



EPEE and EUROVENT Joint Position on the Implementing Measures for the Energy related Products (ErP) ENER Lot 12 of the EU Ecodesign Directive 2009/125/EC

Brussels, 15 July 2011

CONTENT

- 1. Introduction**
- 2. Review of the MEPS calculation proposal of the Wuppertal Institute**
- 3. Improvements of the MEPS calculation for remote display cabinets (RDC)**
- 4. Improvements of the MEPS calculation for integral (plug-in) display cabinets (IDC)**
- 5. Mandatory Energy Labelling**
- 6. Bonus for low GWP refrigerants used in ErP Lot 12 products**
- 7. Market Surveillance schemes in the EU 27 member states to enforce the implementing measures of the Ecodesign Directive**
- 8. Conclusion**

ANNEXES

- 1. Scope of the considered and excluded products**
- 2. Product categories of remote and integral refrigerated display cabinets**
- 3. Temperature Classes for M-packages according to EN ISO 23953**
- 4. Climate Classes according to EN ISO 23953**

1. Introduction

Based on the Final Report of the Preparatory Study on the Ecodesign Requirements for the ErP Lot 12 “commercial refrigerators and freezers” presented by BIO Intelligence Service on behalf of DG Transport and Energy in December 2007, the elaboration of a specific proposal for the Implementing Measures of these Ecodesign Requirements for ErP Lot 12 following the revised Ecodesign Directive 2009/125/EC has been awarded to the Wuppertal Institute.

The Wuppertal Institute, represented by Dr. Wolfgang Irrek, has presented its proposal at the meeting of the Consultation Forum on ErP Lot 12 on 23 April 2010. The trade associations representing the manufacturers of the commercial refrigerator and freezer products, EPEE and EUROVENT, have met the responsible policy officers of DG Energy several times to comment on the proposal for Implementing Measures made by the Wuppertal Institute and to explain their own positions and proposals. EUROVENT had submitted a very detailed proposal for Implementing Measures of ErP Lot 12 in April 2010, which has not been considered by DG Energy.

In recent meetings of EUROVENT and EPEE in April and May 2011 with the responsible policy officer of DG Energy for the ENER Lot 12 products, it was agreed to provide a revised proposal for Implementing Measures of the Ecodesign Requirements for these products by the end of June 2011 which would be pre-agreed between both associations. EPEE and EUROVENT have therefore assigned a Joint Industry Expert Group (JIEG) in May 2011 to work out this proposal for DG Energy.

2. Review of the MEPS calculation proposal of the Wuppertal Institute

The proposal of the Wuppertal Institute contains recommendations on the following elements of possible implementing measures:

- MEPS (Minimum Energy Performance Standards)
- Mandatory Energy Labelling
- Further policies and measures on European and national level

For the derivation of Minimum Energy Performance Standards, the consultant has analysed data and information from EUROVENT, publications, interviews and various other sources.

The main conclusions of the consultant’s analysis are the following:

- Integral products have no significantly higher energy consumption than comparable remote products although it should be different in theory.
- The measurement of volume is more expensive than the measurement of the Total Display Area (TDA) of concerned products.
- Products are partly sold with lighting, partly without lighting.
- Performance data of concerned products are usually given for defined climate classes and temperature classes according to EN ISO 23953.
- Remote refrigerated cabinets can be used with different refrigerants in a remote refrigeration system.
- GHG emissions of refrigerants contribute usually less than 3% to the total lifecycle GHG emissions of the concerned products.
- One general MEPS formula for all different categories of applications (remote/ integral, medium temperature/ low temperature, vertical/ semi-vertical/ horizontal display, open/ closed versions) could be feasible.

As a consequence of these main conclusions, the consultant proposes a “one size fits all” formula for the calculation of the MEPS energy efficiency indexes for all different categories of applications covered by ENER Lot 12.

The Joint Industry Expert Group of EPEE and EUROVENT (JIEG) has compared the European average energy efficiency values for remote refrigerated display cabinets per product category and temperature class as published by the EUROVENT Product Group 14 with the respective energy efficiency threshold values that would result for these product categories from the formula proposed by the Wuppertal Institute. The results are shown in chart 1 below:

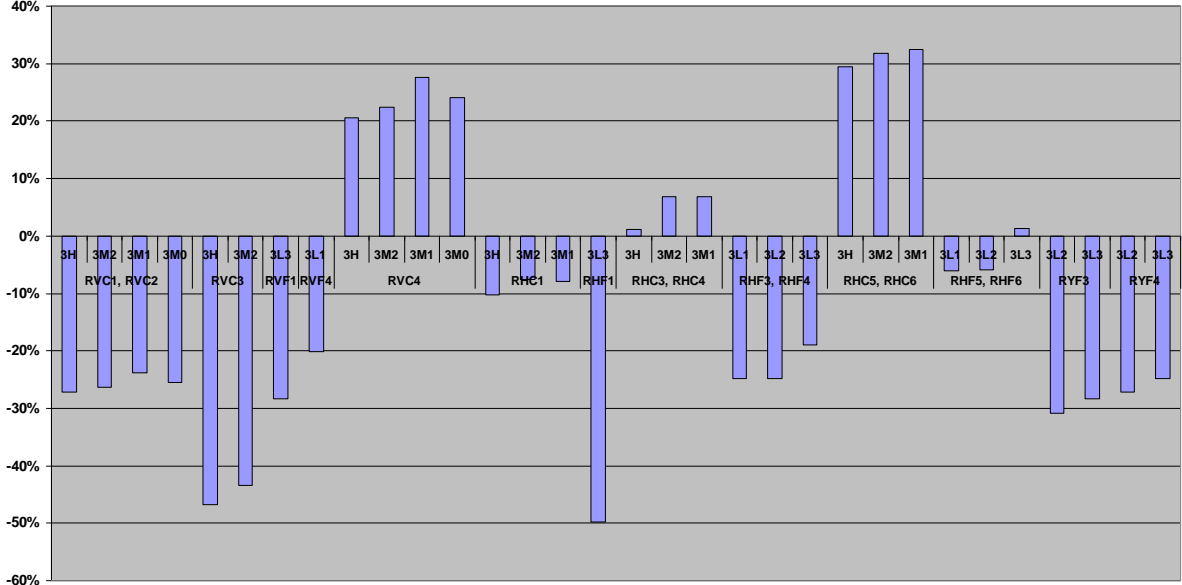


Chart 1 Fluctuation of the MEPS values derived from the formula proposed by the Wuppertal Institute compared to European average energy efficiency values of remote display cabinets per product category and temperature class

The comparison in chart 1 shows the significantly different MEPS values derived from the proposed formula of the Wuppertal Institute compared to the European average energy efficiency values of remote refrigerated display cabinets as published by EUROVENT.

These proposed MEPS values are up to 50% lower than the actual European average energy efficiency values for most of the considered product categories and temperature classes of remote refrigerated display cabinets except for the open horizontal categories RHC1, RHC3 and RHC4, while the closed vertical category RVC4 and the closed horizontal categories RHC5 and RHC6 show a better energy efficiency of up to 30% versus the proposed MEPS values from the consultant.

The application of the formula proposed by the Wuppertal Institute to calculate the MEPS of the average products of the main European manufacturers of remote refrigerated display cabinets would therefore mean that a large majority of product categories like open semi-vertical cabinets (RVC1), open vertical multidecks (RVC2), vertical roll-in cabinets (RVC3), open wall-site freezer cases (RHF3), open island-site freezer cases (RHF4) and even the closed vertical freezer cases (RVF4) and closed freezer combi cases (RYF3/ RYF4) would have to be withdrawn from the market within the European Union.

In effect, the main products for merchandising options frequently used by the European food retailers today would then no longer be available for them.

3. Improvements of the MEPS calculation for remote display cabinets (RDC)

The MEPS calculation formula proposed by the Wuppertal Institute does not reflect the energy efficiency of the existing various remote refrigerated display cabinets in a correct way. Its deviation from the European average energy efficiency values of these products as published by EUROVENT will then need to show a more or less equal distance for each product category in chart 1 - which is by far not the case. Also challenging MEPS require a certain level above the average energy efficiency values of the considered products to avoid the withdrawal of 50% or more of these products from the market once the implementing measures of the Ecodesign Directive will come into mandatory application. A level of the MEPS below the average energy efficiency values of the products - like displayed in chart 1 – will require as a consequence the withdrawal of far more than 50% of the existing products from the market after the enforcement of the MEPS.

These MEPS will normally be located in a certain spread around the median deviation from these average energy efficiency values of each product category, but they will not demonstrate the substantial fluctuation around the average energy efficiency values like in chart 1 if they reflect the real energy efficiency of existing products.

The JIEG of EPEE and EUROVENT recommends therefore to approach the energy efficiency of remote refrigerated display cabinets for the calculation of MEPS values in a different, more realistic and market oriented way. Considering the above mentioned huge methodical fluctuations of the MEPS calculation formula proposed by the consultant versus the average energy efficiency values in the different product categories, this definition of MEPS for each product category reflects the improvement potential for the energy efficiency of remote refrigerated display cabinets in a more suitable way than the actually proposed “one size fits all” MEPS calculation formula.

In addition, the energy consumption of refrigerated display cabinets is also dependent on the product temperature. To consider this aspect, in a simple way, the JIEG suggests to differentiate the MEPS of each product category also by the temperature classes as defined in the European standard EN 23953, but not by a formula giving the MEPS as a function of the product temperature like proposed by the Wuppertal Institute.

To keep the MEPS calculation scheme easily manageable, several product categories can be consolidated per temperature class, like e.g. RVC1 semi-vertical and RVC2 vertical display cabinets or open horizontal RHF3 wall-site and RHF4 island-site freezers.

The proposed MEPS calculation scheme of the JIEG is based on the European average energy efficiency values of the remote refrigerated display cabinets representing the baseline for its calculation (EEI = 100%). The MEPS values representing the upper threshold of the allowed energy efficiency values need to be on a generally higher level than this EEI = 100 % baseline to avoid the withdrawal of 50% or more of the existing products from the EU market.

The JIEG propose to define these MEPS values at a level of 25% above the today's existing European average energy efficiency values which would give them an EEI = 125% at the beginning of their enforcement. The average energy efficiency values (EEI = 100%) and the proposed MEPS values (EEI=125%) for remote refrigerated display cabinets are shown below in chart 2 for each product category and temperature class.

These MEPS values for remote refrigerated display cabinets refer to product length of 2,50 meters without shelf lighting, but with door lighting and canopy lighting only. They are equal for all product lengths as the MEPS values are specific energy efficiency values.

Type of cabinet ISO 23953 reference		Application: ISO 23953 Temperature Class	TEC/TDA	TEC/TDA
			European Average Value EEI = 100%	Proposed MEPS Value EEI = 125%
	RVC1, RVC2	3H	10,1	12,6
	RVC1, RVC2	3M2	12,3	15,4
	RVC1, RVC2	3M1	13,4	16,8
	RVC1, RVC2	3M0	14,5	18,1
	RVC3	3H	13,8	17,3
	RVC3	3M2	16,0	20,0
	RVF1	3L3	29,0	36,3
	RVC4	3H	6,1	7,6
	RVC4	3M2	7,4	9,3
	RVC4	3M1	8,0	10,0
	RVC4	3M0	8,7	10,9
	RVF4	3L1	28,5	35,6
	RHC1	3H	6,2	7,8
	RHC1	3M2	6,7	8,4
	RHC1	3M1	7,2	9,0
	RHF1	3L3	21,0	26,3
	RHC3, RHC4	3H	5,5	6,9
	RHC3, RHC4	3M2	5,8	7,3
	RHC3, RHC4	3M1	6,2	7,8
	RHF3, RHF4	3L3	13,0	16,3
	RHF3, RHF4	3L2	14,0	17,5
	RHF3, RHF4	3L1	15,0	18,8
	RHC5, RHC6	3H	4,3	5,4
	RHC5, RHC6	3M2	4,7	5,9
	RHC5, RHC6	3M1	5,0	6,3
	RHF5, RHF6	3L3	10,4	13,0
	RHF5, RHF6	3L2	11,2	14,0
RHF5, RHF6	3L1	12,0	15,0	
	RYF3	3L3	29,0	36,3
	RYF3	3L2	30,0	37,5
	RYF4	3L3	27,6	34,5
	RYF4	3L2	28,5	35,6

Chart 2 Proposed MEPS calculation scheme per product category and temperature class based on the average European energy efficiency values (EEI=100%) and proposed MEPS values (EEI=125%) all given in kWh/ m²/ day for remote refrigerated display cabinets without shelf lighting and with door lighting and canopy lighting only (see annexes 2, 3 and 4 for product categories, temperature class and climate class)

The main merchandising options of remote refrigerated display cabinets actually used by the European food retailers are reflected in this proposal as it also considers explicitly the MEPS values for open and closed vertical and horizontal display cabinets. In particular, the use of glass doors in front of vertical display cabinets trying to improve the energy efficiency of these products depends heavily on the frequency of the door openings by the customers in the stores of the food retailers.

Energy efficiency data derived from tests of vertical refrigerated display cabinets according to EN ISO 23953 show significant improvements for closed vertical cabinets compared to the respective open versions. However, this test data is based on ten door openings per hour in the test laboratories, while the food retailers have registered up to 250 door openings per hour in their stores during peak times.

Each door opening disrupts the cold air curtain inside the vertical display cabinet and sucks warm and humid air into the cold air circulation resulting in higher energy consumption for the rebuilding of the cold air curtain and a higher frequency of defrosts to dissipate the absorbed humidity during the door openings. The energy efficiency advantage of low door opening frequencies will be reversed once the door opening frequency is exceeding 60 per hour.

Finally, the use of open vertical display cabinets is a key element for typical discount retail stores using integral chest freezer cases for the merchandising of their frozen food. The dissipated heat of these integral chest freezers is absorbed by the open vertical display cabinets and thus enables the store operators to relinquish the installation of additional air conditioning systems.

The JIEG of EPEE and EUROVENT therefore recommends to keep the today existing various product categories of remote refrigerated display cabinets for the merchandising of chilled or frozen food with its open and closed product variants to allow the optimal merchandising concept in each store with the minimum total energy consumption considering not only the energy efficiency of each individual remote refrigerated display cabinet, but the energy efficiency of the entire store mainly dependent on its entire refrigeration system and of its additional air conditioning systems in a given building.

4. Improvements of the MEPS calculation for integral (plug-in) display cabinets (IDC)

Similar to the fluctuating deviation of the MEPS values derived from the MEPS calculation formula of remote refrigerated display cabinets in the different product categories, the proposed formula for the calculation of MEPS values does not reflect the substantial difference in energy consumption between comparable remote and integral refrigerated display cabinets. In principle, the energy efficiency of integral refrigerated display cabinets is considered as being worse than the energy efficiency of comparable remote refrigerated display cabinets, due to the lower efficiency of the components and the higher ambient temperature for the condenser.

The JIEG of EPEE and EUROVENT recommends therefore to calculate the MEPS threshold values of integral refrigerated display cabinets in a similar way to the one proposed for remote refrigerated display cabinets above. The energy efficiency threshold values of integral refrigerated display cabinets will need to consider the different product categories and the temperature classes instead of the “one size fits all” MEPS calculation formula.

To keep the MEPS calculation scheme also easily manageable for integral refrigerated display cabinets, several product categories will be consolidated per temperature class, like e.g. IVC1 semi-vertical and IVC2 vertical display cabinets, open horizontal IHF3 wall-site and IHF4 island-site freezers or closed horizontal IHF5 wall-site and IHF6 island-site freezers.

The proposed MEPS calculation scheme and the proposed MEPS threshold values (EEI=100%) for each product category and temperature class are shown below in chart 3.

Type of cabinet ISO 23953 reference		Application: ISO 23953 Temperature Class	TEC/TDA	TEC/TDA
			European Average Value EEI = 100%	Proposed MEPS Value EEI = 125%
	IVC1, IVC2	3H	12,4	15,5
	IVC1, IVC2	3M2	15,1	18,9
	IVC1, IVC2	3M1	16,5	20,6
	IVC1, IVC2	3M0	17,8	22,3
	IVC3	3H	17,0	21,3
	IVC3	3M2	19,7	24,6
	IVF1	3L3	36,5	45,6
	IVC4	3H	7,5	9,4
	IVC4	3M2	9,1	11,4
	IVC4	3M1	9,8	12,3
	IVC4	3M0	10,7	13,4
	IVF4	3L1	35,9	44,9
  	IHC1	3H	7,6	9,5
	IHC1	3M2	8,2	10,3
	IHC1	3M1	8,9	11,1
	IHF1	3L3	26,5	33,1
	IHC3, IHC4	3H	5,5	6,9
	IHC3, IHC4	3M2	5,8	7,3
	IHC3, IHC4	3M1	6,2	7,8
	IHF3, IHF4	3L3	16,4	20,5
	IHF3, IHF4	3L2	17,6	22,0
	IHF3, IHF4	3L1	18,9	23,6
	IHC5, IHC6	3H	5,3	6,6
	IHC5, IHC6	3M2	5,8	7,3
	IHC5, IHC6	3M1	6,2	7,8
	IHF5, IHF6	3L3	13,1	16,4
	IHF5, IHF6	3L2	14,1	17,6
IHF5, IHF6	3L1	15,1	18,9	
	IYF3	3L3	36,5	45,6
	IYF3	3L2	37,8	47,3
	IYF4	3L3	34,8	43,5
	IYF4	3L2	35,9	44,9

Chart 3 Proposed MEPS calculation scheme per product category and temperature class based on the average European energy efficiency values (EEI=100%) and proposed MEPS values (EEI=125%) all given in kWh/ m²/ day for integral refrigerated display cabinets without shelf lighting and with door lighting and canopy lighting only (see annexes 2, 3 and 4 for product categories, temperature class and climate class)

The length compensation for different product lengths would be calculated according to the formula given below based on the reference length of 2.50 meters:

$$\frac{TEC}{TDA}(x) = \left(\frac{TEC}{TDA} \right)_{2,5} * \left(+0,2 \left(2,5 - x \right) \right)$$

The main merchandising options of integral refrigerated display cabinets that are used by the European food retailers are reflected in this proposal as it considers explicitly the MEPS threshold values for open and closed vertical and horizontal integral display cabinets.

5. Mandatory Energy Labelling

The proposal of the Wuppertal Institute for implementing measures contains next to the above mentioned proposal for the MEPS calculation formula also the recommendation to opt for a mandatory energy labelling for all refrigerated remote and integral display cabinets. The JIEG of EPEE and Eurovent would like to underline that the energy efficiency of a food retail store is mainly influenced by its entire refrigeration system of the store consisting of compressor packs or remote condensing units, remote refrigerated display cabinets, cold rooms and condensers plus its integral refrigerated display cabinets (and an additional air conditioning system where needed).

The JIEG of EPEE and EUROVENT considers the proposed mandatory energy labelling of remote refrigerated display cabinets as not appropriate since these energy efficiency labels tend to give misleading information with regards to the energy efficiency of the entire refrigeration systems used in the stores. The energy labelling of remote refrigerated display cabinets might be considered by single manufacturers as a suitable tool to promote the energy efficiency of their remote display cabinets, however such an energy labelling should be possible, but suggested as a voluntary initiative only and not as a mandatory regulation.

The voluntary energy labelling could be considered also for the integral refrigerated display cabinets as those products are often used for the merchandising of cold drink bottles or ice cream in the stores of the food retailers. These products are normally owned by the food industry, but the energy bill is paid by the store owners. For them, an energy labelling of these integral refrigerated display cabinets as stand-alone products might be of some interest, while the energy labelling of the entire store would qualify their energy efficiency in considering the entire refrigeration and air conditioning systems and other energy related products in a more holistic approach as the drivers of their energy bill.

6. Bonus for low GWP refrigerants used in ErP Lot 12 products

In the recent meetings of EUROVENT and EPEE with the responsible policy officer in DG Energy for the ENER Lot 12 products, the option of a bonus for low GWP refrigerants on the MEPS energy efficiency threshold values was intensively discussed. As an example, the legislation for “residential room conditioning appliances” covered in Ecodesign ENER Lot 10 has adopted such a bonus scheme for refrigerants with a GWP < 150.

The JIEG of EPEE and EUROVENT reconfirms its position already laid out during these meetings that the EU Ecodesign Directive 2009/125/EC is pushing for the improvement of the energy efficiency of energy related products (ErP) while the EU F-Gas Regulation 842/2006/EC is targeting the GWP impact of refrigerants used in those energy related products.

The JIEG of EPEE and EUROVENT recommends thus to keep the different targets of improved energy efficiency of energy related products under the EU Ecodesign Directive and the GWP impact of those products under the EU F-Gas Regulation separated. A compromise based on the GWP impact of the used refrigerants might only lead to a worse Total Equivalent Warming Impact (TEWI) of the considered products when the GWP impact of direct emissions of the refrigerant used will be outbalanced by the impact of a lower energy efficiency of this refrigerant on the indirect emissions.

7. Market Surveillance schemes in the EU 27 member states to enforce the implementing measures of the Ecodesign Directive

The JIEG of EPEE and EUROVENT would like to stress out that the implementing measures to be adopted for refrigerated remote and integral display cabinets under the Ecodesign Directive ErP Lot 12 will only lead to an improved energy efficiency of the considered products once harmonized Market Surveillance schemes will be in operation across the EU. As long as such implementing measures are enforced only in some EU member states while not being equally enforced in others, they will not only lead to a missing of the targeted energy efficiency improvements for the considered products, but will also lead to competitive disadvantages for those manufacturers declaring their energy efficiency threshold values in EU member states with market surveillance schemes in operation for the verification of this claimed data.

In particular, the products delivered by manufacturers from countries outside the EU should need to undergo regular verification tests of claimed product performances in one of the EU member states with market surveillance schemes in operation as the products of the EU manufacturers have to undergo.

The JIEG of EPEE and EUROVENT therefore appeals to DG Energy in the specific case of the refrigerated remote and integral display cabinets in ErP Lot 12 of the Ecodesign Directive legislation to ensure a level playing field for all manufacturers competing with their products in the internal market of the EU.

8. Conclusion

The JIEG of EPEE and EUROVENT recommends the calculation of the MEPS energy efficiency threshold values for refrigerated remote display cabinets and for integral refrigerated display cabinets based on given average values for the European market per product category and temperature class with some clusters as shown above. These MEPS values will define the reference energy efficiency level $EEL=125\%$ of the average energy efficiency values for all products falling under the scope of ENER Lot 12.

The reference MEPS values given in chart 2 and chart 3 are valid for a reference length of 2.50 meters for each refrigerated remote and integral display cabinet. It will be equal for all different lengths of remote refrigerated display cabinets, while it will be corrected by the formula given in section 4 for all integral refrigerated display cabinets.

The JIEG of EPEE and EUROVENT recommends not to differentiate the MEPS values for different heights of semi-vertical and vertical display cabinets or different depths for horizontal display cabinets to keep the proposed MEPS calculation schemes for refrigerated remote and integral display cabinets easily manageable.

The mandatory energy labelling for all refrigerated remote and integral display cabinets as proposed by the Wuppertal Institute should not be enforced for entire refrigeration systems of food retail stores consisting of compressor packs or remote condensing units, remote refrigerated display cabinets, cold rooms, condensers and integral refrigerated display cabinets. Energy labelling might be suggested as a voluntary initiative, but should not be imposed as a mandatory regulation.

The JIEG of EPEE and EUROVENT furthermore recommends to keep the different targets of improved energy efficiency of energy related products under the EU Ecodesign Directive and the GWP impact of those products under the EU F-Gas Regulation separated and for this reason opposes a bonus for the use of low GWP refrigerants in ErP Lot 12 products.

The equal enforcement of the expected implementing measures for the refrigerated remote and integral display cabinets under the Ecodesign Directive ErP Lot 12 by harmonized market surveillance schemes across all EU member states is a major concern for the industry. The JIEG of EPEE and EUROVENT therefore calls on the European Commission to ensure a level playing field for all manufacturers competing with their refrigerated remote and integral display cabinet products in the internal market of the EU. .

ANNEX 1 : Scope of the considered and excluded products

Remote and Integral (Plug-In) Refrigerated Display Cabinets according to the standard EN ISO 23953-1:2005

All product types are defined under standard configuration.

The following refrigerated display cabinet types are explicitly excluded:

- refrigerated corner cabinets
- special models manufactured according to customer's specifications
- refrigerated cabinets especially designed for displaying products not covered by the European regulations on foodstuff storage temperatures and that subsequently do not fall under the definition of one of the standard temperature classes (L1, L2, L3, M0, M1, M2, H1 and H2)

The following products are also not considered as ENER Lot 12 products:

- vending machines, wine cabinets and beverage coolers
- merchandising ice cream freezers
- refrigerated cabinets for catering or similar applications
- cold rooms and walk-in freezers
- power packs and chillers
- components and sub-assemblies of refrigerated display cabinets

ANNEX 2 : Product categories of remote and integral refrigerated display cabinets

Application	Positive Temperature		Negative Temperature	
To be used for	Chilled foodstuffs		Frozen, quick frozen foodstuffs and ice cream	
Horizontal		HC1	Frozen, serve-over counter open service access	HF1
	Chilled, serve-over counter open service access			
	Chilled, serve-over counter with integrated storage open service access	HC2		
	Chilled, open, wall site	HC3	Frozen, open, wall site	HF3
	Chilled, open, island	HC4	Frozen, open, island	HF4
	Chilled, glass lid, wall site	HC5	Frozen, glass lid, wall site	HF5
	Chilled, glass lid, island	HC6	Frozen, glass lid, island	HF6
	Chilled, serve-over counter closed service access	HC7	Frozen, serve-over counter closed service access	HF7
Vertical	Chilled, semi-vertical	VC1	Frozen, semi-vertical	VF1
	Chilled, multi-deck	VC2	Frozen, multi-deck	VF2
	Chilled, roll-in	VC3		
	Chilled, glass door	VC4	Frozen, glass door	VF4
Combined	Chilled, open top, open bottom	YC1	Frozen, open top, open bottom	YF1
	Chilled, open top, glass lid bottom	YC2	Frozen, open top, glass lid bottom	YF2
	Chilled, glass door top, open bottom	YC3	Frozen, glass door top, open bottom	YF3
	Chilled, glass door top, glass lid bottom	YC4	Frozen, glass door top, glass lid bottom	YF4
	Multi-temperature, open top, open bottom			YM5
	Multi-temperature, open top, glass lid bottom			YM6
	Multi-temperature, glass door top, open bottom			YM7
	Multi-temperature, glass door top, glass lid bottom			YM8
R Remote condensing unit	V Vertical			
I Incorporated condensing unit	Y Combined			
A Assisted service	C Chilled			
S Self service	F Frozen			
H Horizontal	M Multi-temperature			
General classification can be used as follows: HC1, VF1, YM5. When necessary, the classification can be more precise for example RHC1A, IVF1S				
NOTE: Serve-over counters are primarily in assisted service but may be in self service Chilled multi-deck cabinets are primarily in self service but may also be in assisted service				

ANNEX 3 : Temperature Classes for M-packages according to EN ISO 23953

Class	The highest temperature θ_{ah} of the warmest M-package equal to or lower than °C	The lowest temperature θ_{bl} of the coldest M-package equal to or higher than °C	The lowest temperature θ_{al} of the warmest M-package equal to or lower than °C
L1	-15	-	-18
L2	-12	-	-18
L3	-12	-	-15
M0	+4	-1	
M1	+5	-1	-
M2	+7	-1	-
H1	+10	+1	-
H2	+10	-1	-

ANNEX 4 : Climate Classes according to EN ISO 23953

Test room climate class	Dry bulb temperature °C	Relative humidity %	Dew point °C	Water vapour mass in dry air
0	20	50	9,3	7,3
1	16	80	12,6	9,1
2	22	65	15,2	10,8
3	25	60	16,7	12,0
4	30	55	20,0	14,8
6	27	70	21,1	15,8
5	40	40	23,9	18,8
7	35	75	30,0	27,3
8	23,9	55	14,3	10,2

NOTE The water vapour mass in dry air is one of the main points influencing the performance and the energy consumption of the cabinets. See also Annex D to compare lab and store conditions.