating products and cooling products throughout the EU. This will help to improve both the functioning of the single market and the environmental performance of the products concerned.

(16) The ecodesign requirements set out in this Regulation should not affect the functionality or affordability of air heating products, cooling products and high temperature process chillers for the end-user and should not have a detrimental effect on health, safety or the environment.

(17) Manufacturers should be given sufficient time to redesign their products so that they comply with this Regulation. This should be considered when setting the date from which the requirements are to apply. The timing should take account of the cost implications for manufacturers, in particular for small and medium-sized enterprises, while also ensuring that the objectives of this Regulation can be met by the target dates.

(18) Measurements of the relevant product parameters should be performed through reliable, accurate and reproducible measurement methods, which take into account the recognised state of the art measurement methods including, where available, harmonised standards adopted by the European standardisation organisations, as listed in Annex I to Regulation (EU) 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation[3].

(19) In accordance with Article 8(2) of Directive 2009/125/EC, this Regulation specifies which conformity assessment procedures apply.

(20) To facilitate compliance checks, manufacturers should provide information in the technical documentation referred to in Annexes IV and V to Directive 2009/125/EC insofar as that information relates to the requirements laid down in this Regulation.

(21) To further limit the environmental effects of air heating products, cooling products and high temperature process chillers, manufacturers should provide information on disassembly, recycling and/or disposal.

(22) In addition to the legally binding requirements laid down in this Regulation, indicative benchmarks for best available technologies should be identified to ensure that information on the environmental performance of air heating products, cooling products and high temperature process chillers is widely available and easily accessible.

(23) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19(1) of Directive 2009/125/EC,

[3] OJ L 316, 14.11.2012, p. 12.

HAS ADOPTED THIS REGULATION:

Article 1
Subject matter and scope

1. This Regulation establishes ecodesign requirements for the placing on the market and/or putting into service of:

   (a) air heating products with a rated heating capacity not exceeding 1 MW;

   (b) cooling products with a rated cooling capacity not exceeding 2 MW;

   (c) fan coil units; and

   (d) high temperature process chillers.

2. This Regulation shall not apply to products meeting at least one of the following criteria:

   (a) products covered by Commission Regulation (EU) No 2015/1188 with regard to ecodesign requirements for local space heaters[4];

   (b) products covered by Commission Regulation (EU) No 206/2012 with regard to ecodesign requirements for air conditioners and comfort fans[5];

   (c) comfort chillers and high temperature process chillers with leaving chilled water temperatures of less than + 2 ºC;

   (d) products designed for using predominantly biomass fuels;

   (e) products using solid fuels;

   (f) products that supply heat or cold in combination with electric power ('cogeneration') by means of a fuel combustion or conversion process;

   (g) products covered by Directive 2010/75/EU on industrial emissions[6];

   (h) high temperature process chillers exclusively using evaporative condensing;

   (i) custom-made high temperature process chillers assembled on site, made on a one-off basis;

   (j) high temperature process chillers in which refrigeration is effected by an absorption process that uses heat as the energy source; and

   (k) air heating and/or cooling products of which the primary function is the purpose of storing and merchandising perishable materials at specified temperatures by commercial, institutional or industrial facilities and of which space heating and/or space cooling is a secondary function and:

      (i) which are covered by Commission Regulation (EU) No 2015/1095 with regard to ecodesign requirements for professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers[7]; and

      (ii) for which the energy efficiency of the space heating and/or space cooling function is dependent on that of the primary function.

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4 OJ L 193, 21.7.2015, p. 76.
5 OJ L 72, 10.3.2012, p. 7.
6 OJ L 334, 17.12.2010, p. 17.
7 OJ L 177, 8.7.2015, p. 19..

Article 2

Definitions

The following definitions shall apply in addition to the definitions set out in Directive 2009/125/EC:

1. ‘air heating product’ means a device that:

   (a) incorporates or provides heat to an air-based heating system; and

   (b) is equipped with one or more heat generators.

   A heat generator designed for an air heating product and an air heating product housing designed to be equipped with such a heat generator shall, together, be considered as an air heating product;

2. ‘air-based heating system’ means the components and/or equipment necessary for the supply of heated air, by means of an air-moving device, either through ducting or directly into the heated space, where the purpose of the system is to attain and maintain the desired indoor temperature of an enclosed space, such as a building or parts thereof, for the thermal comfort of human beings;

3. ‘heat generator’ means the part of an air heating product that generates useful heat using one or more of the following processes:

   (a) the combustion of liquid or gaseous fuels;

   (b) the Joule effect, taking place in the heating elements of an electric resistance heating system;

   (c) by capturing heat from ambient air, water or ground heat source(s) and transferring this heat to the air-based heating system using a vapour compression cycle or a sorption cycle;

4. ‘cooling product’ means a device that:

   (a) incorporates, or provides chilled air or water to, an air-based cooling system or water-based cooling system, and

   (b) is equipped with one or more cold generator(s).

   A cold generator designed for use in a cooling product and a cooling product housing designed to be equipped with such a cold generator shall, together, be considered as a cooling product;

5. ‘air-based cooling system’ means the components or equipment necessary for the distribution of chilled air, through ducting or local cooling of air, in order to attain and maintain the desired indoor temperature of an enclosed space, such as a building or parts thereof, for the thermal comfort of human beings;

6. ‘water-based cooling system’ means the components or equipment necessary for the distribution of chilled water and the transfer of heat from indoor spaces to cold water, where the purpose of the system is to attain and maintain the desired indoor temperature of an enclosed space, such as a building or parts thereof, for the thermal comfort of human beings;

7. ‘cold generator’ means the part of a cooling product that generates a temperature difference allowing heat to be extracted from the heat source, the indoor space to be cooled, and transferred to a heat sink, such as ambient air, water or ground, using a vapour compression cycle or a sorption cycle;

8. ‘comfort chiller’ means a cooling product:

   (a) whose indoor heat exchanger (evaporator) extracts heat from a water-based cooling system (heat source), designed to operate at leaving chilled water temperatures greater than or equal to + 2 °C;

   (b) that is equipped with a cold generator; and

   (c) whose outdoor heat exchanger (condenser) releases this heat to ambient air, water or ground heat sink(s).;

9. ‘fan coil unit’ means a factory-made assembled device that provides forced circulation of air, for the purpose of one or more of heating, cooling, dehumidification and filtering of indoor air, for the thermal comfort of human beings, but which does not include the source of heating or cooling nor an outdoor heat exchanger. The device may be equipped with minimal ductwork to guide the intake and exit of air, including conditioned air. The product may be designed to be built in or may have an enclosure allowing it be placed in the space to be conditioned. It may include a Joule effect heat generator designed to be used as back-up heater only;

10. ‘high temperature process chiller’ means a product:

   (a) integrating at least one compressor, driven or intended to be driven by an electric motor, and at least one evaporator;

   (b) capable of cooling down and continuously maintaining the temperature of a liquid, in order to provide cooling to a refrigerated appliance or system, the purpose of which is not to provide cooling of a space for the thermal comfort of human beings;

   (c) that is capable of delivering its rated refrigeration capacity, at an indoor heat exchanger outlet temperature of 7 °C, at standard rating conditions;

   (d) that may or may not be integrate the condenser, the coolant circuit hardware or other ancillary equipment.

11. ‘rated refrigeration capacity’ (P) means the refrigeration capacity that the high temperature process chiller is able to reach, when operating at full load and measured at an inlet air temperature of 35ºC of air-cooled high temperature process chillers and at an inlet water temperature of 30ºC for water-cooled high temperature process chillers, expressed in kW;

12. ‘air-cooled high temperature process chiller’ means a high temperature process chiller, of which the heat transfer medium at the condensing side is air;

13. ‘water-cooled high temperature process chiller’ means a high temperature process chiller, of which the heat transfer medium at the condensing side is water or brine;

14. ‘biomass fuel’ means a fuel produced from biomass;

15. ‘biomass’ means the biodegradable part of products, waste and residues of biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, and the biodegradable fraction of industrial and municipal waste;

16. ‘solid fuel’ means a fuel which is solid at normal indoor room temperatures;

17. ‘rated heating capacity’ means the heating capacity of a heat pump when providing space heating at ‘standard rating conditions’ ($P_{rated,h}$), or the maximum nominal heat output (P_{nom}) of a warm air heater, expressed in kW;

18. ‘rated cooling capacity’ ($P_{rated,c}$) means the cooling capacity of a comfort chiller and/or air conditioner when providing space cooling at ‘standard rating conditions’, expressed in kW;

19. ‘standard rating conditions’ means the operating conditions of comfort chillers, air conditioners and heat pumps under which they are tested to determine their rated heating capacity, cooling capacity, sound power level and/or emissions of nitrogen oxides. For products using internal combustion engines, this is the engine rpm equivalent;

20. ‘leaving chilled water temperature’ means the temperature of the water leaving the chiller, expressed in degree Celsius.

For the purposes of the Annexes II to VII, additional definitions are set out in Annex I.

Article 3

Ecodesign requirements and timetable

1. The ecodesign requirements for air heating products, cooling products, fan coil units and high temperature chillers are set out in Annex II.

2. Each ecodesign requirement shall apply in accordance with the following timetable:

   (a) From 1 January 2018:

      (i) air heating products shall comply with the requirements set out in point (1) (a) and point (5) of Annex II;

      (ii) cooling products shall comply with the requirements set out in point (2) (a) and point (5) of Annex II;

      (iv) high temperature process chillers shall comply with the requirements set out in point (3) (a) and point (5) of Annex II;

      (iv) fan coil units shall comply with the requirements set out in point (5) of Annex II.

   (b) From 26 September 2018:

      (i) air heating products and cooling products shall comply with the requirements set out in point (4) (a) of Annex II.

   (c) From 1 January 2021:

      (i) air heating products shall comply with the requirements set out in point (1) (b) of Annex II;

      (ii) cooling products shall comply with the requirements set out in point (2) (b) of Annex II;

      (iii) high temperature process chillers shall comply with the requirements set out in point (3) (b) of Annex II;

      (iv) air heating products shall comply with the requirements set out in point (4) (b) of Annex II.

3. Compliance with ecodesign requirements shall be measured and calculated in accordance with the requirements set out in Annex III.

Article 4
Conformity assessment

Manufacturers shall be able to choose whether to use, for the conformity assessment procedure referred to in Article 8(2) of Directive 2009/125/EC, either the internal design control set out in Annex IV to that Directive or the management system set out in Annex V to that Directive.

Manufacturers shall provide the technical documentation containing the information set out in point 5(b) of Annex II to this Regulation.

Article 5
Verification procedure for market surveillance purposes

Member States' competent authorities shall apply the verification procedure set out in Annex IV to this Regulation when performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC, to ensure compliance with the requirements set out in Annex II to this Regulation.

Article 6
Benchmarks

The indicative benchmarks for classifying air heating products, cooling products and high temperature process chillers available on the market at the time of entry into force of this Regulation as 'best-performing' are set out in Annex V to this Regulation.

Article 7
Review

The Commission shall review this Regulation in the light of technological progress made in connection to air heating products, cooling products and high temperature process chillers. It shall present the results of this review to the Ecodesign Consultation Forum no later than 1 January 2022. The review shall include an assessment of the following aspects:

(a) the appropriateness of setting ecodesign requirements covering direct greenhouse gas emissions caused by refrigerants;

(b) the appropriateness of setting ecodesign requirements for high temperature process chillers using evaporative condensing and high temperature process chillers using absorption technology;

(c) the appropriateness of setting stricter ecodesign requirements for the energy efficiency and emissions of nitrogen oxides of air heating products, cooling products and high temperature process chillers;

(d) the appropriateness of setting ecodesign requirements for the noise emissions of air heating products, cooling products and high temperature process chillers;

(e) the appropriateness of setting emission requirements on the basis of useful heating or cooling capacity, instead of energy input; and

(f) for all products, the value of the tolerances for verification, as mentioned in the verification procedures set out in Annex IV.

Article 8

Derogation

1. Until 1 January 2018, Member States may allow the placing on the market and/or putting into service of air heating products, cooling products and high temperature process chillers that comply with their national provisions on seasonal energy efficiency in force at the time of the adoption of this Regulation.

2. Until 1 January 2018, Member States may allow the placing on the market and/or putting into service of high temperature process chillers that comply with their national provisions on seasonal energy performance ratio in force at the time of the adoption of this Regulation.

3. Until 26 September 2018, Member States may allow the placing on the market and/or putting into service of air heating products and cooling products that comply with their national provisions on emissions of nitrogen oxides in force at the time of the adoption of this Regulation.

Article 9

Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission
The President
Jean-Claude JUNCKER

Annex I
Definitions applicable for Annexes II to VII

In addition to the definitions set out in Directive 2009/125/EC, the following definitions shall apply:

Common definitions:

(1) 'conversion coefficient' (CC) means a coefficient reflecting the estimated 40 % average EU generation efficiency, as established in Annex IV of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency[8]; the value of the conversion coefficient shall be CC = 2,5;

(2) 'gross calorific value' (GCV) means the total amount of heat released by a unit quantity of fuel when it is burned completely with oxygen and when the products of combustion are returned to ambient temperature; this quantity includes the heat of condensation of any water vapour contained in the fuel and of the water vapour formed by the combustion of any hydrogen contained in the fuel;

(3) 'global warming potential' (GWP) means the climatic warming potential of a greenhouse gas relative to that of carbon dioxide (CO_2), calculated in terms of the 100-year warming potential of one kilogram of a greenhouse gas related to one kilogram of CO_2. GWP values considered are those set out in Annexes I, II and IV to Regulation (EU) No 517/2014[9]. GWP values for mixtures of refrigerants shall be based on the method presented in Annex IV of the Regulation (EU) No 517/2014;

(4) 'nominal air flow rate' means the air flow rate in m^3/h measured at the air outlet of indoor and/or outdoor units (if applicable) of chillers, air conditioners or heat pumps, and fan coils at standard rating conditions for cooling, or heating if the product has no cooling function;

(5) 'sound power level' (L_{WA}) means the A-weighted sound power level measured indoors and/or outdoors, at standard rating conditions, and expressed in dB;

(6) 'supplementary heater' means a heat generator of the air heating product that generates supplemental heat during conditions where the heating load exceeds the heating capacity of the preferred heat generator;

(7) 'preferred heat generator' means the heat generator of the air heating product that has the highest contribution in the total heat supplied over the heating season;

(8) 'seasonal space heating energy efficiency' ($\eta_{s,h}$) means the ratio between the reference annual heating demand pertaining to the heating season covered by an air heating product, and the annual energy consumption for heating, corrected by contributions accounting for temperature control and the electricity consumption of ground water pump(s), where applicable, expressed in %;

(9) 'seasonal space cooling energy efficiency' ($\eta_{s,c}$) means the ratio between the reference annual cooling demand pertaining to the cooling season covered by a cooling product, and the annual energy consumption for cooling, corrected by contributions accounting for temperature control and the electricity consumption of ground water pump(s), where applicable, expressed in %;

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[8] OJ L 315, 14.11.2012, p.1.

[9] OJ L 150, 20.5.2014, p. 217.

(10) ‘temperature control’ means equipment that interfaces with the end-user regarding the values and timing of desired indoor temperature and communicates relevant data, such as actual indoor and/or outdoor temperature(s), to an interface of the product such as a central processing unit, thus contributing to the regulation of the indoor temperature(s);

(11) ‘bin’ (bin_j) means a combination of an ‘outdoor temperature (T_j)’ and ‘bin hours (h_j)’, as set out in Annex III, Table 26, 27 and 28;

(12) ‘bin hours’ (h_j) means the hours per season, expressed in hours per year, at which an outdoor temperature occurs for each bin, as set out in Annex III, Table 26, 27 and 28;

(13) ‘indoor temperature’ (T_{in}) means the dry bulb indoor air temperature, expressed in degrees Celsius; the relative humidity may be indicated by a corresponding wet bulb temperature;

(14) ‘outdoor temperature’ (T_j) means the dry bulb outdoor air temperature, expressed in degrees Celsius; the relative humidity may be indicated by a corresponding wet bulb temperature;

(15) ‘capacity control’ means the ability of a heat pump, air conditioner, comfort chiller or high temperature process chiller to change its heating or cooling capacity by changing the volumetric flow rate of the refrigerant(s), to be indicated as ‘fixed’ if the volumetric flow rate cannot be changed, 'staged' if the volumetric flow rate is changed or varied in series of not more than two steps, or ‘variable’ if the volumetric flow rate is changed or varied in series of three or more steps;

(16) ‘degradation coefficient’ (C_d for air conditioners and heat pumps C_{dc} for comfort chillers and high temperature process chillers) means the measure of efficiency loss due to cycling of the product; if it is not determined by measurement then the default degradation coefficient shall be 0,25 for an air conditioner or heat pump, or 0,9 for a comfort or high temperature process chiller;

(17) 'nitrogen oxides emissions' means the sum of the emissions of nitrogen monoxide and nitrogen dioxide by air heating products or cooling products using gaseous or liquid fuels, and expressed in nitrogen dioxide, established while providing the rated heating capacity, expressed in mg/kWh in terms of GCV.

Definitions related to warm air heaters:

(18) ‘warm air heater’ means an air heating product that transfers the heat from a heat generator directly to air and incorporates or distributes this heat through an air-based heating system.

(19) ‘warm air heater using gaseous/liquid fuels’ means a warm air heater that uses a heat generator using the combustion of gaseous or liquid fuels;

(20) ‘warm air heater using electricity’ means a warm air heater that uses a heat generator using the Joule effect in resistance heating;

(21) ‘B_1 warm air heater’ means a warm air heater using gaseous/liquid fuels specifically designed to be connected to a natural draught flue that evacuates the residues of combustion to the outside of the room containing the B_1 warm air heater and for drawing the combustion air directly from the room; a type B_1 warm air heater is marketed as a B1 warm air heater only;

(22) ‘minimum capacity’ means the minimum heating capacity of the warm air heater (P_{min}), expressed in kW;

(23) ‘useful efficiency at rated heating capacity’ (η_{nom}) means the ratio of the rated heating capacity and the total energy input to achieve this heating capacity, expressed in %, whereby the total energy input is based on the GCV of the fuel if using gaseous/liquid fuels;

(24) ‘useful efficiency at minimum capacity’ (η_{pl}) means the ratio of the minimum capacity and the total energy input to achieve this heating capacity, expressed in %, whereby the total energy input is based on the GCV of the fuel;

(25) ‘seasonal space heating energy efficiency in active mode’ ($\eta_{s,on}$) means the seasonal thermal energy efficiency multiplied by the emission efficiency, expressed in %;

(26) ‘seasonal thermal energy efficiency’ ($\eta_{s,th}$) means the weighted average of the useful efficiency at rated heating capacity, and the useful efficiency at minimum capacity, including consideration of the envelope losses;

(27) ‘emission efficiency’ ($\eta_{s,flow}$) means a correction applied in the calculation of the seasonal space heating energy efficiency in active mode that takes into account the equivalent air flow of the heated air and the heating capacity;

(28) ‘envelope loss factor (F_{env})’ means the losses in seasonal space heating energy efficiency due to heat loss of the heat generator to areas outside the space to be heated, expressed in %;

(29) ‘auxiliary electricity consumption’ means the losses in seasonal space heating energy efficiency due to electric power consumption at rated heating capacity (el_{max}), at minimum capacity (el_{min}) and in standby mode (el_{sb}), expressed in %;

(30) ‘pilot flame losses’ means the losses in seasonal space heating energy efficiency caused by the ignition burner power consumption, expressed in %;

(31) ‘permanent pilot flame power consumption’ (P_{ign}) means the power consumption of a burner intended to ignite the main burner and that can only be extinguished by intervention of the user, expressed in W based on the GCV of the fuel;

(32) ‘vented flue losses’ means the losses in seasonal space heating energy efficiency during periods the main preferred generator is not active, expressed in %.

Definitions of heat pumps, air conditioners and comfort chillers:

(33) ‘heat pump’ means an air heating product:

(a) of which the outdoor heat exchanger (evaporator) extracts heat from ambient air, water, or ground heat sources,

(b) which has a heat generator that uses a vapour compression cycle or a sorption cycle,

(c) of which the indoor heat exchanger (condenser) releases this heat to an air-based heating system,

(d) which may be equipped with a supplementary heater;

(e) which may operate in reverse in which case it functions as an air conditioner.

(34) ‘air-to-air heat pump’ means a heat pump which has a heat generator that uses a vapour compression cycle driven by an electric motor or internal combustion engine and whereby the outdoor heat exchanger (evaporator) allows heat transfer from ambient air;

(35) ‘water/brine-to-air heat pump’ means a heat pump which has a heat generator that uses a vapour compression cycle driven by an electric motor or internal combustion engine and whereby the outdoor heat exchanger (evaporator) allows heat transfer from water or brine;

(36) ‘rooftop heat pump’ means an air-to-air heat pump, driven by an electric compressor, of which the evaporator, compressor and condenser are integrated into a single package;

(37) ‘sorption cycle heat pump’ means a heat pump which has a heat generator that uses a sorption cycle relying on external combustion of fuels and/or supply of heat;

(38) ‘multi-split heat pump’ means a heat pump incorporating more than one indoor units, one or more refrigerating circuit, one or more compressors and one or more outdoor units, where the indoor units may or may not be individually controlled;

(39) ‘air conditioner’ means a cooling product that provides in space cooling and:

(a) of which the indoor heat exchanger (evaporator) extracts heat from an air-based cooling system (heat source),

(b) which has a cold generator that uses a vapour compression cycle or a sorption cycle,

(c) of which the outdoor heat exchanger (condenser) releases this heat to ambient air, water or ground heat sink(s) and which may or may not include heat transfer that is based on evaporation of externally added water;

(d) may operate in reverse in which case it functions as a heat pump.

(40) ‘air-to-air air conditioner’ means an air conditioner which has a cold generator that uses a vapour compression cycle driven by an electric motor or internal combustion engine and whereby the outdoor heat exchanger (condenser) allows heat transfer to air;

(41) ‘water/brine-to-air air conditioner’ means an air conditioner which has a cold generator that uses a vapour compression cycle driven by an electric motor or internal combustion engine and whereby the outdoor heat exchanger (condenser) allows heat transfer to water or brine;

(42) ‘rooftop air conditioner’ means an air-to-air air conditioner, driven by an electric compressor, of which the evaporator, compressor and condenser are integrated into a single package;

(43) ‘multi-split air conditioner’ means an air conditioner incorporating more than one indoor units, one or more refrigeration circuits, one or more compressors and one or more outdoor units, where the indoor units may or may not be individually controlled;

(44) ‘sorption cycle air conditioner’ means an air conditioner which has a cold generator that uses a sorption cycle relying on external combustion of fuels and/or supply of heat;

(45) ‘air-to-water comfort chiller’ means a comfort chiller that has a cold generator that uses a vapour compression cycle driven by an electric motor or internal combustion engine and whereby the outdoor heat exchanger (condenser) allows heat transfer to air, including heat transfer that is based on evaporation into this air of externally added water;

(46) ‘water/brine-to-water comfort chiller’ means a comfort chiller that has a cold generator that uses a vapour compression cycle driven by an electric motor or internal combustion engine and whereby the outdoor heat exchanger (condenser) allows heat transfer to water or brine, excluding heat transfer that is based on evaporation of externally added water.

Definitions related to the calculation method for comfort chillers, air conditioners and heat pumps

(47) ‘reference design conditions’ means the combination of the ‘reference design temperature’, the maximum ‘bivalent temperature’ and the maximum ‘operation limit temperature’, as set out in Annex III, Table 24;

(48) ‘reference design temperature’ means the ‘outdoor temperature’ for either cooling ($T_{design,c}$) or heating ($T_{design,h}$) as described in Annex III, Table 24, at which the ‘part load ratio’ is equal to 1 and which varies according to the cooling or heating season, expressed in degrees Celsius;

(49) ‘bivalent temperature’ (T_{biv}) means the outdoor temperature (T_j) declared by the manufacturer at which the declared heating capacity equals the part load for heating and below which the declared heating capacity has to be supplemented with electric back-up heater capacity in order to meet the part load for heating, expressed in degrees Celsius;

(50) ‘operation limit temperature’ (T_{ol}) means the outdoor temperature declared by the manufacturer for heating, below which the heat pump will not be able to deliver any heating capacity and the declared heating capacity is equal to zero, expressed in degrees Celsius;

(51) ‘part load ratio’ ($pl(T_j)$) means the 'outdoor temperature' minus 16ºC, divided by the ‘reference design temperature’ minus 16ºC, for either space cooling or space heating;

(52) ‘season’ means a set of ambient conditions, designated as either a heating season or a cooling season, describing per bin the combination of outdoor temperatures and bin hours pertaining to that season;

(53) ‘part load for heating’ ($Ph(T_j)$) means the heating load at a specific outdoor temperature, calculated as the design heating load multiplied by the part load ratio and expressed in kW;

(54) ‘part load for cooling’ ($Pc(T_j)$) means the cooling load at a specific outdoor temperature, calculated as the design cooling load multiplied by the part load ratio and expressed in kW;

(55) ‘seasonal energy efficiency ratio’ (SEER) is the overall energy efficiency ratio of the air conditioner or chiller, representative for the cooling season, calculated as the ‘reference annual cooling demand’ divided by the ‘annual energy consumption for cooling’;

(56) ‘seasonal coefficient of performance’ (SCOP) is the overall coefficient of performance of a heat pump using electricity, representative of the heating season, calculated as the reference annual heating demand divided by the ‘annual energy consumption for heating’;

(57) ‘reference annual cooling demand’ (Q_C) means the reference cooling demand to be used as basis for calculation of SEER and calculated as the product of the design

cooling load ($P_{design,c}$) and the equivalent active mode hours for cooling (H_{CE}), expressed in kWh;

(58) 'reference annual heating demand' (Q_H) means the reference heating demand, and pertaining to a designated heating season, to be used as basis for calculation of SCOP and calculated as the product of the design heating load ($P_{design,h}$) and the annual equivalent active mode hours (H_{HE}), expressed in kWh;

(59) 'annual energy consumption for cooling' (Q_{CE}) means the energy consumption required to meet the 'reference annual cooling demand' and is calculated as the 'reference annual cooling demand' divided by the 'active mode seasonal energy efficiency ratio' ($SEER_{on}$) and the electricity consumption of the unit for thermostat off-, standby-, off- and crankcase heater-mode during the cooling season, expressed in kWh;

(60) 'annual energy consumption for heating' (Q_{HE}) means the energy consumption required to meet the 'reference annual heating demand' pertaining to a designated heating season, and is calculated as the 'reference annual heating demand' divided by the 'active mode seasonal coefficient of performance' ($SCOP_{on}$) and the electricity consumption of the unit for thermostat off-, standby-, off- and crankcase heater-mode during the heating season expressed in kWh;

(61) 'equivalent active mode hours for cooling' (H_{CE}) means the assumed annual number of hours the unit must provide the 'design cooling load' ($P_{designc}$) in order to satisfy the 'reference annual cooling demand', expressed in hours;

(62) 'equivalent active mode hours for heating' (H_{HE}) means the assumed annual number of hours a heat pump air heater has to provide the design heating load to satisfy the reference annual heating demand, expressed in hours;

(63) 'active mode seasonal energy efficiency ratio' ($SEER_{on}$) means the average energy efficiency ratio of the unit in active mode for the cooling function, constructed from part load and bin-specific energy efficiency ratios ($EER_{bin}(T_j)$) and weighted by the bin hours the bin condition occurs;

(64) 'active mode seasonal coefficient of performance' ($SCOP_{on}$) means the average coefficient of performance of the heat pump in active mode, for the heating season, constructed from the part load, electric back up heating capacity (where required) and bin-specific coefficients of performance ($COP_{bin}(T_j)$) and weighted by the bin hours the bin condition occurs;

(65) 'bin-specific coefficient of performance' ($COP_{bin}(T_j)$) means the coefficient of performance of the heat pump for every bin_j with outdoor temperature T_j in a season, derived from the part load, declared capacity and declared coefficient of performance ($COP_d(T_j)$) and calculated for other bins through inter/extrapolation, when necessary corrected by the applicable degradation coefficient;

(66) 'bin-specific energy efficiency ratio' ($EER_{bin}(T_j)$) means the energy efficiency ratio specific for every bin_j with outdoor temperature T_j in a season, derived from the part load, declared capacity and declared energy efficiency ratio ($EER_d(T_j)$) and calculated for other bins through inter/extrapolation, when necessary corrected by the applicable degradation coefficient;

(67) 'declared heating capacity' ($Pdh(T_j)$) means the heating capacity of the vapour compression cycle of a heat pump, pertaining to an outdoor temperature T_j and indoor temperature (T_{in}), as declared by the manufacturer, expressed in kW;

(68) ‘declared cooling capacity’ ($Pdc(T_j)$) means the cooling capacity of the vapour compression cycle of the air conditioner or comfort chiller, pertaining to an outdoor temperature (T_j) and indoor temperature (T_{in}), as declared by the manufacturer, expressed in kW

(69) ‘design heating load’ ($P_{design,h}$) means the heating load applied to a heat pump at the reference design temperature, whereby the design heating load ($P_{design,h}$) is equal to the part load for heating with outdoor temperature (T_j) equal to reference design temperature ($T_{design,h}$), expressed in kW;

(70) ‘design cooling load’ ($P_{design,c}$) means the cooling load applied to a chiller or air conditioner at the reference design conditions, whereby the design cooling load ($P_{design,c}$) is equal to declared cooling capacity at outdoor temperature (T_j) equal to reference design temperature for cooling ($T_{design,c}$), expressed in kW

(71) ‘declared coefficient of performance’ ($COP_d(T_j)$) means the coefficient of performance at a limited number of specified bins (j) with outdoor temperature (Tj);

(72) ‘declared energy efficiency ratio’ ($EER_d(T_j)$ means the energy efficiency ratio at a limited number of specified bins (j) with outdoor temperature (T_j);

(73) ‘electric back-up heating capacity’ ($elbu(T_j)$) is the heating capacity of a real or assumed supplementary heater with a COP of 1 that supplements the declared heating capacity ($Pdh(T_j)$) in order to meet the part load for heating ($Ph(T_j)$) in case $Pdh(T_j)$ is less than $Ph(T_j)$, for the outdoor temperature (T_j), expressed in kW;

(74) ‘capacity ratio’ means the part load for heating $P_h(T_j)$ divided by the declared heating capacity $P_{dh}(T_j)$ or the part load for cooling $P_c(T_j)$ divided by the declared cooling capacity $P_{dc}(T^J)$;

Operating modes for calculation of seasonal space heating or cooling energy efficiency of air heating products and cooling products:

(75) ‘active mode’ means the mode corresponding to the hours with a cooling or heating load of the building and whereby the cooling or heating function of the unit is activated. This condition may involve on/off-cycling of the unit in order to reach or maintain a required indoor air temperature;

(76) ‘standby mode’ means a condition where the warm air heater, comfort chiller, air conditioner or heat pump 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;

(77) ‘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;

(78) ‘information or status display’ is a continuous function providing information or indicating the status of the equipment on a display, including clocks;

(79) ‘off mode’ means a condition in which the comfort chiller, air conditioner or heat pump is connected to the mains power source and is not providing any function. Also considered as 'off mode' are conditions providing only an indication of 'off mode' condition, as well as conditions providing only functionalities intended to ensure

electromagnetic compatibility pursuant to Directive 2004/108/EC of the European Parliament and of the Council[10];

(80) 'thermostat-off mode' means the condition corresponding to the hours with no cooling or heating load, whereby the cooling or heating function is switched on but the unit is not operational; cycling in active mode is not considered as thermostat-off mode;

(81) 'crankcase heater mode' means the condition in which the unit has activated a heating device to avoid the refrigerant migrating to the compressor to limit the refrigerant concentration in oil at compressor start;

(82) 'off mode power consumption' (P_{OFF}) means the power consumption of unit in off mode, expressed in kW;

(83) 'thermostat-off mode power consumption' (P_{TO}) means the power consumption of the unit while in thermostat-off mode, expressed in kW;

(84) 'standby mode power consumption' (P_{SB}) means the power consumption of the unit while in standby mode, expressed in kW;

(85) 'crankcase heater mode power consumption' (P_{CK}) means the power consumption of the unit while in crankcase heater mode, expressed in kW;

(86) 'off mode operating hours' (H_{OFF}) means the annual number of hours [hrs/a] the unit is considered to be in off-mode, the value of which depends on the designated season and function;

(87) 'thermostat-off mode operating hours' (H_{TO}) means the annual number of hours [hrs/a] the unit is considered to be in thermostat-off mode, the value of which depends on the designated season and function;

(88) 'standby mode operating hours' (H_{SB}) means the annual number of hours [hrs/a] the unit is considered to be in standby mode, the value of which depends on the designated season and function;

(89) 'crankcase heater mode operating hours' (H_{CK}) means the annual number of hours [hrs/a] the unit is considered to be in crankcase heater operation mode, the value of which depends on the designated season and function;

Definitions related to the calculation method for air conditioners, comfort chillers and heat pumps using fuels

(90) 'seasonal primary energy ratio in cooling mode' ($SPER_c$) means the overall energy efficiency ratio of the air conditioner or comfort chiller using fuels, representative for the cooling season;

(91) 'seasonal gas utilization efficiency in cooling mode' ($SGUE_c$) means the gas utilization efficiency for the whole cooling season;

(92) 'gas utilization efficiency at partial load' means the gas utilization efficiency when cooling ($GUE_{c,bin}$) or heating ($GUE_{h,bin}$) at outdoor temperature T_j;

(93) 'gas utilization efficiency at declared capacity' means the gas utilization efficiency when cooling (GUE_{cDC}) or heating (GUE_{hDC}) at part load conditions as defined in Annex III, Table 21, and corrected for possible cycling behaviour of the unit, in case

[10] OJ L 390, 31.12.2004, p.24.

the effective cooling capacity (Q_{Ec}) exceeds the cooling load ($P_c(T_j)$) or the effective heating capacity (Q_{Eh}) exceeds the heating load ($P_h(T_j)$);

(94) 'effective cooling capacity' (Q_{Ec}) means the measured cooling capacity corrected for the heat from the device (pump(s) or fan(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger, expressed in kW;

(95) 'effective heat recovery capacity' means the measured heat recovery capacity corrected for the heat from the device (pump(s)) of the heat recovery circuit for cooling ($Q_{Ehr,c}$) or heating ($Q_{Ehr,h}$), expressed in kW;

(96) 'measured heat input for cooling' (Q_{gmc}) means the measured fuel input at part load conditions as defined in Annex III, Table 21, expressed in kW;

(97) 'seasonal auxiliary energy factor in cooling mode' ($SAEF_c$) means the auxiliary energy efficiency for the cooling season, including the contribution of low power modes;

(98) 'reference annual cooling demand' (Q_C) means the annual cooling demand, calculated as the design cooling load ($P_{design,c}$) multiplied by the equivalent active mode hours for cooling (H_{CE});

(99) 'seasonal auxiliary energy factor in cooling mode in active mode' ($SAEF_{con}$) means the auxiliary energy efficiency for the cooling season, excluding the contribution of low power modes;

(100) 'auxiliary energy factor in cooling mode at partial load' ($AEF_{c,bin}$) means the auxiliary energy efficiency when cooling at outdoor temperature (T_j);

(101) 'electric power input in cooling mode' (P_{Ec}) means the effective cooling electrical power input, in kW;

(102) 'seasonal primary energy ratio in heating mode' ($SPER_h$) means the overall energy efficiency ratio of the heat pump using fuels, representative for the heating season;

(103) 'seasonal gas utilization efficiency in heating mode' ($SGUE_h$) means the gas utilization efficiency for the heating season;

(104) 'effective heating capacity' (Q_{Eh}) means the measured heating capacity corrected for the heat from the device (pump(s) or fan(s)) responsible for circulating the heat transfer medium through the indoor heat exchanger, expressed in kW;

(105) 'measured heat input for heating' (Q_{gmh}) means the measured fuel input at part load conditions as defined in Annex III Table 21, expressed in kW;

(106) 'seasonal auxiliary energy factor in heating mode' ($SAEF_h$) means the auxiliary energy efficiency for the heating season, including the contribution of low power modes;

(107) 'reference annual heating demand' (Q_H) means the annual heating demand, calculated as the design heating load multiplied by the annual equivalent active mode hours for heating (H_{HE});

(108) 'seasonal auxiliary energy factor in heating mode in active mode' ($SAEF_{h,on}$) means the the auxiliary energy efficiency for the heating season, excluding the contribution of low power modes;

(109) 'auxiliary energy factor in heating mode at partial load' ($AEF_{h,bin}$) means the auxiliary energy efficiency when heating at outdoor temperature T_j;

(110) 'auxiliary energy factor at declared capacity' means the auxiliary energy factor when cooling ($AEF_{c,dc}$) or heating ($AEF_{h,dc}$) at part load conditions as defined in Annex III, Table 21, and corrected for possible cycling behaviour of the unit, in case the effective cooling capacity (Q_{Ec}) exceeds the cooling load ($P_c(T_j)$) or the effective heating capacity (Q_{Eh}) exceeds the heating load ($P_h(T_j)$);

(111) 'electric power input in heating mode' (P_{Eh}) means the effective heating electrical power input, in kW;

(112) 'NO_x emissions of heat pumps, comfort chillers and air conditioners with an internal combustion engine' means the emissions of the sum of nitrogen monoxide and nitrogen dioxide emissions, of heat pumps, comfort chillers and air conditioners with an internal combustion engine, measured at standard rating conditions, using engine rpm equivalent, expressed in mg nitrogen dioxide per kWh fuel input in terms of GCV;

(113) 'engine rpm equivalent' ($Erpm_{equivalent}$) means the revolutions per minute of the internal combustion engine calculated on the basis of an engine rpm at 70, 60, 40 and 20 % part load ratios for heating (or cooling if no heating function is offered) and weighing factors of 0.15, 0.25, 0.30 and 0.30 respectively;

Definitions related to high temperature process chillers

(114) 'rated power input' (D_A) means the electrical power input which is needed by the high temperature process chiller (including the compressor, the condenser fan(s) or pumps(s), the evaporator pump(s) and possible auxiliaries) to reach the rated refrigeration capacity, expressed in kW to two decimal places;

(115) 'rated energy efficiency ratio' (EER_A) means the rated refrigeration capacity, expressed in kW divided by the rated power input, expressed in kW, expressed to two decimal places;

(116) 'seasonal energy performance ratio' (SEPR) is the efficiency ratio of a high temperature process chiller at standard rating conditions, representative of the variations in load and ambient temperature throughout the year, and calculated as the ratio between the annual refrigeration demand and the annual electricity consumption;

(117) 'annual refrigeration demand' means the sum of each bin-specific refrigeration multiplied by the corresponding number of bin hours;

(118) 'refrigeration load' means the rated refrigeration capacity multiplied by the part load ratio of high temperature process chillers, expressed in kW to two decimal places;

(119) 'part load' ($P_C(T_j)$) means the refrigeration load at a specific ambient temperature (T_j), calculated as the full load multiplied by the part load ratio of high temperature process chillers corresponding to the same ambient temperature T_j and expressed in kW at two decimal places;

(120) 'part load ratio of high temperature process chillers' ($P_R(T_j)$) means :

(a) for high temperature process chillers using air-cooled condensing, the ambient temperature Tj minus 5 ºC divided by the reference ambient temperature minus 5 ºC multiplied by 0.2 and added to 0.8. For ambient temperatures higher than the reference ambient temperature, the part load ratio of high temperature process chillers shall be 1. For ambient temperatures lower than 5°C, the part load ratio of high temperature process chillers shall be 0.8;

(b) for high temperature process chillers using water-cooled condensing, the water inlet temperature (water inlet to condenser) minus 9°C divided by the reference ambient temperature of the water inlet to condenser (30ºC) minus 9°C, and multiplied by 0,2 and added to 0,8. For ambient temperatures (water inlet to condenser) higher than the reference ambient temperature, the part load ratio of high temperature process chillers shall be 1. For ambient temperatures lower than 9°C (water inlet to condenser), the part load ratio of high temperature process chillers shall be 0.8;

(c) which can be expressed to three decimal places or in percentage, after multiplying by 100, at one decimal place;

(121) 'annual electricity consumption' is calculated as the sum of the ratios between each bin-specific cooling demand and the corresponding bin-specific energy efficiency ratio, multiplied by the corresponding number of bin hours;

(122) 'ambient temperature' means:

(a) for high temperature process chillers using air-cooled condensing, the air dry bulb temperature, expressed in degrees Celsius;

(b) for high temperature process chillers using water-cooled condensing, the water inlet temperature at the condenser, expressed in degrees Celsius;

(123) 'reference ambient temperature' means the ambient temperature, expressed in degrees Celsius, at which the part load ratio of high temperature process chillers is equal to 1. It shall be set at 35°C. For air-cooled high temperature process chillers, the air inlet temperature to the condenser is defined as 35ºC while for water-cooled high temperature process chillers the water inlet temperature to the condenser is defined as 30ºC with 35°C outdoor air temperature to the condenser;

(124) 'energy efficiency ratio at part load' ($EER_{PL}(T_j)$) means the energy efficiency ratio for every bin in the year, derived from the declared energy efficiency ratio (EER_{DC}) for specified bins and calculated for other bins by linear interpolation;

(125) 'declared refrigeration demand means the refrigeration load at specified bin conditions, and calculated as the rated refrigeration capacity multiplied by the corresponding part load ratio of high temperature process chillers;

(126) 'declared energy efficiency ratio' (EER_{DC}) means the energy efficiency ratio of the high temperature process chiller at a specific rating point, corrected where necessary by the degradation coefficient if the minimum declared refrigeration capacity exceeds the refrigeration load or interpolated if the nearest declared refrigeration capacities lie above and below the refrigeration load;

(127) 'declared power input' means the electrical power input needed by the high temperature process chiller to meet the declared refrigeration capacity at a specific rating point;

(128) 'declared refrigeration capacity' means the refrigeration capacity delivered by the high temperature process chiller to meet the declared refrigeration demand at a specific rating point.

Definitions related to fan coil units:

(129) 'total electric power input' (P_{elec}) means the total electric power absorbed by the unit, including fan(s) and auxiliary devices;

Annex II
Ecodesign requirements

1) Seasonal space heating energy efficiency of air heating products:

   a) From 1 January 2018 the seasonal space heating energy efficiency of air heating products shall not fall below the values in Table 1;

Table 1

First tier minimum seasonal space heating energy efficiency of air heating products, expressed in %

Warm air heater using fuels except B_1 warm air heaters	72
B_1 warm air heaters	68
Warm air heater using electricity	30
Air-to-air heat pump, driven by an electric motor, except rooftop heat pump	133
Rooftop heat pump	115
Air-to-air heat pump, driven by an internal combustion engine	120

   b) From 1 January 2021 the seasonal space heating energy efficiency of air heating products shall not fall below the values in Table 2;

Table 2

Second tier minimum seasonal space heating energy efficiency of air heating products, expressed in %

Warm air heater using fuels except B_1 warm air heaters	78
Warm air heater using electricity	32
Air-to-air heat pump, driven by an electric motor, except rooftop heat pump	137
Rooftop heat pump	125
Air-to-air heat pump, driven by an internal combustion engine	130

2) Seasonal space cooling energy efficiency of cooling products:

   a) From 1 January 2018 the seasonal space cooling energy efficiency of cooling products shall not fall below the values in Table 3;

Table 3

First tier minimum seasonal space cooling energy efficiency of cooling products, expressed in %

	GWP > 150	GWP ≤ 150
Air-to-water chillers with rated cooling capacity < 400 kW, when driven by an electric motor	149	134
Air-to-water chillers with rated cooling capacity ≥ 400 kW when driven by an electric motor	161	145
Water/brine to-water chillers with rated cooling capacity < 400 kW when driven by an electric motor	196	179
Water/brine to-water chillers with ≥400 kW rated cooling capacity < 1500 kW when driven by an electric motor	227	204
Water/brine to-water chillers with rated cooling capacity ≥ 1500 kW when driven by an electric motor	245	220
Air-to-water comfort chillers, when driven by an internal combustion engine	144	130
Air-to-air air conditioners, driven by an electric motor, except rooftop air conditioners	181	163

Rooftop air conditioners	117	105
Air-to-air air conditioners, driven by an internal combustion engine	157	141

b) From 1 January 2021 the seasonal space cooling energy efficiency of cooling products shall not fall below the values in Table 4;

Table 4

Second tier minimum seasonal space cooling energy efficiency of cooling products, expressed in %

	GWP > 150	GWP < 150
Air-to-water chillers with rated cooling capacity < 400 kW, when driven by an electric motor	161	145
Air-to-water chillers with rated cooling capacity ≥ 400 kW when driven by an electric motor	185	167
Water/brine to-water chillers with rated cooling capacity < 400 kW when driven by an electric motor	200	180
Water/brine to-water chillers with ≥400 kW rated cooling capacity < 1500 kW when driven by an electric motor	252	227
Water/brine to-water chillers with rated cooling capacity ≥ 1500 kW when driven by an electric motor	272	245
Air-to-water chillers with rated cooling capacity ≥ 400 kW, when driven by an internal combustion engine	154	139
Air-to-air air conditioners, driven by an electric motor, except rooftop air conditioners	189	170
Rooftop air conditioners	138	124
Air-to-air air conditioners, driven by an internal combustion engine	167	150

3) Seasonal energy performance ratio of high temperature process chillers:

a) From 1 January 2018 the seasonal energy performance ratio of high temperature process chillers shall not fall below the values in Table 5;

Table 5

First tier seasonal energy performance ratio of high temperature process chillers, expressed in %

Heat transfer medium at the condensing side	Rated refrigeration capacity	Minimum SEPR value
Air	P_A < 400 kW	4.5
	$P_A \geq$ 400 kW	5.0
Water	P_A < 400 kW	6.5
	400 kW ≤ P_A < 1500 kW	7.5
	$P_A \geq$ 1500 kW	8.0

b) From 1 January 2021 the seasonal energy performance ratio of high temperature process chillers shall not fall below the values in Table 6

Table 6

Second tier seasonal energy performance ratio of high temperature process chillers, expressed in %

Heat transfer medium at the condensing side	Rated refrigeration capacity	Minimum SEPR value
Air	P_A < 400 kW	5.0
	$P_A \geq$ 400 kW	5.5
Water	P_A < 400 kW	7.0
	400 kW ≤ P_A < 1500 kW	8.0

	$P_A \geq 1500$ kW	8.5

4) Emissions of nitrogen oxides:

a) From 26 September 2018 the emissions of nitrogen oxides, expressed in nitrogen dioxide, of warm air heaters, heat pumps, comfort chillers and air conditioners shall not exceed values in Table 7:

Table 7

First tier maximum nitrogen oxides emissions, expressed in mg/kWh fuel input in terms of GCV

Warm air heaters using gaseous fuels	100
Warm air heaters using liquid fuels	180
Heat pumps, comfort chillers and air conditioners, equipped with external combustion engines using gaseous fuels	70
Heat pumps, comfort chillers and air conditioners, equipped with external combustion engines using liquid fuels	120
Heat pumps, comfort chillers and air conditioners, equipped with internal combustion engines using gaseous fuels	240
Heat pumps, comfort chillers and air conditioners, equipped with internal combustion engines using liquid fuels	420

b) From 1 January 2021 the emissions of nitrogen oxides, expressed in nitrogen dioxide, of warm air heaters shall not exceed values in Table 8:

Table 8

Second tier maximum nitrogen oxides emissions, expressed in mg/kWh fuel input in terms of GCV

Warm air heaters using gaseous fuels	70
Warm air heaters using liquid fuels	150

5) Product information:

a) From 1 January 2018 the instruction manuals for installers and end-users, and free access websites of manufacturers, their authorised representatives and importers shall provide the following product information:

(1) For warm air heaters, the information set out in Table 9 of this Annex, measured and calculated in accordance with Annex III;

(2) For comfort chillers, the information set out in Table 10 of this Annex, measured and calculated in accordance with Annex III;

(3) For air-to-air air conditioners, the information set out in Table 11 of this Annex, measured and calculated in accordance with Annex III;

(4) For water/brine-to-air air conditioners, the information set out in Table 12 of this Annex, measured and calculated in accordance with Annex III;

(5) For fan coil units, the information set out in Table 13 of this Annex, measured and calculated in accordance with Annex III;

(6) For heat pumps, the information set out in Table 14 of this Annex, measured and calculated in accordance with Annex III;

(7) For high temperature process chillers, the information set out in Table 15 of this Annex, measured and calculated in accordance with Annex III

(8) Any specific precautions that must be taken when the product is assembled, installed or maintained;

(9) For heat generators or cold generators designed for air heating or cooling products, and air heating or cooling product housings to be equipped with such heat or cold generators, their characteristics, the requirements for assembly, to ensure compliance with the ecodesign requirements for air heating or cooling products and, where appropriate, the list of combinations recommended by the manufacturer;

(10) For multi-split heat pumps and multi-split air conditioners, a list of appropriate indoor units;

(11) For B_1 warm air heaters the following standard text: 'This warm air heater is intended to be connected only to a flue shared between multiple dwellings in existing buildings. Due to a lower efficiency, any other use of this warm air heater shall be avoided and would result in higher energy consumption and higher operating costs'.

(12) Information relevant for disassembly, recycling and/or disposal at end-of-life.

b) The technical documentation for the purposes of conformity assessment pursuant to Article 4 shall contain the following elements:

i) the elements specified in point (a);

ii) where the information relating to a specific model has been obtained by calculation on the basis of design, and/or extrapolation from other combinations, the technical documentation shall include details of such calculations and/or extrapolations, and of tests undertaken to verify the accuracy of the calculations undertaken, including details of the mathematical model for calculating performance of such combinations, and of measurements taken to verify this model, and a list of any other products where the information included in the technical documentation was obtained on the same basis.

c) The manufacturer or comfort chillers, air-to-air and water/brine-to-air air conditioners, heat pumps and high temperature process chillers shall provide laboratories performing market surveillance checks, upon request, the necessary information on the setting of the unit, as applied for the establishment of declared capacities, SEER/EER, SCOP/COP, SEPR/COP values where applicable and service values and provide contact information for obtaining such information.

Table 9

Information requirements for warm air heaters

Information to identify the model(s) to which the information relates to:							
Item	Symbol	Value	Unit	Item	Symbol	Value	Unit
Capacity				Useful efficiency			
Rated heating capacity	$P_{ated,h}$	x,x	kW	Useful efficiency at rated heating capacity*	η_{nom}	x,x	%
Minimum capacity	P_{min}	x,x	kW	Useful efficiency at minimum capacity*	η_{pl}	x,x	%
Electric power consumption*				Other items			
At rated heating capacity	el_{max}	x,x	kW	Envelope loss factor	F_{env}	x,x	%
At minimal capacity	el_{min}	x,x	kW	Ignition burner power consumption *	P_{ign}	x,x	kW
In standby mode	el_{sb}	x,x	kW	Emissions of nitrogen oxides *	NO_x	x	mg/kWh input energy (GCV)
				Emission efficiency	$\eta_{s,flow}$		%
				Seasonal space heating energy efficiency	$\eta_{s,h}$	x,x	%
* not required for electric warm air heaters							
Contact details	Name and address of the manufacturer or of its authorised representative.						

Table 10

Information requirements for comfort chillers

Model(s): Information to identify the model(s) to which the information relates to:								
Outdoor heat exchanger of chiller: [select which: air or water/brine]								
Indoor heat exchanger chiller: [default: water]								
Type: compressor driven vapour compression or sorption process								
if applicable: driver of compressor: [electric motor or fuel driven]								
Item	Symbol	Value	Unit		Item	Symbol	Value	Unit
Rated cooling capacity	$P_{rated,c}$	x,x	kW		Seasonal space cooling energy efficiency	$\eta_{s,c}$	x,x	%
Declared cooling capacity for part load at given outdoor temperatures T_j					Declared energy efficiency ratio or gas utilization efficiency / auxiliary energy factor for part load at given outdoor temperatures T_j			
T_j = +35 ºC	Pdc	x,x	kW		T_j = +35 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
T_j = + 30 ºC	Pdc	x,x	kW		T_j = + 30 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
T_j = + 25 ºC	Pdc	x,x	kW		T_j = + 25 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
T_j = + 20 ºC	Pdc	x,x	kW		T_j = + 20 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
Degradation co-efficient chillers**	C_{dc}	x,x	-					
Power consumption in modes other than 'active mode'								
Off mode	P_{OFF}	x,x	kW		Crankcase heater mode	P_{CK}	x,x	kW
Thermostat-off mode	P_{TO}	x,x	kW		Standby mode	P_{SB}	x,x	kW
Other items								
Capacity control	fixed/staged/variable				For air-to-water comfort chillers: Nominal air flow rate, outdoor measured	-	x	m^3/h
Sound power level, outdoor	L_{WA}	x,x / x,x	dB		For water-/brine-to-water chillers: Rated brine or water flow rate, outdoor heat exchanger	-	x	m^3/h
Emissions of nitrogen oxides (if applicable)	NO_x	x,x	mg/kWh input GCV					
GWP of the refrigerant			kg CO_2 eq (100 years)					
Contact details	Name and address of the manufacturer or of its authorised representative.							
** If C_{dc} is not determined by measurement then the default degradation coefficient of chillers shall be 0,9.								

Table 11

Information requirements for air-to-air air conditioners

Model(s): Information to identify the model(s) to which the information relates to:								
Outdoor heat exchanger of air conditioner: [default: air]								
Indoor heat exchanger of air conditioner: [default: air]								
Type: compressor driven vapour compression or sorption process								
if applicable: driver of compressor: [electric motor or internal combustion]								
Item	Symbol	Value	Unit	Item	Symbol		Value	Unit
Rated cooling capacity	$P_{rated,c}$	x,x	kW	Seasonal space cooling energy efficiency	$\eta_{s,c}$		x,x	%
Declared cooling capacity for part load at given outdoor temperatures T_j and indoor 27ºC/19ºC (dry/wet bulb)				Declared energy efficiency ratio or gas utilization efficiency / auxiliary energy factor for part load at given outdoor temperatures T_j				
T_j = +35 ºC	Pdc	x,x	kW	T_j = +35 ºC	EER_d	or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
T_j = + 30 ºC	Pdc	x,x	kW	T_j = + 30 ºC	EER_d	or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
T_j = + 25 ºC	Pdc	x,x	kW	T_j = + 25 ºC	EER_d	or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
T_j = + 20 ºC	Pdc	x,x	kW	T_j = + 20 ºC	EER_d	or $GUE_{c,bin}/AEF_{c,bin}$	x,x	%
Degradation co-efficient air conditioners**	C_d	x,x	-					
Power consumption in modes other than 'active mode'								
Off mode	P_{OFF}	x,x	kW	Crankcase heater mode	P_{CK}		x,x	kW
Thermostat-off mode	P_{TO}	x,x	kW	Standby mode	P_{SB}		x,x	kW
Other items								
Capacity control	fixed/staged/variable			For air-to-air air conditioner: Nominal air flow rate, outdoor measured	-		x	m^3/h
Sound power level, outdoor	L_{WA}	x,x / x,x	dB					
if engine driven: Emissions of nitrogen oxides	NO_x	x	mg/kWh fuel input GCV					
Contact details	Name and address of the manufacturer or of its authorised representative.							
** If C_d is not determined by measurement then the default degradation coefficient air conditioners shall be 0.25. Where information relates to multi-split air conditioners, the test result and performance data may be obtained on the basis of the performance of the outdoor unit.								

Table 12

Information requirements for water/brine-to-air air conditioners

Model(s): Information to identify the model(s) to which the information relates to:								
Outdoor heat exchanger of air conditioner: [default: water/brine]								
Indoor heat exchanger of air conditioner: [default: air]								
Type: compressor driven vapour compression or sorption process								
if applicable: driver of compressor: [electric motor or fuel driven]								
Item			Symbol	Value	Unit	Item	Symbol	Value / Unit
Rated cooling capacity			$P_{rated,c}$	x,x	kW	Seasonal space cooling energy efficiency	$\eta_{s,c}$	x,x / %
Declared cooling capacity for part load at given outdoor temperatures T_j and indoor 27º/19ºC (dry/wet bulb)						Declared energy efficiency ratio or gas utilization efficiency / auxiliary energy factor for part load at given outdoor temperatures T_j		
Outdoor temperature T_j	cooling tower (inlet/outlet)	ground coupled						
T_j = +35 ºC	30/35	10/15	Pdc	x,x	kW	T_j = +35 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x / %
T_j = + 30 ºC	26/*	10/*	Pdc	x,x	kW	T_j = + 30 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x / %
T_j = + 25 ºC	22/*	10/*	Pdc	x,x	kW	T_j = + 25 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x / %
T_j = + 20 ºC	18/*	10/*	Pdc	x,x	kW	T_j = + 20 ºC	EER_d or $GUE_{c,bin}/AEF_{c,bin}$	x,x / %
Degradation co-efficient air conditioners**			Cd	x,x	-			
Power consumption in modes other than 'active mode'								
Off mode			P_{OFF}	x,x	kW	Crankcase heater mode	P_{CK}	x,x / kW
Thermostat-off mode			P_{TO}	x,x	kW	Standby mode	P_{SB}	x,x / kW
Other items								
Capacity control			fixed/staged/variable					
Sound power level, outdoor			L_{WA}	x,x / x,x	dB			
if engine driven Emissions of nitrogen oxides (if applicable)			NO_x	x	mg/kWh	For air-to-water//brine air conditioners: Rated brine or water flow rate, outdoor heat exchanger	-	x / m^3/h
Contact details	Name and address of the manufacturer or of its authorised representative.							

** If C_d is not determined by measurement then the default degradation coefficient air conditioners shall be 0.25. Where information relates to multi-split air conditioners, the test result and performance data may be obtained on the basis of the performance of the outdoor unit.

Table 13

Information requirements for fan coil units

Information to identify the model(s) to which the information relates to:							
Item	Symbol	Value	Unit	Item	Symbol	Value	Unit
Cooling capacity (sensible)	$P_{rated,c}$	x,x	W	Total electric power input	P_{elec}	x,x	W
Cooling capacity (latent)	$P_{rated,c}$	x,x	W	Sound power level (per speed setting, if applicable)	L_{WA}	x / etc.	dB
Contact details	Name and address of the manufacturer or of its authorised representative.						

Table 14

Information requirements for heat pumps

Information to identify the model(s) to which the information relates to:								
Outdoor heat exchanger of heat pump: [select which: air/water/brine]								
Indoor heat exchanger of heat pump: [select which: air/water/brine]								
Indication if the heater is equipped with a supplementary heater: yes/no								
Parameters shall be declared for the average heating season, parameters for the warmer and colder heating seasons are optional.								
Item	Symbol	Value	Unit	Item	Symbol		Value	Unit
Rated heating capacity	$P_{rated,h}$	x,x	kW	Seasonal space heating energy efficiency	$\eta_{s,h}$		x,x	%
Declared heating capacity for part load at indoor temperature 20 °C and outdoor temperature T_j				Declared coefficient of performance or gas utilization efficiency / auxiliary energy factor for part load at given outdoor temperatures T_j				
T_j = - 7 ºC	Pdh	x,x	kW	T_j = - 7 ºC	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
T_j = + 2 ºC	Pdh	x,x	kW	T_j = + 2 ºC	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
T_j = + 7 ºC	Pdh	x,x	kW	T_j = + 7 ºC	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
T_j = + 12 ºC	Pdh	x,x	kW	T_j = + 12 ºC	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
T_j = bivalent temperature	Pdh	x,x	kW	T_j = bivalent temperature	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
T_j = operation limit	Pdh	x,x	kW	T_j = operation limit	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
For air-to-water heat pumps: T_j = - 15 ºC (if T_{OL} < - 20 ºC)	Pdh	x,x	kW	For water-to-air heat pumps: T_j = - 15 ºC (if T_{OL} < -20 ºC)	COP_d / $GUE_{h,bin}$/$AEF_{h,bin}$	or	x,x	%
Bivalent temperature	T_{biv}	x	ºC	For water-to-air heat pumps: Operation limit temperature	T_{ol}		x	ºC
Degradation co-efficient heat pumps**	C_{dh}	x,x	-					
Power consumption in modes other than 'active mode'				Supplementary heater				
Off mode	P_{OFF}	x,x	kW	Electric back-up heating capacity *	elbu		x,x	kW
Thermostat-off mode	P_{TO}	x,x	kW	Type of energy input				
Crankcase heater mode	P_{CK}	x,x	kW	Standby mode	P_{SB}		x,x	kW
Other items								
Capacity control	fixed/staged/variable			For air-to-air heat pumps: Nominal air flow rate, outdoor measured	-		x	m³/h
Sound power level, indoor / outdoor measured	L_{WA}	x,x / x,x	dB	For water-/brine-to-air heat pumps: Rated brine or water flow rate, outdoor heat exchanger	-		x	m³/h
Emissions of nitrogen oxides (if applicable)	NO_x	x	mg/kWh					
Contact details	Name and address of the manufacturer or of its authorised representative.							
** If C_d is not determined by measurement then the default degradation coefficient of heat pumps shall be 0,25. Where information relates to multi-split heat pumps, the test result and performance data may be obtained on the basis of the performance of the outdoor unit.								

Table 15

Information requirements for high temperature process chillers

Information to identify the model(s) to which the information relates to:			
Type of condensing: [air-cooled /water-cooled]			
Refrigerant fluid(s): [information identifying the refrigerant fluid(s) intended to be used with the process chiller]			
Item	Symbol	Value	Unit
Operating temperature	t	7	ºC
Seasonal energy performance ratio	SEPR	x,xx	[-]
Annual electricity consumption	Q	x	kWh/a
Parameters at full load and reference ambient temperature at ration point A **			
Rated refrigeration capacity	P_A	x,xx	kW
Rated power input	D_A	x,xx	kW
Rated energy efficiency ratio	$EER_{DC,A}$	x,xx	[-]
Parameters at rating point B			
Declared refrigeration capacity	P_B	x,xx	kW
Declared power input	D_B	x,xx	kW
Declared energy efficiency ratio	$EER_{DC,B}$	x,xx	[-]
Parameters at rating point C			
Declared refrigeration capacity	P_C	x,xx	kW
Declared power input	D_C	x,xx	kW
Declared energy efficiency ratio	$EER_{DC,C}$	x,xx	[-]
Parameters at rating point D			
Declared refrigeration capacity	P_D	x,xx	kW
Declared power input	D_D	x,xx	kW
Declared energy efficiency ratio	$EER_{DC,D}$	x,xx	[-]
Other items			
Capacity control		fixed/staged**/variable	
Degradation co-efficient chillers*	C_{dc}	x,xx	[-]
Contact details	Name and address of the manufacturer or of its authorised representative.		
* If C_{dc} is not determined by measurement then the default degradation coefficient chillers shall be 0,9.			
** For staged capacity units, two values divided by a slash ('/') will be declared in each box in the section referring to 'refrigeration capacity' and 'EER'			

Annex III
Measurement and Calculation

1. For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements and calculations shall be made using harmonised standards the reference numbers of which have been published for this purpose in the Official Journal of the European Union, or other reliable, accurate and reproducible method, which takes into account the generally recognised state-of-the-art methods. They shall fulfil the conditions and technical parameters set out in points 2 to 8.

2. General conditions for measurements and calculations:

   a) For the purposes of the calculations set out in points 3 to 8, consumption of electricity shall be multiplied by the conversion coefficient CC of 2,5;

   b) Emissions of nitrogen oxides shall be measured as sum of nitrogen monoxide and nitrogen dioxide, and expressed in nitrogen dioxide equivalents;

   c) For heat pumps equipped with supplementary heaters, the measurement and calculation of rated heating capacity, seasonal space heating energy efficiency, sound power level and emissions of nitrogen oxides shall take account of the supplementary heater;

   d) A heat generator designed for an air heating product, or a housing to be equipped with such a generator shall be tested with an appropriate housing or generator, respectively;

   e) A cold generator designed for a cooling product, or a housing to be equipped with such a generator shall be tested with an appropriate housing or generator, respectively.

3. Seasonal space heating energy efficiency of warm air heaters:

   a) The seasonal space heating energy efficiency $\eta_{s,h}$ shall be calculated as the seasonal space heating energy efficiency in active mode $\eta_{s,on}$ which includes consideration of the seasonal thermal energy efficiency $\eta_{s,th}$, the envelope loss factor F_{env} and the emission efficiency $\eta_{s,flow}$, corrected by contributions accounting for heat output control, auxiliary electricity consumption, vented flue losses and ignition burner power consumption (P_{ign}) (if applicable).

4. Seasonal space cooling energy efficiency of comfort chillers and air conditioners when driven by electric motors:

   a) For the purposes of the measurements of air conditioners the indoor ambient temperature shall be set at 27 °C;

   b) While establishing the sound power level, the operating conditions shall be the standard rating conditions set out in Table 16 (air-to-air heat pumps and air conditioners), Table 17 (water/brine to-water comfort chillers), Table 18 (air-to-water comfort chillers), Table 19 (water/brine-to-air heat pumps and air conditioners);

   c) The active mode seasonal energy efficiency ratio $SEER_{on}$ shall be calculated on the basis of the part load for cooling $P_c(T_j)$ and the bin-specific energy efficiency ratio $EER_{bin}(T_j)$, and weighted by the bin-hours the bin conditions occurs, taking into account the following conditions:

      i) the reference design conditions set out in Table 24;

      ii) the European average cooling season set out in Table 27;

iii) if applicable, the effects of the degradation of the energy efficiency caused by cycling depending on the type of control of the cooling capacity;

iv) The reference annual cooling demand Q_C, shall be the design cooling load $P_{designc}$ multiplied by the equivalent active mode hours for cooling H_{CE} as set out in Table 29;

v) The annual energy consumption for cooling Q_{CE} shall be calculated as the sum of:

(1) the ratio of the reference annual cooling demand Q_C and the active mode energy efficiency ratio $SEER_{on}$ and

(2) the energy consumption during thermostat-off, standby, off and crankcase heater mode during the season;

vi) The seasonal energy efficiency ratio SEER shall be calculated as the ratio of the reference annual cooling demand Q_C and the reference annual energy consumption for cooling Q_{CE};

vii) The seasonal space cooling energy efficiency $\eta_{s,c}$ shall be calculated as the seasonal energy efficiency ratio SEER divided by the conversion coefficient CC, corrected by contributions accounting for temperature control and, for water/brine-to water comfort chillers, or water/brine-to-air air conditioners only, the electricity consumption of ground water pump(s).

5. Seasonal space cooling energy efficiency of comfort chillers and air conditioners using internal combustion:

a) The seasonal space cooling energy efficiency $\eta_{s,c}$ shall be calculated on the basis of the seasonal primary energy ratio in cooling mode $SPER_C$, corrected by contributions accounting for temperature control and, for water/brine-to-water comfort chillers, or water/brine-to-air air conditioners only, the electricity consumption of ground water pump(s).

b) The seasonal primary energy ratio in cooling mode $SPER_C$ shall be calculated on the basis of seasonal gas utilization efficiency in cooling mode $SGUE_C$, the seasonal auxiliary energy factor in cooling mode $SAEF_C$ taking into account the conversion coefficient for electricity CC.

c) The seasonal gas utilization efficiency in cooling mode SGUEC shall be based on the part load for cooling $P_c(T_j)$ divided by the bin-specific gas utilization efficiency for cooling at partial load $GUE_{c,bin}$, weighted by the bin-hours the bin conditions occurs, using the conditions set out below;

d) The $SAEF_C$ shall be based on the reference annual cooling demand $Q_{ref,c}$ and the annual energy consumption for cooling Q_{CE};

e) The reference annual cooling demand Q_C shall be based on the reference cooling capacity $P_{design,c}$ multiplied by the equivalent active mode hours for cooling H_{CE} as set out in Table 28;

f) The annual energy consumption for cooling Q_{CE} shall be calculated as the sum of:

i) the ratio of the reference annual cooling demand Q_C and the seasonal auxiliary energy factor in cooling mode in active mode $SAEF_{c,on}$ and

ii) the energy consumption during thermostat-off, off and crankcase heater mode during the season;

g) The $SAEF_{c,on}$ shall be based (insofar relevant) on the part load for cooling $P_c(T_j)$ and the auxiliary energy factor in cooling mode at partial load $AEF_{c,bin}$, weighted by the bin-hours the bin conditions occurs using the conditions set out below;

h) The conditions to calculate the $SGUE_c$ and the $SAEF_{c,on}$ shall take into account:

i) the reference design conditions set out in Table 24;

ii) the European average cooling season set out in Table 27;

iii) if applicable, the effects of the degradation of the energy efficiency caused by cycling depending on the type of control of the cooling capacity;

6. Seasonal space heating energy efficiency of electric heat pumps:

a) For the purposes of the measurements of heat pumps the indoor ambient temperature shall be set at 20 °C;

b) While establishing the sound power level, the operating conditions shall be the standard rating conditions set out in Table 16 (air-to-air heat pumps), Table 19 (water/brine-to-air heat pumps);

c) The active mode seasonal coefficient of performance $SCOP_{on}$ shall be calculated on the basis of the part load for heating $P_h(T_j)$, the electric back-up heating capacity $elbu(T_j)$ (if applicable) and the bin-specific coefficient of performance $COP_{bin}(T_j)$ and weighted by the bin-hours the bin conditions occurs, and shall take into account:

i) the reference design conditions set out in Table 24;

ii) the European 'average' heating season set out in Table 26;

iii) if applicable, the effects of the degradation of the energy efficiency caused by cycling depending on the type of control of the heating capacity;

d) The reference annual heating demand Q_H, shall be the design heating load $P_{design,h}$ multiplied by the equivalent active mode hours for heating H_{HE} set out in Table 26;

e) The annual energy consumption for heating Q_{HE} shall be calculated as the sum of:

i) the ratio of the reference annual heating demand Q_H and the active mode seasonal coefficient of performance $SCOP_{on}$ and;

ii) the energy consumption for thermostat-off, off and crankcase heater mode during the season;

f) The seasonal coefficient of performance SCOP shall be calculated as the ratio of the reference annual heating demand Q_H and the annual energy consumption for heating Q_{HE};

g) The seasonal space heating energy efficiency $\eta_{s,h}$ shall be calculated as the seasonal coefficient of performance SCOP divided by the conversion coefficient CC, corrected by contributions accounting for temperature control and for water/brine-to-air heat pumps only, the electricity consumption of ground water pump(s).

7. Seasonal space heating energy efficiency of heat pumps using internal combustion:

a) The seasonal space heating energy efficiency $\eta_{s,h}$ shall be calculated on the basis of the seasonal primary energy ratio in heating mode $SPER_h$, corrected by contributions accounting for temperature control and, for water/brine-to-water heat pumps only, the electricity consumption of ground water pump(s).

b) The seasonal primary energy efficiency ratio in heating mode $SPER_h$ shall be calculated on the basis of seasonal gas utilization efficiency in heating mode $SGUE_h$, the seasonal auxiliary energy factor in heating mode $SAEF_h$ taking into account the conversion coefficient for electricity CC.

c) The seasonal gas utilization efficiency in heating mode $SGUE_h$ shall be based on the part load for heating $P_h(T_j)$ divided by the bin-specific gas utilization efficiency when heating at partial load $GUE_{h,bin}$, weighted by the bin-hours the bin conditions occurs, using the conditions set out below;

d) The $SAEF_h$ shall be based on the reference annual heating demand $Q_{ref,h}$ and the reference annual energy consumption for heating Q_{HE};

e) The reference annual heating demand Q_H shall be based on the design heating load $P_{design,h}$ multiplied by the annual equivalent active mode hours H_{HE} as set out in Table 28;

f) The annual energy consumption for heating Q_{HE} shall be calculated as the sum of:

i) the ratio of the reference annual heating demand Q_H and the seasonal auxiliary energy factor in heating mode in active mode $SAEF_{h,on}$ and

ii) the energy consumption during thermostat-off, standby, off and crankcase heater mode during the designated season;

g) The $SAEF_{h,on}$ shall be based (insofar relevant) on the part load for heating $P_h(T_j)$ and the auxiliary energy factor in heating mode at partial load $AEF_{h,bin}$, weighted by the bin-hours the bin conditions occurs using the conditions set out below;

h) The conditions to calculate the $SGUE_h$ and the $SAEF_{h,on}$ shall take into account:

i) the reference design conditions set out in Table 24;

ii) the European average heating season set out in Table 26;

iii) if applicable, the effects of the degradation of the energy efficiency caused by cycling depending on the type of control of the heating capacity;

8. General conditions for measurements and calculations of high temperature process chillers

For establishing the values of rated and declared cooling capacity, power input, energy efficiency ratio and the seasonal energy performance ratio, measurements shall be done using the following conditions:

a) the reference ambient temperature at the outdoor heat exchanger shall be 35°C for air-cooled high temperature process chillers and 30°C water inlet temperature to the condenser (rating point with 35°C outdoor air temperature) for water-cooled high temperature process chillers

b) the outlet temperature of the liquid at the indoor heat exchanger shall be 7°C dry bulb temperature;

c) the variations of the ambient temperature throughout the year, representative of average climate conditions in the European Union, and the corresponding number of hours when these temperatures occur, shall be as set out in Table 28;

d) the effect of the degradation of energy efficiency caused by cycling depending on the type of capacity control of the high temperature process chiller shall be measured or a default value shall be used.

Table 16

Standard rating conditions for air-to-air heat pumps and air conditioners

		Outdoor heat exchanger		Indoor heat exchanger	
		inlet dry bulb temperature ºC	inlet wet bulb temperature ºC	inlet dry bulb temperature ºC	inlet wet bulb temperature ºC
Heating mode (for heat pumps)	Outside air / recycled air	7	6	20	15 max
	Exhaust air / outdoor air	20	12	7	6
Cooling mode (for air conditioners)	Outside air / recycled air	35	24*	27	19
	Exhaust air / recycled air	27	19	27	19
	Exhaust air / outdoor air	27	19	35	24

* the wet bulb temperature condition is not required when testing units which do not evaporate condensate

Table 17

Standard rating conditions for water/brine-to-water comfort chillers

		Outdoor heat exchanger		Indoor heat exchanger	
		inlet temperature ºC	outlet temperature ºC	inlet temperature ºC	outlet temperature ºC
Cooling mode	water-to-water (for medium temperature heating applications) from cooling tower	30	35	12	7
	water-to-water (for low temperature heating applications) from cooling tower	30	35	23	18

Table 18

Standard rating conditions air-to-water comfort chillers

		Outdoor heat exchanger		Indoor heat exchanger	
		inlet temperature ºC	outlet temperature ºC	inlet temperature ºC	outlet temperature ºC
Cooling mode	air-to-water (for medium temperature applications)	35	-	12	7
	air-to-water (for low temperature applications)	35	-	23	18

Table 19

Standard rating conditions for water/brine-to-air heat pumps and air conditioners

		Outdoor heat exchanger		Indoor heat exchanger	
		inlet temperature ºC	outlet temperature ºC	inlet dry bulb temperature ºC	inlet wet bulb temperature ºC
Heating mode (for heat	water	10	7	20	15 max
	brine	0	-3 *	20	15 max

pumps)	water loop	20	17*	20	15 max
Cooling mode (for air conditioners)	cooling tower	30	35	27	19
	ground coupled (water or brine)	10	15	27	19

* For units designed for heating and cooling mode, the flow rate obtained during the test at standard rating conditions in cooling mode is used.

Table 20

Reference ambient temperatures for high temperature process chillers

Test point	**Part load ratio of high temperature process chillers**	**Part load ratio (%)**	**Outdoor heat exchanger**	**Indoor heat exchanger**
				Evaporator inlet/outlet water temperatures (°C)
				Fixed outlet
A	80% + 20%*(T_A-T_D)/(T_A-T_D)	100%	**inlet air temperature** 35 **(°C)**	12/ 7
			Inlet/ outlet water temperatures 30 / 35 **(°C)**	

Table 21

Part load conditions for air conditioners, comfort chillers and heat pumps

Rating point	Outdoor temperature	Part load ratio	Outdoor heat exchanger		Indoor heat exchanger		
Air-to-air air conditioners							
	T_j (ºC)		Outdoor air dry bulb temperatures (ºC)		Indoor air dry bulb (wet bulb) temperatures (ºC)		
A	35	100%	35		27 (19)		
B	30	74%	30		27 (19)		
C	25	47%	25		27 (19)		
D	20	21%	20		27 (19)		
Water-to-air air conditioners							
Rating point	T_j (ºC)	Part load ratio	Cooling tower or water loop application inlet/outlet temperatures (ºC)	Ground coupled application (water or brine) inlet/outlet temperatures (ºC)	Indoor air dry bulb (wet bulb) temperatures (ºC)		
A	35	100%	30/35	10/15	27 (19)		
B	30	74%	26/*	10/*	27 (19)		
C	25	47%	22/*	10/*	27 (19)		
D	20	21%	18/*	10/*	27 (19)		
Air-to-water comfort chillers							
Rating point	T_j (ºC)	Part load ratio	Outdoor air dry bulb temperatures (ºC)		Fan coil application inlet/outlet water temperatures (ºC)		Cooling floor application inlet/outlet water temperatures (ºC)
					Fixed outlet	Variable outlet**	
A	35	100%	35		12/7	12/7	23/18
B	30	74%	30		*/7	*/8.5	*/18
C	25	47%	25		*/7	*/10	*/18
D	20	21%	20		*/7	*/11.5	*/18
Water-to-water comfort chillers							
Rating point	T_j (ºC)	Part load ratio	Cooling tower or water loop application inlet/outlet temperatures (ºC)	Ground coupled application (water or brine) inlet/outlet temperatures (ºC)	Fan coil application inlet/outlet water temperatures (ºC)		Cooling floor application inlet/outlet water temperatures (ºC)
					Fixed outlet	Variable outlet**	
A	35	100%	30/35	10/15	12/7	12/7	23/18
B	30	74%	26/*	10/*	*/7	*/8.5	*/18
C	25	47%	22/*	10/*	*/7	*/10	*/18
D	20	21%	18/*	10/*	*/7	*/11.5	*/18
Air-to-air heat pumps							
Rating point	T_j (ºC)	Part load ratio	Outdoor air dry bulb (wet bulb) temperatures (ºC)		Indoor air dry bulb temperature (ºC)		
A	-7	88%	-7(-8)		20		
B	+2	54%	+2(+1)		20		
C	+7	35%	+7(+6)		20		
D	+12	15%	+12(+11)		20		
E	T_{ol}	depends	$T_j = T_{ol}$		20		

		on T_{ol}		
F	T_{biv}	depends on T_{biv}	$T_j = T_{biv}$	20
Water/brine-to-air heat pumps				
Rating point	T_j (ºC)	Part load ratio	Ground Water Inlet/outlet temperatures (ºC)	Brine Inlet/outlet temperatures (ºC)	Indoor air dry bulb temperature (ºC)
A	-7	88%	10/*	0/*	20
B	+2	54%	10/*	0/*	20
C	+7	35%	10/*	0/*	20
D	+12	15%	10/*	0/*	20
E	T_{ol}	depends on T_{ol}	10/*	0/*	20
F	T_{biv}	depends on T_{biv}	10/*	0/*	20

* outlet temperatures dependent on water flow rate as determined at standard rating conditions (100% part load ratio when cooling, 88% when heating)

Table 22

Part load conditions for SEPR calculation for air-cooled high temperature process chillers

Rating point	Part load ratio of high temperature process chillers	Part load ratio (%)	Outdoor heat exchanger inlet air temperature (°C)	Indoor heat exchanger Evaporator inlet/outlet water temperatures (°C) Fixed outlet
A	$80\% + 20\% \cdot (T_A-T_D)/(T_A-T_D)$	100%	35	12/ 7
B	$80\% + 20\% \cdot (T_B-T_D)/(T_A-T_D)$	93%	25	* / 7
C	$80\% + 20\% \cdot (T_C-T_D)/(T_A-T_D)$	87%	15	* / 7
D	$80\% + 20\% \cdot (T_D-T_D)/(T_A-T_D)$	80%	5	* / 7

* with the water flow rate determined during "A" test for units with a fixed water flow rate or with a variable flow rate.

Table 23

Part load conditions for SEPR calculation for water-cooled high temperature process chillers

Rating point	Part load ratio of high temperature process chillers	Part load ratio (%)	Water-cooled condenser Inlet/ outlet water temperatures (°C)	Outdoor air temperature (ºC)	Indoor heat exchanger Evaporator Inlet / outlet water temperatures (°C) Fixed outlet
A	$80\% + 20\%*(T_A-T_D)/(T_A-T_D)$	100%	30 / 35	35	12/ 7
B	$80\% + 20\%*(T_B-T_D)/(T_A-T_D)$	93%	23 / [a]	25	* / 7

C	80% + 20%*(T_C-T_D)/(T_A-T_D)	87%	16 / [a]	15	* / 7
D	80% + 20%*(T_D-T_D)/(T_A-T_D)	80%	9 / [a]	5	* / 7

Table 24

Reference design conditions for comfort chillers, air conditioners and heat pumps

Function	Season	Reference design temperature dry bulb (wet bulb)		
		$T_{design,c}$		
Cooling	Average	35 (24) °C		
		Reference design temperature	Bivalent temperature maximum	Operation limit temperature maximum
		$T_{design,h}$	T_{biv}	T_{ol}
Heating	Average	- 10 (- 11) °C	+ 2 °C	- 7 °C
	Warmer	2 (-11) ºC	7 ºC	2 ºC
	Colder	-22 (-23) ºC	-7 ºC	-15 ºC

Table 25

Standard rating conditions for fan coil units

Cooling test		Heating test		Sound power test
Air temperature	27ºC (db) 19ºC (wb)	Air temperature	20ºC (db)	At ambient conditions without water flow
Inlet water temperature	7ºC	Inlet water temperature	50ºC for 2-pipe units 70ºC for 4-pipe units	
Water temperature rise	5ºC	Water temperature decrease	10ºC	

Table 26

European heating seasons for heat pumps

bin_j	T_j [°C]	H_j [h/annum]		
		Warmer	Average	Colder
1 to 8	-30 to -23	0	0	0
9	-22	0	0	1
10	-21	0	0	6
11	-20	0	0	13
12	-19	0	0	17
13	-18	0	0	19
14	-17	0	0	26
15	-16	0	0	39
16	-15	0	0	41
17	-14	0	0	35
18	-13	0	0	52
19	-12	0	0	37
20	-11	0	0	41
21	-10	0	1	43
22	-9	0	25	54
23	-8	0	23	90
24	-7	0	24	125
25	-6	0	27	169
26	-5	0	68	195
27	-4	0	91	278
28	-3	0	89	306
29	-2	0	165	454
30	-1	0	173	385
31	0	0	240	490
32	1	0	280	533
33	2	3	320	380
34	3	22	357	228
35	4	63	356	261
36	5	63	303	279
37	6	175	330	229
38	7	162	326	269
39	8	259	348	233
40	9	360	335	230
41	10	428	315	243
42	11	430	215	191
43	12	503	169	146
44	13	444	151	150
45	14	384	105	97
46	15	294	74	61
Total hours:		3 590	4 910	6 446

Table 27

European cooling season for comfort chillers and air conditioners

Bins	Outdoor temperature (dry bulb)	"Average cooling season" bin hours	EER calculation
j	T_j	h_j	
#	°C	h/annum	
1	17	205	EER(D)
2	18	227	EER(D)
3	19	225	EER(D)
4	20	225	D - Measured value
5	21	216	Linear interpolation
6	22	215	Linear interpolation
7	23	218	Linear interpolation
8	24	197	Linear interpolation
9	25	178	C - Measured value
10	26	158	Linear interpolation
11	27	137	Linear interpolation
12	28	109	Linear interpolation
13	29	88	Linear interpolation
14	30	63	B - Measured value
15	31	39	Linear interpolation
16	32	31	Linear interpolation
17	33	24	Linear interpolation
18	34	17	Linear interpolation
19	35	13	A - Measured value
20	36	9	EER(A)
21	37	4	EER(A)
22	38	3	EER(A)
23	39	1	EER(A)
24	40	0	EER(A)

Table 28

European reference refrigeration season for high temperature process chillers

bin_i	T_i [°C]	H_i [h/annum]
1	-19	0,08
2	-18	0,41
3	-17	0,65
4	-16	1,05
5	-15	1,74
6	-14	2,98
7	-13	3,79
8	-12	5,69
9	-11	8,94
10	-10	11,81
11	-9	17,29
12	-8	20,02
13	-7	28,73
14	-6	39,71
15	-5	56,61
16	-4	76,36
17	-3	106,07
18	-2	153,22
19	-1	203,41
20	0	247,98
21	1	282,01
22	2	275,91
23	3	300,61
24	4	310,77
25	5	336,48
26	6	350,48
27	7	363,49
28	8	368,91
29	9	371,63
30	10	377,32
31	11	376,53
32	12	386,42
33	13	389,84
34	14	384,45
35	15	370,45
36	16	344,96
37	17	328,02
38	18	305,36
39	19	261,87
40	20	223,90
41	21	196,31
42	22	163,04
43	23	141,78
44	24	121,93
45	25	104,46
46	26	85,77
47	27	71,54
48	28	56,57
49	29	43,35
50	30	31,02
51	31	20,21
52	32	11,85
53	33	8,17
54	34	3,83
55	35	2,09
56	36	1,21
57	37	0,52
58	38	0,40

Table 29

Operational hours per functional mode for comfort chillers, air conditioners and heat pumps

Season		Operational hours				
		On-mode	Thermostat Off	Standby	Off	Crankcase heater mode
		H_{CE} (cooling); H_{HE} (heating)	H_{TO}	H_{SB}	H_{OFF}	H_{CK}
Cooling (to calculate SEER)	Average	600	659	1377	0	2036
	Colder	300	436	828	0	1264
	Warmer	900	767	1647	0	2414
Heating only (to calculate SCOP)	Average	1 400	179	0	3 672	3 851
	Colder	2 100	131	0	2 189	2 320
	Warmer	1 400	755	0	4 345	5 100
Heating, if reversible (to calculate SCOP)	Average	1400	179	0	0	179
	Colder	2100	131	0	0	131
	Warmer	1400	755	0	0	755

Annex IV
Verification procedures

When performing the market surveillance checks referred to in Article 3 (2) of Directive 2009/125/EC, the authorities of the Member States shall apply the following verification procedure for the requirements set out in Annex II:

1) The Member State authorities shall test one single unit per model.

2) The air heating product, cooling product or high temperature process chiller model shall be considered to comply with the applicable requirements set out in Annex II to this Regulation;

   a) if the declared values comply with the requirements set out in Annex II;

   b) if for air heating products the seasonal space heating energy efficiency $\eta_{s,h}$ is not less than the declared value minus 8 % at the rated heating capacity of the unit;

   c) if for cooling products the seasonal space cooling energy efficiency $\eta_{s,c}$ is not less than the declared value minus 8 % at the rated cooling capacity of the unit;

   d) if for air heating product and/or cooling products the sound power level L_{WA} is not more than the declared value plus 1,5 dB;

   e) if for air heating or cooling products using fuels the emissions of nitrogen oxides, expressed in nitrogen dioxide, are not more than the declared value plus 20 %;

   f) if for high temperature process chiller products:

      i) the SEPR value is not less than the declared value minus 10 % at the rated refrigeration capacity of the unit;

      ii) the rated energy efficiency ratio (EER_A) is not more than 5 % lower than the declared value, measured at the rated refrigeration capacity.

3) If the result referred to in point 2 is not achieved, the Member State authorities shall randomly select three additional units of the same model for testing.

   The air heating product, cooling product or high temperature process chiller model shall be considered to comply with the applicable requirements set out in Annex II to this Regulation;

   a) if the declared values of all three additional units comply with the requirements set out in Annex II;

   b) if for air heating products the average of the three units for seasonal space heating energy efficiency $\eta_{s,h}$ is not less than the declared value minus 8 % at the rated heating capacity of the unit;

   c) if for cooling products the average of the three units for seasonal space cooling energy efficiency $\eta_{s,c}$ is not less than the declared value minus 8 % at the rated cooling capacity of the unit;

   d) if for air heating product and/or cooling products the average of the three units for the sound power level L_{WA} is not more than the declared value plus 1,5 dB;

   e) if for air heating or cooling products using fuels the average of the three units for the emissions of nitrogen oxides, expressed in nitrogen dioxide, are not more than the declared value plus 20 %;

   f) if for high temperature process chiller products:

i) the average of the three units for the SEPR value is not less than the declared value minus 10 % at the rated refrigeration capacity of the unit;

ii) the average of the three units for the rated energy efficiency ratio (EER_A) is not more than 5 % lower than the declared value, measured at the rated refrigeration capacity;

4) If the results referred to in point 3 are not achieved, the model shall be considered not to comply with this Regulation.

5) Member State authorities shall use the measurement and calculation methods set out in Annex III;

6) Given the weight and size limitations in the transportation of air heating products, cooling products and high temperature process chillers, Member State authorities may decide to undertake the verification procedure at the premises of manufacturers, before they are put into service in their final destination;

7) The Member State authorities shall provide the test results and other relevant information to the authorities of the other Member States and to the Commission within one month of the decision being taken on the non-compliance of the model;

8) The verification tolerances defined in this Annex relate only to the verification of the measured parameters by Member State authorities and shall not be used by the manufacturer as an allowed tolerance to establish the values in the technical documentation.

Annex V
Benchmarks

At the time of entry into force of this Regulation, the best available technology on the market for air heating products and cooling products in terms of seasonal space heating energy efficiency, seasonal space cooling energy efficiency or seasonal energy performance ratio, and emissions of nitrogen oxides was identified as follows:

1) Benchmarks for seasonal space heating or cooling energy efficiency or air heating products and cooling products and seasonal energy performance ratio of high temperature process chillers are described in Table 30;

Table 30

Benchmark for seasonal space heating or cooling energy efficiency of air heating products and cooling products and seasonal energy performance ratio for high temperature process chillers

Warm air heaters	Using gaseous or liquid fuels	84%
	Using electricity	33%
Comfort chillers	Air-to-water, $P_{rated,c} < 200$ kW	209%
	Air-to-water , $P_{rated,c} \geq 200$ kW	225%
	Water/brine-to-water , $P_{rated,c} < 200$ kW	272%
	Water/brine-to-water , $P_{rated,c} \geq 200$ kW	352%
Air conditioners	Electric, air-to-air air conditioner	257%
Heat pumps	Electric, air-to-air heat pump	177%
High temperature process chillers	Air-cooled, $P_A < 200$ kW	6.5 SEPR
	Air-cooled, 200 kW $\leq P_A < 400$ kW	8.0 SEPR
	Air-cooled, $P_A \geq 400$ kW	8.0 SEPR
	Water-cooled, $P_A < 200$ kW	8.5 SEPR
	Water-cooled, 200 kW $\leq P_A < 400$ kW	12.0 SEPR
	Water-cooled, 400 kW $\leq P_A < 1000$ kW	12.5 SEPR
	Water-cooled, $P_A \geq 1000$ kW	13.0 SEPR

2) Benchmarks for emissions of nitrogen oxides, expressed in nitrogen dioxide:

   a) For warm air heaters using liquid fuel, the best available products in the market have emissions below 50 mg/kWh fuel input in terms of GCV;

   b) For warm air heaters using liquid fuel, the best available products in the market have emissions below 120 mg/kWh fuel input in terms of GCV;

   c) For external combustion heat pumps, comfort chillers and air conditioners using gaseous fuel, the best available products in the market have emissions below 50 mg/kWh fuel input in terms of GCV;

3) The benchmarks specified in points 1 and 2 do not necessarily imply that a combination of these values is achievable for a single product.