WORKING DOCUMENT
ON A POSSIBLE COMMISSION REGULATION
IMPLEMENTING DIRECTIVE 2005/32/EC WITH REGARD TO
HOUSEHOLD REFRIGERATING APPLIANCES

Explanatory Notes

Rationale of the draft regulation

Scope

The purpose of the implementing measure – in the following abbreviated as "IM" – is to set ecodesign requirements on electric mains operated household refrigerating appliances with the aim to reduce their environmental impact (as required in Article 16 of Directive 2005/32/EC). The measure applies to household refrigerating appliances also when sold for non-household uses (for example to refrigerate foodstuffs in hotels or in other tertiary sector applications) or when they are used for the refrigeration of items different from foodstuffs (for example in beauty centres for the refrigeration of creams and similar items).

The definition of refrigerating appliances has been updated, to take into consideration also the experience existing at international levels – and to clarify that some product such as the wine cabinets and the mini drink chillers are now included. The definitions and the appliance classification have also been made more clear to address the ambiguities identified for some specific products during the long term application of the energy labelling Directives.

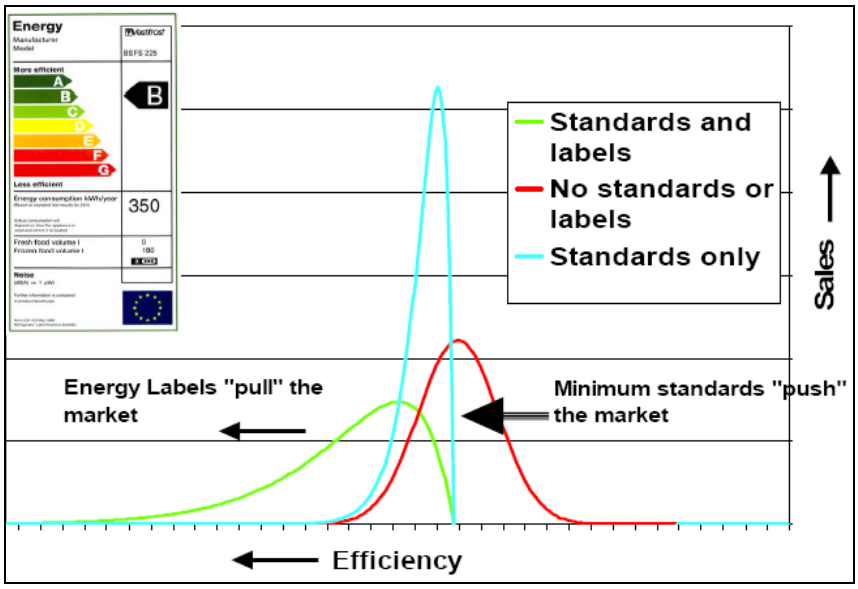
Relation with unspecific ("horizontal") IMs

For the vast majority of the refrigerating appliances covered by this product specific measure there is no relation with other horizontal ecodesign IMs, such as the standby power consumption Regulation. In fact the 24h measurement of the energy consumption already considers the consumption of any features such as temperature displays, clocks, temperature alarms, through-the-door-dispensers, etc. which may present low power modes consumption. Nevertheless, when the application of the measurement method is considered unpractical, such as in the case of very small appliances under 10 litre of storage volume, the appliances are requested to automatically enter into a condition with a power consumption of 0,00 Watts after no more than 1 hour when empty.

Relation with other energy efficiency policy measures

An effective coordination is necessary between this measure and the parallel energy labelling scheme (under framework Directive 92/75/EEC) for refrigerating appliances. It is the intention that the two policies will share not only the basic definitions and the appliance classification in 10 Categories, but also the algorithms for the calculation of the Energy Efficiency Index. This will remove differences in scope and thresholds between directives 96/57/EC and 94/2/EC or 2003/66/EC. This harmonisation will

allow an optimum co-ordination of the dynamic steps and revision time horizon, which will insure a synergic effect of the pushing effect of the eco-design specific requirements and the pulling effect of the new labelling energy efficiency scale, according to the qualitative but well experienced relation[1]:



Mandatory requirements

The following aspects are addressed by generic and specific requirements:

- Generic requirements, to be implemented partly one year and partly three years after the enforcement of the measure:

  - for refrigerator-freezers with one compressor and one thermostat, the automatic control according to the ambient temperature variation of the heating function (the so called "winter setting switch", or a similar device or function) which some manufacturers recommend to activate in some models at an ambient temperature below 16°C to maintain the correct storage temperature in the freezer compartment;
  - automatic reversion of the fast freezing facility/function in freezers and freezer compartments to avoid the extra-consumption when users forget to switch it off;
  - automatic switching to an operating conditions with a power consumption of 0,00 Watts for refrigerating appliances with a volume below 10 litres, when left empty for more than 1 hour;
  - for wine storage appliances, indication in the booklet of instructions that the appliance is "intended to be used exclusively for the long term storage and/or maturation of wine", to avoid a potential loop-hole due to the exemption of these appliances from the specific requirements;
  - for all refrigerating appliances, indications about the combination of drawers, baskets and shelves giving the best appliance energy efficiency.

[1] IEA, P. Waide, International use of policy instruments: country comparisons, Copenhagen, 05 April 2006.

- Specific requirements, to be implemented in three steps starting one year after the entry into force of the measure:

  - maximum EEI level (the lower the EEI, the higher the energy efficiency) for compressor-type refrigerating appliances with a storage volume equal or larger than 10 litres;
  - maximum EEI level for absorption and other-type type refrigerating appliances with a storage volume larger than 10 litres.

The preparatory study did not identify other significant environmental parameters to be dealt within an ecodesign measure, a part from energy consumption and noise in the use phase. The LCA (Life Cycle Analysis) performed for the compression-type appliances (representing over 95% of the overall refrigerating appliance market in the EU) in the study showed that, despite the significant achieved energy efficiency improvement, the use phase is still responsible for most of the environmental impact of this product group. As far as other environmental parameters of interest are concerned:

- HCFC and HFC used as refrigerating and foaming agents have been in practice totally replaced by hydrocarbons. In fact, almost all models in the 2005 database[2] use hydrocarbons as foaming agent and only a residual ~5-8% of models still exists with HFC as refrigerant.
- hazardous materials in production are dealt within the RoHs Directive
- end-of-life wastes are addressed in the WEEE Directive.

For noise, it has been considered more appropriate to address it in the parallel Energy Labelling Directive for this product group.

Noise is not addressed in terms of specific requirements because this could have a negative impact for high energy efficiency compressor-type refrigerating appliances, since on the market noiseless absorption-type models are available which have a lower energy efficiency. If a mandatory requirement on a maximum noise level is set, then the need to set a labelling scheme will arise, to differentiate refrigerating appliance models on the basis of their airborne acoustical noise. This would lead to the situation of noiseless refrigerating appliances being in the best labelling class for noise and in a much lower one for energy efficiency, and vice-versa high energy efficient models being poorly rated in terms of airborne noise. It was therefore considered more appropriate to address noise through a mandatory declaration in the new labelling scheme for refrigerating appliances, which will give anyhow consumers the possibility to select a lower noise model having its energy efficiency rating. Airborne noise is measured as A-weighted sound power level with reference to a sound power of 1pW.

Finally **benchmarks** are set for the EEI and the noise of the major appliance categories of compression and absorption technologies.

Timing and revision:

Stage 1 (One year after entry into force): Setting efficiency requirements that would result in the phasing out of all compressor-type refrigerating appliances with EEI beyond 55 (the threshold of the present energy efficiency class A); setting efficiency requirements that would result in the phasing out of the most inefficient absorption-type

[2] Technical database used for the preparatory study.

and other-type refrigerating appliances with EEI beyond 150. Setting of the last two generic requirements.
The one year transition period after entry into force should allow industry to discontinue the production of less efficient models for the different technologies.

Stage 2 (three years after entry into force): Setting efficiency requirements that would result in the phasing out of all refrigerating appliances other than compressor-type with EEI beyond 125; setting the second part (the first three) of the generic requirements.

Stage 3 (Six years after entry into force): Setting efficiency requirements that would result in the phasing out of all compressor-type refrigerating appliances with EEI beyond 44 (about the present energy efficiency class A+); setting efficiency requirements that would result in the phasing out of all the absorption-type and other-type refrigerating appliances with EEI beyond 110.

Revision
It is planned to examine the necessity to revise the measure including the provisions for further steps, at the latest 7 years after adoption, that is immediately after the second Stage of specific requirements will be implemented. This revision should be possibly developed in parallel with the revision of the Energy Labelling Directive on refrigerating appliances.

Rationale for the mandatory requirements

The aim is to improve the environmental impact of refrigerating appliances through a Regulation establishing mandatory energy efficiency requirements which set the maximum annual energy consumption for the different appliance types through their energy efficiency index. Additional generic requirements complement the specific ones to make the overall regulation even more effective. A strong co-ordination with the parallel new Energy Labelling Directive for the same product group is needed to achieve a synergy between the two policy measures.

The proposed ecodesign requirements are tailor-made for the different types of refrigerating appliances covered by the measure (compression, absorption, other), in order to achieve the maximum improvement potential within each refrigerating technology and substantial energy savings in the EU. The alternative to adopt a unique requirement valid for all the technologies would have resulted in setting out the lowest common denominator, because depending on the application, different technologies are needed. The zero-noise added value of the absorption and thermoelectric (Peltier) refrigerators allows their use in rooms and spaces where the absence of noise is of primarily importance (e.g. hospitals and hotels), although their energy efficiency is low. Compressor refrigerators can reach a low noise emission, but still not the same as the absorption/thermoelectric technologies: at present there are no noiseless alternatives to absorption/thermoelectric products in applications where noise is perceived by the user to be a major issue.

The mandatory requirements will phase out the least efficient models for each technology, contemporarily leaving the room for the implementation of an effective revised energy labelling scheme to encourage front-runners. The requirements are less stringent for the absorption-type and other-type models because the room for

technological innovation (in terms of the energy efficiency improvement) is smaller, although the energy savings in absolute terms is significant considering the small storage volume of the appliances. The use phase is further addressed through the energy efficiency rating and the noise declaration within the parallel Energy Labelling Directive.

Verification procedure for market surveillance purposes

European standard EN 153 describes a two-stage verification procedure which is used for the EU labelling scheme. This staged procedure is acceptable for the verification of this measure, but the values of the measurement uncertainty include at present the production variability, which is today considered as being part of the overall appliance quality and therefore under manufacturers' responsibility. On the other hand the variability of the measurement method and in testing shall remain under the responsibility of standardisation bodies and test laboratories.

The proposed revised verification procedure foresees a lower measurement uncertainty of 10% for a single product while requiring that the average of the product sample under test (three more units) has to meet the limit EEI value (with the same uncertainty). This approach avoids that energy efficiency benchmarks/requirements are de facto ("structurally") higher.

This procedure will remain valid until a suitable harmonised standard is prepared by the relevant ESOs under a specific mandate issued by the Commission after the consultation with Member States and stakeholders.

Detailed explanation of the Ecodesign measure

Chapter 1: the scope of the directive is described to cover electric mains operated household refrigerating appliances for foodstuffs (including therefore food and beverages) also when they are sold for non-household uses or for non-foodstuffs refrigeration. The scope is then refined through some exemptions which exclude for example appliances operated with fuels (such as LPG, kerosene, biodiesel) and batteries and appliances designed primarily for specific applications outside the household food preservation. In particular, appliances specifically designed to be operated through the mains but that can be also use batteries are included; vice-versa models designed to be primarily operated through batteries but that can also be connected to the mains are excluded.

Chapter 2: definitions are provided for the terms used in the requirements set out in the Annexes. Some definitions have been set to complement those in EN 153, the reference standard for refrigerating appliances in Europe, taking into consideration policy measures and experiences outside the EU and to allow the inclusion of the so called 'wine cellars' and 'mini drinks chillers' in the measure. The additionally applicable definitions which are needed to complement the measurement method are included in Annex V.

Chapter 3 and 4: ecodesign requirements and benchmarks are set with simple reference to Annex I and II, which contain the actual requirements and benchmarks.

Chapter 5: conformity assessment is recalled along with the elements to be included in the necessary technical documentation file.

Chapter 6: a verification procedure for market surveillance purposes already exists for refrigerating appliances set out in the European standard EN 153, providing compliance with measurements under the refrigerator and freezers energy label directives 94/2/EC and 2003/66/EC. Through the provisions in this Chapter and in Annex III, the verification procedure is extended to all refrigerating appliances under the scope of this measure and is also made more rigorous by placing under the manufacturers' responsibility the manufacturing process variability.

Chapter 7: the repeal of Directive 96/57/EC is necessary because the mandatory requirements stated in 1999 on maximum energy consumption are now replaced by the new specific requirements on Energy Efficiency Index. The old requirements are not necessary anymore since they are included in the new ones.

Chapter 8: the revision of the measure is foreseen no later than 7 years after its entry into force, which is just after the implementing of the third step of specific requirements (and the second step of the label in the parallel labelling directive). This revision will evaluate the technological progress and the technical and economical feasibility of further specific requirements.

Annex I: sets out the mandatory requirements on refrigerating appliances.

In **Part 1 generic requirements**: some generic requirements are set in terms of technical features that specific products, namely freezer and freezer compartment with a fast-freeze capability, refrigerator-freezer with one compressor and one thermostat to be used in cool ambient temperature below 16°C, and refrigerating appliances with a storage volume equal or larger than 10 litres shall fulfil, three years after the entry into force of the measure, in order to avoid waste of energy due to a suboptimal use by the end-user. Other generic requirements are set in terms of product information that shall be fulfilled by wine storage appliances and by appliances with drawers or shelves to be applied one year after the entry into force of the measure.

Wine storage appliances are manufactured to be used for the long term storage of wine (up to 25 years for some red wines, which is even longer than the expected average lifetime of a traditional refrigerator) at a thoroughly controlled temperature (simulating a real house cellar) with a variation of no more than 0,5K over the year, achieved through both a cooling system as well as a heating system (different from the no-frost or the anti-sweater heaters available in other refrigerating appliances) depending on the variations of the ambient temperature where the cabinet is installed. In addition, at present no suitable standard is available worldwide to thoroughly test wine storage cabinets according to their specific performance characteristics, although it is under discussion at IEC level.
Provided that wine storage appliances comply with the relevant very strict definition, not applicable to more traditional household refrigerators, and awaiting the availability of a suitable measurement standard, the only requirement in this measure is that a specific information to consumers about the intended use of a wine storage appliance is included in the booklet of instructions.

The same information will be provided under the parallel Energy Labelling Directive when these appliances are offered for sale, hire or hire purchase by means of a printed or written communication, or by other means such as a written offer, a mail order catalogue, advertisements on the Internet or on other electronic media. This will avoid any possible confusion for the user (either consumer of more professional user) at the purchasing.

For some of the refrigerator-freezers with one compressor and one thermostat to be used in cool ambient temperature below 16°C (according to the manufacturers instructions) the so called winter switch setting (which activates a heating device or function) has to be switched-on to allow the correct operation of the freezer compartment at this low ambient temperature. The associated additional energy consumption can be only estimated at present, and depends on how often and for how long the temperature of the room where the refrigerator-.freezer is installed remains below 16°C. The generic requirement asking for an automatic control of the heating device/function depending on the ambient temperature will keep this extra energy at the real minimum. The application of this requirement will imply the phase out of the thermo-mechanical thermostats used in refrigerator-freezers in favour of the electronic control, which will allow the automatic activation/deactivation of the heating function. The installation of the electronic control implies an increase in the annual appliance energy consumption. A simulation was run to evaluate under which conditions this increase in energy consumption is balanced by the reduction in energy losses due to consumers forgetting to switch-off the winter setting at the rise of the ambient temperature above 16°C. The results of the simulation highlighted that if the new electronic control is also used for the fast-freeze facility automatic reversion then the overall energy saved is higher that the additional consumption.

In general, the indication of the minimum ambient temperature for the correct operation of the refrigerator-freezers is also valuable information for end-users, but it is considered more appropriate to have it under the Energy Labelling Directive when the products are displayed to end-users, or advertised by written, electronic and media communications.

For freezers and freezer compartments with a fast-freeze capability there is the need that this feature is automatically switched off once the fresh food introduced in the cabinet/compartment has been correctly frozen. This will prevent waste of energy due to a suboptimal use by the consumers, which may forget for some time to revert the feature manually. The proposed maximum period of 72 hours is considered allowing a complete food freezing in case the consumer has incautiously overloaded the cabinet or compartment, while contemporarily preventing the extra energy consumption when the fast-freeze is forgotten "on". For freezers a reversible thermo-mechanical thermostat is on the market, but for freezer compartments in refrigerator-freezer the compliance with this requirement will imply the installation of an electronic control. A brief evaluation of such installation has been discussed in the previous point.

For refrigerating appliances with a volume lower than 10 litres the evaluation of the energy consumption is not practical due to the very small volume, although not explicitly excluded in the current EN 153 standard. These small appliances generally claim that they work up to 20°C below the ambient temperature and are limited by a fixed point thermostat to +5 °C; some also have a heating function of up to 65 °C.

According to the UK Market Transformation Programme, they are widely available in high street stores such as supermarkets, multiple retailers, DIY stores and catalogue stores, often used as gadget o toys; such mini refrigerators can cool from one to several cans or bottles and their usage pattern is not well known: some are claimed to be used only as and when the cooling is needed, but there is the possibility that they are forgotten running but empty. To avoid the energy waste when they are running without a load, this measure states that – if they can be connected to the mains – they shall be automatically reverted to a condition with a power consumption of 0,00 Watts after 1 hour when they are left empty. This obligation is complemented by the specification that the mere presence of a hard switch is not considered sufficient to comply with the requirement.

In **Part 2 specific requirements** are set in terms of the minimum Energy Efficiency Index that refrigerating appliances shall fulfil according to their type. A three-step implementation of energy efficiency requirements is foreseen, the first one year after the enforcement of the measure, the second step two years later (i.e. three years after the enforcement of the measure) and the third step five years later (i.e. six years after the enforcement of the measure).
The rationale for the mandatory requirements has been previously explained. In particular, the differentiation of the requirements for the compression and the absorption/other technologies is considered necessary because the compressor-type appliances are intrinsically more efficient but more noisy, where the absorption-type and the thermoelectric-type appliances are significantly less efficient but noiseless. There is therefore the need to maintain the absorption appliances on the market, contemporarily improving their energy efficiency as much as it is possible for those applications requiring absence of noise. The annual market of the electric absorption refrigerating appliances is about 250.000 to 300.000 units, compared to the about 18 million compressor refrigerators. The sales are concentrated in specific sectors, mainly hotels (where they are commercially called mini-bars), followed by household applications (in compact living spaces, offices and rooms outside the kitchen where they are called mini-coolers). The market of the household thermoelectric refrigerating appliances is estimated to be smaller than for the absorption appliances.
Specific exemptions are set in this Annex for wine storage cabinets and for absorption-type appliances – if existing – belonging to categories from 4 to 9. Wine storage cabinets are exempted for the reasons explained in the above, while only an extremely low number of electric absorption appliances with more than a simple ice-box may be sold on the EU market for household use. Due to the presence of a low temperature compartment in combination with the absorption technology there energy efficiency is low, but they represent an extremely small niche market which has in practice no effect on the overall EU energy consumption for household refrigerating appliances. On the contrary their banning from the market will leave the user with no alternative noiseless products.

Annex II: includes the indicative benchmarks for products belonging to the compression-type and the absorption-type. The indicative benchmarks are set for each specific technology to inform about the existing room between the less efficient products and the most efficient ones, that can be used for other national or local policy measures such as incentive programmes. Noise is also indicated for each technology to make Member States aware of the correlation between appliance noise and energy efficiency.

Annex III: contains provisions on the verification procedure to be applied by the Member States' authorities when performing market surveillance checks referred to in Directive 2005/32/EC, Article 3 (2), and until a suitable harmonised standard is published for the purpose of this Annex and of following Annex V.

Annex IV: contains the method for calculating the maximum allowable Energy Efficiency Index. EEI of a refrigerating appliance model is the ratio between its estimated annual energy consumption and the standard annual energy consumption, which in turn is a function of the category of appliance, the construction characteristics and the climate class under which the specific model is deemed to operate. To calculate the Energy Efficiency Index of a model it is therefore necessary to define its equivalent volume and the category of appliance to which it belongs.

In **Part 1** the ten Categories of appliance are described in their essential elements, especially the mandatory and optional compartments which qualify a refrigerating appliance model for a specific Category. In this IM almost the same ten Categories used in previous directives 96/57/EC on mandatory requirements and in energy labelling directives are used: definitions have been improved and made clearer to avoid some ambiguity identified and described in the preparatory study and in previous SAVE studies on refrigerating appliances. In particular the proposed classification is independent from the number of doors and compartments and an appliance is classified in a specific Category from 1 to 9 if the mandatory compartment or compartments are present; optional compartments are also possible but their presence is not sufficient for the classification purposes. Category 10 has been confirmed as a catch-all category, to be used if the classification in the previous 9 categories has failed or in case of multi-use cabinets.
In **Part 2** the algorithms for the calculation of the equivalent volume (adjusted volume) are set. The equivalent volume of a refrigerating appliance is the weighted sum of the storage volumes of all the compartments, adjusted to compensate for heat loadings on spaces which are at temperatures other than that of fresh food compartment (+5°C), taken as reference. Five correction factors have been identified to calculate the equivalent volume:

- the thermodynamic correction factor
- the no frost correction factor
- the built in correction factor
- the transparent door correction factor
- the climate class correction factor.

The thermodynamic correction factor ($\frac{(25-T_c)}{20}$) considers the temperature difference between the nominal temperature of a compartment and the ambient temperature under standard test conditions compared to the situation of the basic refrigerator compartment, the fresh food one considered at +5°C. This factor varies with the nominal temperature of the different compartment types. For compartments defined in Annex IV this factor has been calculates and is shown in Table 3.

The no frost correction factor (*FF*): a 1,2 factor is set only for the frozen-food compartments or cabinets. The specific analysis developed during a previous SAVE study of 2000 showed that depending on the no-frost technology used, under the

EN 153 test conditions no-frost appliances would be expected to use between 3,5% and 15% more energy than equivalent natural-convection appliances. For partial no-frost appliances with a 'no-frost' refrigerator compartment and a natural-convection frozen-food compartment, the increment in energy consumption would be expected to be very small and not sufficient to justify the correction factor; conversely, if a combination appliance has a no-frost frozen-food compartment and a natural-convection fresh-food compartment, a correction factor of 1,2 times the equivalent volume of the freezer compartment appears to be justified.

The built in correction factor (*BI*): a 1,2 correction factor is set for real built-in products (built-under are excluded) of no more than 58 cm. The rationale is that the external dimensions of built-in appliances are particularly constrained as they have to be incorporated into standard fitted-kitchen designs, which use in general a fixed unit depth and width of 60 cm. In practice this means the appliance should be 55cm deep and 55cm wide if there is to be enough space to add the finishing panels. Constraining the width and depth means that it is only possible to increase the insulation thickness by raising the height if the internal volume is to remain constant (but this modifies the product dimensions) or to use vacuum insulation panels but the energy-engineering analysis for free standing products developed in the preparatory study has indicated that they are not yet cost-effective for the consumer.

The transparent door correction factor (*TD*): a 1,05 correction factor is set for those compartments (or cabinets) where a transparent door is applied when the free transparent area is higher than 90% of the access opening of the compartment or the cabinet.
If a transparent door is used, then energy savings technologies such as a better insulation or vacuum panels can not be applied. A part from being an aesthetic element, a transparent door could allow a better check of the refrigerated products from the outside of the appliance without (or with a shorter) opening the door, thus reducing the energy loss, estimated in the preliminary study in about 25 kWh/year (for the standard base case refrigerator-freezers with an EEI = 54,3, for 8,2 opening per day per person and for 2,9 persons/household).
A simulation was developed, evaluating that if door openings are shortened by one third (33%) through the use of the transparent door, then the loss of about 8,5 kWh/year can be avoided in the same standard base case, or 2,6% of the annual energy consumption. The effect of the 1,05 correction factor on the same base case is to allow an increase of about 2,6% in the appliance energy consumption without modifying its EEI. The 1,05 correction factor for the compartment or the cabinet storage volume seems therefore to be justified.

The climate class correction factor (*CC*): a 1,1 factor is set for ST-class and 1,2 for T-class appliances (i.e. for model to be able to maintain the correct storage temperature at an ambient temperature up to 43°C).
As a trend in the EU more appliances are receiving multiple climate-class ratings than before and some appliances are even rated at all four climate classes from SN to N to ST to T, as they were to be sold in the cold and warm regions of Europe. It should be therefore considered if the latest values of the correction factors for the ST- and T-class models – as said respectively 1,1 and 1,2 - are appropriate for this measure.
In general, a part from having a higher-capacity compressor, appliances which are designed to operate as ST- and T-class products will employ a number of other design

changes, such as higher-grade insulation and larger-capacity heat exchangers. These design changes, which are implemented as a result of the need to meet ST or T class criteria, also have the effect of improving the energy efficiency of the product when tested under EN 153 conditions at 25°C ambient temperature.
The conclusion of the previous SAVE study on refrigerating appliances developed in 1998-2000 was that giving a bonus to ST and T products at low and intermediate efficiency levels would have encouraged manufacturers to take the cheapest option of making ST- and T-class products rather than using the options which give the best life-cycle cost benefit to the consumer and benefit the environment (improved insulation and higher-capacity heat exchangers). On the contrary any ST- or T-class correction-factor bonus given to products striving to attain the highest efficiency levels would have promoted technological improvement. This outcome was applied in the revision of the energy labelling directive 2003/66/EC where a 1,1 factor is used for the ST-class and a 1,2 factor is used for a T-class appliance, but only for EEI below 42 (current A+ and A++ models).
The same correction factors are kept in this measure due to the fact that at the high energy-efficiency levels of today (the market entry level for compressor-type refrigerating appliances will be EEI<55 one year after the enforcement of this IM) any SN- or N-class product can only be redesigned as an ST- or T-class product by the use of measures which increase its costs beyond the life-cycle optimum, i.e. beyond the LLCC. The same will happen for a ST- or T- class product to be maintained in the same climate class when they have to comply with the new and lower EEI levels of the revised energy labelling rating.

Finally, no extra energy consumption allowances are considered for “through-the-door features”, such as a typical TTD ice-maker or chilled water dispenser, which would increase the appliance annual energy consumption of about 120 kWh (the energy consumption allowance in Australia). These services are not a primary food preservation function of the refrigerating appliances but are pure convenience features, and should not be entitled for any allowance. It might be argued that end-users have to open the appliance door to take ice or chilled water and this will increase also the appliance energy consumption. However, this depends on how many times - out of the total number of door openings - an appliance is opened to take stored ice or cold water which might be instead dispensed; it might be also argued that without this or a soft drink dispensing feature the user will be forced to buy an additional small refrigerator just to have cold drinks easily available. But, if cold drinks are consumed in the same room where the appliance is located (usually the kitchen) there is a very little need of an extra cooler; if on the contrary drinks are consumed in a room different from where the appliance is located, then the need of an extra drink cooler will arise with or without a dispenser available in the main refrigerating appliance.
An allowance of 50 kWh/year in the standard annual energy consumption is given for the presence of a chill compartment of at least 15 litre volume, since this compartment allows a longer preservation of highly perishable food.

In **Part 3** the algorithms for the calculation of the Energy Efficiency Index are set. For the calculation of the EEI, the energy consumption of any given appliance is compared to the reference energy consumption (the standard annual energy consumption) of the same category of appliance with an identical equivalent volume, and the result is expressed as percentage. The standard annual energy consumption is a linear function of the equivalent volume where the intercept (N) and angular coefficient (M) are defined

in the measure (Table 5). In addition the 50 kWh/year allowance for the chill compartment applies.

Through the values provided in Table 5 the maximum allowable annual energy consumption for each refrigerating appliance can be calculated once the equivalent volume is known. This annual energy consumption can be used for ex-post calculation of the achieved energy savings and for ex-ante evaluation of national/local policy measures such as the tax incentive programmes.

Precision in recording and rounding is also indicated for all calculation steps, starting from the energy consumption in 24 hours (E_{24h}) to be recorded to the third decimal place, to the annual energy consumption and the standard annual energy consumption to be recorded to the second decimal place, to the EEI value to be finally rounded to first decimal place. EEI threshold values between classes are instead rounded to the first integer.

Annex V: the measured parameters, the additionally applicable definitions and the testing conditions to be adopted in addition to the current EN 153 standard are defined here along with the present testing conditions. Precision in recording and rounding is also indicated.

A mandate for corresponding harmonised standard will be issued to European standardisation bodies after the consultation of Member States and stakeholders. When the new standard(s) will be ready this Annex (and Annex III) will be superseded.

Estimated energy savings

The combined effect of the ecodesign implementing measure and of the new energy labelling scheme have been estimated in the preparatory study for the EU25 countries and for the compressor-type refrigerating appliances, compared to a reference BaU scenario. For refrigerators and refrigerator-freezers the energy savings under the Realistic Scenario, is about 4 TWh in 2020 and 12,5 TWh in 2030. For freezers smaller savings are expected, due to their lower ownership especially in the new Member States, going from 2,5 TWh in 2020 and 5,0 TWh in 2030. In terms of expected energy savings percentage, refrigerators and freezers are quite similar.

It is worth adding that the significant difference between the savings potential foreseen for 2020 and 2030 (the savings are more than doubled) is due to the strong spreading in the market of the models having EEI <20-25.

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Chapter 1
Subject matter and scope

This implementing measure pursuant to Directive 2005/32/EC establishes eco-design requirements for the placing on the market of electric mains operated household refrigerating appliances also where these are sold for non-household uses and/or for the refrigeration of items different from foodstuffs.

Refrigerating appliances primarily operated through the mains but that can also use batteries are included in the scope.

The following appliances and equipments are excluded from the scope of this Regulation:

- Refrigerating appliances that can use fuels (such as LPG, kerosene, bio-diesel, etc.);
- Refrigerating appliances that are only battery operated;
- Refrigerating appliances designed to be primarily operated by batteries, but than can be connected to the electric mains through the addition of an AC/DC converter to be purchased as a separate part, for primary use in non-household applications such as car, caravan, motor caravan, truck, marine, etc.;
- Refrigerating appliances manufactured on a one-off basis;
- Refrigerating appliances for medical applications under the World Health Organisation vaccine refrigerators and freezers specifications;
- Refrigerating appliances in which the removal of refrigerated items is electronically sensed and can be automatically transmitted through a network connection to a remote control system for accounting;
- Equipments where the household storage of foodstuffs through refrigeration is not the primary function (such as stand-alone ice-makers or chilled water/drink dispensers).

Chapter 2
Definitions

For the purposes of this Regulation, the definitions set out in Directive 2005/32/EC shall apply.

The following definitions shall also apply:

1. “Foodstuffs’ mean food, ingredients, beverages and/or other items primarily intended for consumption, and that require refrigeration at specified temperature conditions.

2. “Refrigerating appliance” means a factory-assembled insulated cabinet with one or

more compartments and of suitable volume and equipment for household use, cooled by natural convection or a frost-free system whereby the cooling is obtained by one or more energy-consuming means.

3. “Refrigerator” means a refrigerating appliance intended for the preservation of foodstuffs, one of whose compartments - or the unique compartment in case of a single compartment appliance - is suitable for the storage of fresh food and/or beverages including wine.

4. “Refrigerator-freezer” means a refrigerating appliance having at least one compartment suitable for the storage of fresh food and/or beverages including wine (the fresh-food storage compartment) and at least one other (the food freezer compartment) suitable for the freezing of fresh food and the storage of frozen foodstuffs under three-star storage conditions.

5. “Frozen-food storage cabinet” means a refrigerating appliance having one or more compartments suitable for the storage of frozen foodstuffs.

6. “Food freezer” means a refrigerating appliance having one or more compartments suitable for freezing foodstuffs from ambient temperature down to a temperature of -18 °C and which is also suitable for the storage of frozen foodstuffs under three-star storage conditions, although in certain instances, two-star sections and/or compartments are permitted within the compartment or cabinet.

7. “Wine storage appliance” means a refrigerating appliance having one or more wine storage compartment, as defined in Annex V.

8. “Multi-use appliance” means a refrigerating appliance having one or more multi-use compartment, as defined in Annex V.

9. “Equivalent refrigerating appliance” means a model placed on the market with the same gross and storage volumes, same technical, efficiency and performance characteristics, and same compartment types of another refrigerating appliance model placed on the market under a different commercial code number by the same manufacturer.

For the purposes of Annex I, the additional definitions set out in Annex V shall also apply.

Chapter 3
Ecodesign requirements

Refrigerating appliances shall meet the generic ecodesign requirements set out in **Annex I, Part 1** and the specific ecodesign requirements set out in **Annex I, Part 2**.

Chapter 4
Benchmarks

The benchmarks for best-performing products for compression-type refrigerating

appliances and absorption-type refrigerating appliances available on the market at the time of drafting this Regulation are of indicative nature and are identified in **Annex II**.

Chapter 5
Conformity assessment

1. The procedure for assessing conformity referred to in Article 8(2) of Directive 2005/32/EC shall be the internal design control system set out in Annex IV of Directive 2005/32/EC or the management system set out in Annex V of Directive 2005/32/EC.

2. For the purposes of conformity assessment pursuant to Article 8 of Directive 2005/32/EC, the technical documentation file shall contain the elements required in **Annex V, Part 4** and the results of the calculations required in **Annex IV, Parts 2 and 3**.

Where the information included in the technical documentation file for a particular refrigerating appliance model has been obtained by calculation on the basis of design, and/or extrapolation from other equivalent or similar refrigerating appliances, the documentation should include details of such calculations and/or extrapolations, and of tests undertaken to verify the accuracy of the calculations undertaken (details of mathematical model for calculating performance and of measurements taken to verify this model). Information shall also include a list of all other equivalent or similar refrigerating appliance models whose information has been obtained on the same basis.

Chapter 6
Verification procedure for market surveillance purposes

When performing the market surveillance checks referred to in Directive 2005/32/EC, Article 3 (2), Member State authorities shall apply the verification procedure set out in **Annex III** of this Regulation.

Chapter 7
Repeals

Directive 96/57/EC shall be repealed one year after the entry into force of this Regulation.

Chapter 8
Revision

No later than [7] years after entry into force of this Regulation the Commission shall review it (including the annexes) in the light of technological progress and present the result of this review to the Consultation Forum.

Chapter 9
Entry into force

This Regulation shall enter into force on the 20th day following that of its publication in the *Official Journal of the European Union*.

Annex I specifies for each ecodesign requirement the period of time after the date referred to in the first paragraph following which the requirement applies.

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

Done at Brussels,

For the Commission

Member of the Commission

STRUCTURE OF THE ANNEXES

Annex I: Ecodesign requirements

Part 1: Generic ecodesign requirements
Part 2: Specific ecodesign requirements

Annex II: Benchmarks

Annex III: Verification procedure for market surveillance purposes

Part 1: Rated gross volume
Part 2: Rated storage volume
Part 3: Storage temperatures
Part 4: Control procedure of Parts1, 2 and 3
Part 5: Freezing capacity
Part 6: Energy consumption
Part 7: Power consumption
Part 8: Wine storage appliances

Annex IV: Method for calculating the maximum allowable Energy Efficiency Index

Part 1: Refrigerating appliances classification
Part 2: Calculation of the Equivalent Volume
Part 3: Calculation of the Energy Efficiency Index

Annex V: Additional applicable definitions and measurement method for the energy consumption and other functional performance of refrigerating appliances

Part 1: Additional definitions for the purposes of Annex I
Part 2: General conditions for testing
Part 3: Specific conditions for testing
Part 4: Measured parameters

ANNEX I
Ecodesign requirements

1. Generic ecodesign requirements

1) One year after this implementing measure has come into force:

a) The following information shall be provided in the booklet of instructions for wine storage appliances: "*This appliance is intended to be used exclusively for the long term storage and the aging of wine*".

b) Indications shall be provided in the booklet of instructions about the combination of drawers, baskets and shelves giving the best appliance energy efficiency

2) [Three] years after this implementing measure has come into force:

a) The fast freezing facility, or any similar function, in freezers and freezer compartments shall, once activated by the user according to the manufacturers instructions, be automatically reverted after no more than [72] hours as to insure normal cabinet or compartment(s) storage temperature conditions according to the manufacturers instructions.

b) Refrigerator-freezers with one thermostat and one compressor, which can be used in cool ambient temperature below 16°C according to the manufacturer instructions and which provide also a fast freezing facility, shall insure that any winter setting switch or similar function guaranteeing the correct frozen food storage temperature is automatically operated according to the temperature of the ambient where the appliance is installed.

c) Refrigerating appliances with a storage volume below [10] litre shall, once activated by the user, automatically enter into an operating conditions with a power consumption of 0,00 Watt after no more than [1] hour when no foodstuff is inside. The mere presence of an hard switch is not considered sufficient to fulfil this requirement.

2. Specific ecodesign requirements

The specific requirements set the maximum allowable annual energy consumption in terms of Energy Efficiency Index (EEI) value, which refrigerating appliance models shall fulfil.

1) One year after this implementing measure has come into force the Energy Efficiency Index for refrigerating appliances with a storage volume equal or higher than [10] litres shall be:

a) for compression-type refrigerating appliances: $EEI < 55$
b) for absorption-type and other-type refrigerating appliances: $EEI < 150$.

2) [Three] years after this implementing measure has come into force the Energy Efficiency Index for refrigerating appliances other than compressor-type, with a storage volume equal or higher than [10] litres, shall be: EEI < 125.

3) [Six] years after this implementing measure has come into force the Energy Efficiency Index for refrigerating appliances with a storage volume equal or higher than [10] litres shall be:

a) for compression-type refrigerating appliances: EEI < 44
b) for absorption-type and other-type refrigerating appliances: EEI < 110.

The Energy Efficiency Index of refrigerating appliances shall be calculated according to the procedure described in Annex IV.

Specific eco-design requirements in paragraphs 1), 2) and 3) shall not apply to wine storage appliances and to absorption-type refrigerating appliances and other-type refrigerating appliances belonging to Categories from 4 to 9 as set in Annex IV Part 1.

Specific eco-design requirements in paragraphs 1), 2) and 3) shall apply to refrigerating appliances that are not specifically designed for wine storage but that may be nevertheless used for this purpose and to refrigerating appliances that have a wine storage compartment combined with any other compartment type defined in this Regulation.

ANNEX II
Benckmarks

The following benchmarks are identified for the purpose of Annex I, part 3, point 2, of Directive 2005/32/EC:

At the time of adoption of this Regulation, the following values can be considered as benchmarks for the products concerned in terms of their Energy Efficiency Index and noise.

Refrigerators, compressor-type:

- EEI = 29,7 and an annual energy consumption of 115 kWh/year for a total storage volume of 300 of fresh food compartment plus 25 litre of chill compartment, and T (tropical) climate class;
- Noise: 33 dB(A).

Refrigerators, absorption-type:

- EEI = 97,2 and an annual energy consumption of 245 kWh/year for a total storage volume of 28 of fresh food compartment, and N (temperate) climatic class;
- Noise = no airborne acoustical noise is emitted by absorption-type refrigerating appliances.

Refrigerator-freezers, compressor-type:

- EEI = 28,0 and an annual energy consumption of 157 kWh/year for a total storage volume of 255 litre, of which 236 litre of fresh food compartment and 19 litre of four-star freezer compartment, and T (tropical) climate class;
- Noise = 33 dB(A).

Upright freezers, compressor-type:

- EEI = 29,3 and an annual energy consumption of 172 kWh/year for a total storage volume of 195 litre of four-star freezer compartment, and T (tropical) climate class;
- Noise = 35 dB(A).

Chest freezers, compressor-type:

- EEI = 27,4 and an annual energy consumption of 153 kWh/year for a total storage volume of 223 litre of four-star freezer compartment, and T (tropical) climate class.
- Noise = 37 dB(A).

ANNEX III
Verification procedure for market surveillance purposes

When performing the market surveillance checks referred to in Directive 2005/32/EC, Article 3 (2), the authorities of the Member States shall apply the following verification procedure, until a suitable harmonised standard is published for the purpose of this Annex and of Annex V.

Member State authorities shall test one single unit.

1. Rated gross volume

The measured value shall not be less than the rated value by more than 3 % or 1 l, whichever is the greater value.

2 Rated storage volume

The measured value shall not be less than the rated value by more than 3% or 1 l, whichever is the greater value. Where the volumes of the cellar compartment and fresh food storage compartment are adjustable relative to one another by the user, this requirement applies when the cellar compartment is adjusted to its minimum volume.

3. Storage temperatures

The values measured on the first sample refrigerating appliance tested shall comply with requirements in Table 7.

4 Control procedure of Parts 1, 2 and 3

If the requirements of Parts 1, 2 or 3 are not met on the single refrigerating appliance the measurements shall be made on a further three randomly selected refrigerating appliances. The arithmetical mean of the measured values of these three refrigerating appliances shall be in accordance with the requirements of Parts 1, 2 or 3.

Otherwise, the model and all other equivalent refrigerating appliance models shall be considered not to comply.

5 Freezing capacity

The value measured on the first refrigerating appliance tested shall not be less than the rated value by more than 10 %. If the result of the test carried out on the first refrigerating appliance is less than the rated value minus 10 %, the test shall be carried out on a further three randomly selected refrigerating appliances. The arithmetical mean of the values of these three refrigerating appliances shall not be less than the rated value by more than 10 %.

The value obtained either on the first refrigerating appliance tested or the arithmetical mean value obtained on a further three refrigerating appliances shall be in accordance with the minimum values stated in Annex V, Point g.5).

Otherwise, the model and all other equivalent refrigerating appliance models shall be considered not to comply.

6 Energy consumption

The value measured shall not be greater than the rated value (E_{24h}) by more than 10 %. If the result of the test carried out on the first refrigerating appliance is greater than the rated value plus 10 %, the test shall be carried out on a further three randomly selected refrigerating appliances. The arithmetical mean of the values of these three refrigerating appliances shall not be greater than the rated value by more than 10 %..

Otherwise, the model and all other equivalent refrigerating appliance models shall be considered not to comply.

7 Power consumption

The refrigerating appliance shall be considered to comply with the provisions set out in Annex V, Point 1.c) if the result do not exceed the limit value by more than 0,10 W. Otherwise, three more units shall be tested. The model shall be considered to comply if the average of the results of the latter three tests does not exceed the limit values by more than 0,10 W.

Otherwise, the model and all other equivalent refrigerating appliance models shall be considered not to comply.

8 Wine storage appliances

For wine storage appliances evidence shall be provided that the appliance complies with the technical characteristics described in Annex V point g.6.

ANNEX IV
Method for calculating the maximum allowable Energy Efficiency Index

The energy consumption of a refrigerating appliance is a function of the category of appliance to which it belongs, its volume and the construction characteristics (thickness of insulation, compressor efficiency, defrosting characteristics, etc.) and the climate class under which it is deemed to operate.

In setting minimum energy efficiency requirements therefore, allowances must be made for the main endogenous factor which influence energy consumption.

For this reason the energy consumption is defined by a linear equation which is a function of the volume of the appliance, with different equations laid down for each category of appliance. To calculate the maximum allowable EEI of a given appliance, it must therefore first be allocated to the appropriate Category.

The Energy Efficiency Index of a refrigerating appliance is then the ratio between its estimated annual energy consumption and the standard annual energy consumption, which is considered the reference or base energy consumption of refrigerating appliances.

1. Refrigerating appliances classification

Refrigerating appliances are classified in ten categories as shown in Table 1. Each category is defined by the specific compartment composition as in Table 2 and is independent from the number of doors, external drawers and compartments. An external drawer is equivalent to a door.

Table 1: Refrigerating appliances categories

Category	Description
1	Refrigerator without other compartments
2	Refrigerator-cellar and Cellar
3	Refrigerator-chiller and Refrigerator with a 0 star compartment
4	Refrigerator with a 1 star compartment
5	Refrigerator with a 2 star compartment
6	Refrigerator with a 3 star compartment
7	Refrigerator-freezer
8	Upright freezer
9	Chest freezer
10	Multi-use cabinet and other appliances

If the compartment(s) temperature does not allow the classification of the appliance in one of the Categories from 1 to 9, or in case of multi-use cabinets Category 10 can be selected.

Table 2: Refrigerating appliance classification and relevant compartment composition

Storage temperature range (°C)	> +14	± 0,5K[a]	+14 / +8	+8 / +3	+3 / -2 °C	< 0 / > -6	< -6	< -12	< -18	< -18	Category (number)
Nominal temperature (for the EEI) (°C)	design T	design T (+15 /+9)	+12	+5	0	0	-6	-12	-18	-18	
Compartments types	Other[c]	Wine storage	Cellar	Refrigerator	Chill	0star/ Ice making	1 star	2 star	3 star	4 star	
Appliance Category	**Compartments composition**										
REFRIGERATOR WITHOUT OTHER COMPARTMENTS	N	N	N	**Y**	N	N	N	N	N	N	**1**
REFRIGERATOR-CELLAR and CELLAR	O	O	**Y**	**Y**	N	N	N	N	N	N	**2**
	O	O	**Y**	N	N	N	N	N	N	N	
	O	**Y**	N	**Y**	N	N	N	N	N	N	
REFRIGERATOR-CHILLER and REFRIGERATOR WITH A 0 STAR LOW COMPARTMENT	O	O	O	**Y**	**Y**	O	N	N	N	N	**3**
	O	O	O	**Y**	O	**Y**	N	N	N	N	
REFRIGERATOR WITH A 1 STAR COMPARTMENT	O	O	O	**Y**	O	O	**Y**	N	N	N	**4**
REFRIGERATOR WITH A 2 STAR COMPARTMENT	O	O	O	**Y**	O	O	O	**Y**	N	N	**5**
REFRIGERATOR WITH A 3 STAR COMPARTMENT	O	O	O	**Y**	O	O	O	O	**Y**	N	**6**
REFRIGERATOR-FREEZER	O	O	O	**Y**	O	O	O	O	O	**Y**	**7**
UPRIGHT FREEZER	N	N	N	N	N	N	N	O	(**Y**)[b]	**Y**	**8**
CHEST FREEZER	N	N	N	N	N	N	N	O	N	**Y**	**9**
MULTI-USE AND OTHER APPLIANCES	O	O	O	O	O	O	O	O	O	O	**10**

Notes:
Y = the compartment shall be present;
N = the compartment shall not be present;
O = the compartment presence is optional;
a) the range of the storage temperature for wine storage compartments is ± 0,5K of the nominal temperature, to be included in the range +15/+9;
b) includes also the three-star frozen food cabinets;
c) "Other compartment" includes any compartment, other than a wine storage one, with a storage temperature higher than 14°C

2. Calculation of the Equivalent Volume

Because refrigerating appliances contain different compartments maintained at different temperatures which have a significant influence of the overall energy consumption, the maximum allowable EEI is defined as a function of the Equivalent Volume, which is the weighted sum of the storage volumes of the different compartments.

The equivalent volume of a compartment is the net storage volume of the compartment adjusted to compensate for heat loadings on spaces which are at temperatures other than that of fresh food compartment. The equivalent volume of a refrigerating appliance is the sum of the equivalent volumes of all compartments.

To determine the equivalent volume of a compartment, the volume correction factors shall first be determined as follows:

- The thermodynamic correction factor $\frac{(25-T_c)}{20}$ is the temperature difference between the nominal temperature of a compartment (Table 2) and the ambient temperature under standard test conditions (+25 °C) expressed as a ratio of the same difference for a fresh food compartment at +5 °C. The thermodynamic factors for the compartments described in Annex V, points from g.1) to g.5) are as in following Table 3:

Table 3: Thermodynamic factors for refrigerating appliance compartments

Compartment	**Nominal temperature**	**(25-T_c/20)**
Wine storage compartment/Other compartment	design temperature	$\frac{(25-T_c)}{20}$
Cellar compartment	+12°C	0,65
Fresh food storage compartment	+5°C	1,00
Chill compartment	0 °C	1,25
Ice making compartment and 0-star compartment	0 °C	1,25
One-star compartment	-6 °C	1,55
Two-star compartment	-12 °C	1,85
Three-star compartment	-18 °C	2,15
Food freezer compartment (four-star compartment)	-18 °C	2,15

Notes:

(i) for wine storage compartments the thermodynamic factor shall be determined by the coldest nominal temperature, included in the relevant temperature range, capable of being set by a user and maintained continuously according to the manufacturer instructions;

(ii) for multi-use compartments, the thermodynamic factor shall be determined by the warmest temperature of the coldest storage temperature range for the cabinet or compartment capable of being set by a user and maintained continuously according to the manufacturer instructions;

(iii) for any two-star section (within a freezer) the thermodynamic factor shall be determined considering a temperature of -12 °C;

(iv) for other compartments the thermodynamic factor shall be determined by the coldest nominal temperature capable of being set by a user and maintained continuously according to the manufacturer instructions.

- *FF*: is the volume correction factor for the presence of a 'no frost' function (Table 4);
- *BI*: is the volume correction factor for built in appliances (Table 4);
- *TD*: is the volume correction factor for the transparent door (Table 4).

Table 4: Value of the correction factors

Correction factor	Value	Conditions
FF (Frost-free)	1,2	for Frost-free (ventilated) frozen food compartments
	1	otherwise
CC (climate class)	1,2	for T class (tropical) appliances
	1,1	for ST class (subtropical) appliances
	1	otherwise
BI (built-in)	1,2	for built-in appliances of under 58 cm in width
	1	otherwise
TD (transparent door)	1,05	for compartments having a door with a free transparent area ≥ 90% of their access opening
	1	otherwise

The refrigerating appliance equivalent volume, in litre and recorded to the first integer, is then calculated as:

$$V_{eq} = \left[\sum_{c=1}^{c=n} V_c \times \frac{(25 - T_c)}{20} \times FF_c \times TD_c \right] \times CC \times BI$$

where
n is the number of compartments,
T_c is the nominal temperature of the compartment in Table 2.

3. Calculation of the Energy Efficiency Index

For the calculation of the EEI, the energy consumption of any given appliance is compared to the reference energy consumption of the same category of appliance with an identical equivalent volume.

The Energy Efficiency Index is calculated as:

$EEI = \frac{AC}{SC} \times 100$ and is rounded to the first decimal place,

where:

– *AC* = annual energy consumption of the refrigerating appliance
– *SC* = standard annual energy consumption of the refrigerating appliance.

The Annual Energy Consumption *AC* of a refrigerating appliance is calculated, in kWh/year and recorded to two decimal places, as:

$$AC = E_{24h} \times 365$$

where E_{24h} is the energy consumption of the refrigerating appliance in kWh/24h and rounded to three decimal places.

The Standard Annual Energy Consumption *SC* of a refrigerating appliance is calculated, in kWh/year and recorded to two decimal places, as:

$$SC = V_{eq} \times M + N + CH$$

where:
– Veq is the equivalent volume of the refrigerating appliance
– CH is an allowance equal to 50 kWh/year given to appliances with a chill compartment of at least 15 litres
– M and N values depend from the appliance category as in following Table 5:

Table 5: M and N values by appliance category

Category	M	N
1	0,233	245
2	0,233	245
3	0,233	245
4	0,643	191
5	0,450	245
6	0,777	303
7	0,777	303
8	0,539	315
9	0,472	286
10	a	a

[a]for Category 10 refrigerating appliances the M and N values depend on the temperature and the star rating of the compartment with the lowest storage temperature capable of being set by a user and maintained continuously according to the manufacturer instructions. When only other compartment as defined in Table 2 is present, M and N values for Category 1 shall apply.

ANNEX V

Additional applicable definitions and measurement method for the energy consumption and other functional performance of refrigerating appliances

For the purposes of compliance and verification of compliance with the requirements of this Regulation, the parameters described in Part 4 shall be established by reliable, accurate and reproducible measurement procedures, which take into account the recognised state of the art measurement methods. The general testing conditions described in Part 2 and the specific testing conditions described in Part 3 shall also apply.

The application of the harmonised standard published in the Official Journal for the purpose of this Annex shall provide presumption of conformity

1. Additional definitions for the purposes of Annex I

The following definitions shall apply.

a) Type of refrigerating appliances are:

- a.1) "Compression-type refrigerating appliance" means a refrigerating appliance in which refrigeration is effected by means of a motor-driven compressor;
- a.2) "Absorption-type refrigerating appliance" means a refrigerating appliance in which refrigeration is effected by an absorption process using heat as energy source;
- a.3) "Other-type refrigerating appliances" means a refrigerating appliance in which refrigeration is effected by any other technology or process.

b) "Frost-free refrigerator means a refrigerator in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system and at least one is a "frozen-food storage" compartment. However a single-compartment refrigerator using a frost-free system cannot be called a frost-free refrigerator.

c). "Frost-free refrigerator-freezer means a refrigerator-freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system.

d). "Frost-free frozen-food storage cabinet means a frozen-food storage cabinet in which all compartments are automatically defrosted with automatic disposal of the defrosted water and which is cooled by a frost-free system.

e) "Frost-free food freezer means a food freezer in which all compartments are automatically defrosted with automatic disposal of the defrosted water and at least one compartment is cooled by a frost-free system.

f) "Built-in appliance" means a fixed refrigerating appliance intended to be installed in a cabinet, in a prepared recess in a wall or similar location, with the need of furniture finishing.

g) Compartments and sections in refrigerating appliances are:

g.1) "Fresh-food storage compartment" means a compartment intended for the storage of unfrozen foodstuffs, which may itself be divided into sub-compartments.

g.2) "Cellar compartment" means a compartment intended for the storage of particular foodstuffs or beverages at a temperature warmer than that of the fresh-food storage compartment.

g.3) "Chill compartment" means a compartment intended specifically for the storage of highly perishable foodstuffs.

g.4) "Ice-making compartment" means a low-temperature compartment intended specifically for the freezing and storage of ice.

g.5) "Frozen-food storage compartment" means a low-temperature compartment intended specifically for the storage of frozen foodstuffs. Frozen-food storage compartments are classified according to temperature in:

- "One-star compartment": a frozen-food storage compartment in which the temperature is not warmer than - 6 °C;
- "Two-star compartment": a frozen-food storage compartment in which the temperature is not warmer than - 12 °C;
- "Three-star compartment": a frozen-food storage compartment in which the temperature is not warmer than - 18 °C;
- "Food freezer compartment" (named also "four-star compartment"): a compartment suitable for freezing foodstuffs from ambient temperature down to -18°C, and which is also suitable for the storage of frozen food under three-star storage conditions. Two-star sections are permitted within the compartment; the rated freezing capacity shall be at least 4,5 kg per 100 l of its storage volume in 24 h, and in no case less than 2 kg;
- "0-star compartment": a frozen-food storage compartment in which the temperature is <0°C and that can be used also for the freezing and storage of ice but it is not intended for the storage of highly perishable foodstuffs

g.6) "Wine storage compartment": means a compartment exclusively designed for long term storage of wine. It has to be designed for:

(i) the capability of maintaining continuously a nominal temperature in the range from +9 °C to +15 °C with cooling as well as heating;

(ii) the capability of maintaining the storage temperature within a variation over time of less than 0,5 K

(iii) the active or passive control of the compartment humidity in the range 50-80%;

(iv) a construction to reduce the transmission of vibration to the compartment, whether from the refrigerator compressor or from external source.

g.7) "Multi-use compartment" means a compartment intended for use at two or more of the temperatures of the compartment types and capable of being set by a user to maintain continuously the operating temperature range applicable to each compartment type according to the manufacturer instructions.

Where a feature shifts temperatures in a compartment to a different operating temperature range for a period of limited duration only (i.e. the

feature does not maintain the alternative temperature range continuously, e.g. a fast freeze facility) that feature does not qualify the compartment as multi-use.

h) Sections and convenience features that may be present in refrigerating appliances are:

h.1) "Two-star section": part of a food freezer compartment or cabinet, or three-star compartment or cabinet, which is not self-contained (i.e. does not have its own individual access door or lid) and in which the temperature is not warmer than -12 °C.

h.2) "Convenience feature" means an enclosure, or a container either fixed or removable by the user in which suitable storage conditions are provided for designated types of foodstuffs. These conditions may be different from those of the compartment in which it is located.

A fixed convenience feature is one which is not intended to be removed and its removal is likely to require the use of tools.

i) Where a freezer has both "chest" and "upright" configurations, it shall be classified as a chest where the gross volume of the chest part(s) exceeds [75%] of the total gross volume of the appliance.

j) "Fast freeze" means a reversible feature or a function to be activated by the user according to the manufacturers instructions, that decreases the storage temperature of the freezer or the freezer compartment to achieve a faster freezing of unfrozen foodstuffs or to assist the freezing of large loads of unfrozen foodstuffs.

2. General conditions for testing

The following general conditions for testing refrigerating appliances shall apply:

a) if anti-condensation heaters are provided which can be switched on and off by the user, they shall be switched on and - if adjustable - set at maximum heating;

b) if 'through the door devices' (such as ice or chilled water/drinks dispenser) are provided which can be switched on and off by the user, they shall be switched on during the energy consumption measurement but actual dispensing operation shall not be run;

c) for multi-use cabinet the storage temperature during the measurement of the energy consumption shall be the coldest claimed for continuous normal use according to the manufacturers instructions;

d) the energy consumption of a refrigerating appliance shall be determined in the coldest configuration claimed by manufacturer for continuous normal use of any multi-use compartment(s). This shall be applied also when a feature, to be switched on by the user, alters the temperature in one or more compartments towards the warmest end of the operating temperature range for the compartments type.

e) Climate classes: refrigerating appliances are classified into four climate classes or into a range of classes according to Table 6, showing the range of ambient temperatures for which the required storage temperatures (according to Table 7) are to be met.

Table 6: Climate classes

Class	Symbol	Ambient average temperature °C
Extended temperate	SN	+ 10 to +32
Temperate	N	+16 to +32
Subtropical	ST	+16 to +38
Tropical	T	+16 to +43

f) The refrigerating appliance shall be capable of maintaining, simultaneously, the required storage temperatures in the different compartments and the permitted temperature deviations (during the defrost cycle) as given in Table 7 for the different types of refrigerating appliances and for the appropriate climate classes.

Table 7: Storage temperatures

Storage temperatures (°C)							
Fresh food storage compartment t_{ma}	Food freezer and three-star compartment/ cabinet t***	Two-star compartment /section t**	One-star compartment t*	Chill compartment t_{cc}	Cellar compartment t_{cm}	Wine storage compartment t_{wc}	Other compartment t_{om}
≤ + 4	≤ -18 [a]	≤ -12 [a]	≤ -6	$-2 \leq t_{cc} \leq +3$	$+8 \leq t_{cm} \leq +14$	$+0 \leq t_{cm} \leq +15$	≥14°C

- t_{ma}: mean storage temperature of the fresh-food compartment,
- t*, t**, t***: maximum temperatures of the frozen-food storage compartments
- t_{cm}: mean storage temperature of the cellar compartment
- t_{cc}: instantaneous storage temperature of the chill compartment
- t_{wc}: instantaneous storage temperature of the wine storage compartment
- t_{om}: mean storage temperature of the other compartment
- No specific storage temperature is requested for the ice making compartment and for the "0 star" compartment, but storage temperature shall be < 0 °C

a) permitted temperature deviations during the defrost cycle: a rise of no more than 3 K during a period that 4 hours or 20% of the duration of the operating cycle, whichever is the shorter

3. Specific conditions for testing

The following specific conditions for testing refrigerating appliances shall apply:

a) Terms, definitions and symbols: Clause 3 of EN 153 (Clause 3 of EN ISO 15502:2005); where in contrast definitions in Annex V Part 1 shall prevail;

b) Classification and symbols: Clause 4.2 of EN ISO 15502:2005;

c) Design: Clause 5 of EN 153 (Clauses 5.1 and 5.6 of EN ISO 15502:2005);

d) Storage temperatures: Clause 6 of EN 153 (Clauses 6 of EN ISO 15502:2005), where in contrast Table 7 in Annex V shall prevail;

e) Determination of linear dimensions, volumes and areas: Clause 7 of EN 153 (Clause 7 of EN ISO 15502:2005);

f) General test conditions: Clause 8 of EN 153, where in contrast definitions in Annex V Part 2 shall prevail;

g) Testing the storage temperatures: Clause 13 of EN 153 (Clause 13 of EN ISO 15502:2005);

h) Energy consumption test: Clause 15 of EN 153, where in contrast conditions set in Annex V Part 2 shall prevail;

i) Temperature rise test: Clause 16 of EN 153 (Clause 16 of EN ISO 15502:2005);

j) Freezing test: Clause 17 of EN 153 (Clause 17 of EN ISO 15502:2005);

k) Final test report: Clause 19 of EN 153, where in contrast Annex V Part 4 shall prevail;

l) Designation: Clause 20 of EN 153 (Clause 20 of EN ISO 15502:2005);

m) Marking: Clause 21.2, 21.2, 21.3 and 21.4 of EN ISO 15502:2005;

n) Built-in refrigerating appliances: Annex D of EN 153;

o) Rated characteristics and control procedure: Annex E of ENE 153, where in contrast Annex III shall prevail;

p) Noise: IEC 60704-2-14 Refrigerators, frozen-food storage cabinets and food freezers for household and similar use – Measurement of emission of airborne acoustical noise.

q) Power consumption measurement: the measurement of the power consumption of refrigerating appliances with a storage volume below [10] litre shall be made with an uncertainty of less than or equal to 0,01 W at the 95% confidence level, using the same measurement method as in Commission Regulation (EC) No …/.. of […] implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment.

4. Measured parameters

The parameters below shall be established and recorded as indicated:

a) overall dimensions: the overall dimensions measured as the height, width and depth of the rectangular parallelepiped, whose base is horizontal, within which the refrigerating appliance is inscribed to include the complete appliance except for the handle - the protrusion of which, if any, is to be specified separately.

Linear dimensions shall be measured to the nearest millimetre;

b) overall space required in use: the overall space required in use measured as the height, width and depth, including the handle, increased by the space necessary for free circulation of the cooling air when the refrigerating appliance is in service, plus the space necessary to allow opening of the means of access to that minimum angle permitting removal of all removable parts such as containers and shelves, including a drip tray that has to be removed and any water that has to be emptied manually.

Linear dimensions shall be measured to the nearest millimetre;

c) total gross volumes(s): the gross volume calculated by dividing the total volume into convenient units of volumes of geometric shapes, which can easily be measured. When the gross volume is determined, internal fittings such as shelves, removable partitions, containers, evaporators, temperature control devices and interior light housings shall be considered as not being in place. However, the gross volume shall take into account the exact shapes of the walls if they contain depressions or projections.

Calculated volume shall be expressed to the nearest whole number of cubic decimetres or of litres;

d) storage volume(s) and total storage volume(s): the total storage volume is the sum of the storage volumes of all compartments, including two-star section(s), as applicable. For the determination of storage volumes, the total volume of devices and of spaces considered unusable for the storage of food shall be deducted from the gross volume.

Calculated volume shall be expressed to the nearest whole number of cubic decimetres or of litres;

e) defrosting type for each compartment, except for frost free refrigerating appliances the different defrosting type shall be assessed. Possible defrosting types are automatic defrost, semi-automatic defrost, manual defrost (with automatic or manual removal of the defrost water) and adaptive defrost;

f) storage temperature: the refrigerating appliance shall be capable of maintaining, simultaneously, the required storage temperatures in the different compartments and the permitted temperature deviations (during the defrost cycle) as given in Table 7 for the different types of refrigerating appliances and for the appropriate climate classes (given in Table 6);

g) energy consumption: the value of the energy consumption shall be calculated for a period of exactly 24 hours from the measured value.

The energy consumption shall be expressed in kilowatt hours per 24 h (kWh/24h), to three decimal places;

h) temperature rise: the time for the temperature rise, from –18°C to –9°C, in a frozen-food storage cabinet or compartment, or food freezer cabinet or three-star compartment;

i) freezing capacity: the mass which would be frozen in 24 hours in food freezers and food freezer compartments, contemporarily fulfilling the temperature requirements for the other compartments;

j) power consumption: the power consumption data shall be expressed in Watts rounded to two decimal places.