

Policy recommendations and data input for the review study for professional refrigerated storage cabinets and blast cabinets

Authors: Maike Hepp, Nadja Gross, H el ene Rochat

Contact: maike.hepp@topten.ch

Topten International Group (TIG), Zurich, Switzerland

Transparency register number: 043746118747-53

May 12th, 2021

Summary

The Energy labelling and Ecodesign regulations for professional refrigerated storage cabinets were adopted in May 2015 and entered into force in July 2016. These two regulations were instrumental in transforming the market for professional refrigeration (see Market overview). Since then, classes G and F have been banned because of the strengthening of the MEPS and some models already reach the A+ class.

The revision of the regulation for professional refrigerated storage units is welcomed. Further topics should be considered during the review study to fill some existing gaps and maximize the impact of the regulation in the future:

Scope:

- **Refrigerated medicine cabinets, laboratory refrigerators and freezers and ice machines** should be included in the scope of the Ecodesign and energy labelling regulations. Based on a recent study (BFE, 2021), the potential energy savings are significant and the stock and sales warrant their inclusion.

Further requirements

- **Remove MEPS exemption for heavy-duty cabinets in the Ecodesign regulation:** The Topten database shows that most of the best available technology (BAT) models on the European market are currently categorized as "heavy-duty". Their exemption is not justified anymore and the regulation should be adapted accordingly.
- **MEPS and an Energy Label should be established for refrigerator-freezers and blast cabinets.** Information requirements for these products have been mandatory since July 2016. The data gathered so far allows for the introduction of MEPS and an energy label to assist buyers in making informed decisions.

Information requirements

- Add mandatory declaration of energy data for **walk-in cold rooms, pass-through and roll-in cabinets, cabinets with a remote condensing unit and static-air and horizontal storage cabinets** (if not covered by 2019/2016).

1 Market overview

The market has evolved significantly since the entry into force of the regulation in 2016. While some product types have developed BATs faster than others, the overall changes are across all categories (Figure 1).

In the end of 2016, the first counter refrigerators in class A+ were put on the market. The number of models has steadily increased since then. The largest increase in class A counter refrigerators took place from 2017 to 2018 with an increase from 3 to 17 models. For 2-door refrigerators, models were in classes C and D in 2016. Three years later, almost half of all models are in classes A and B.

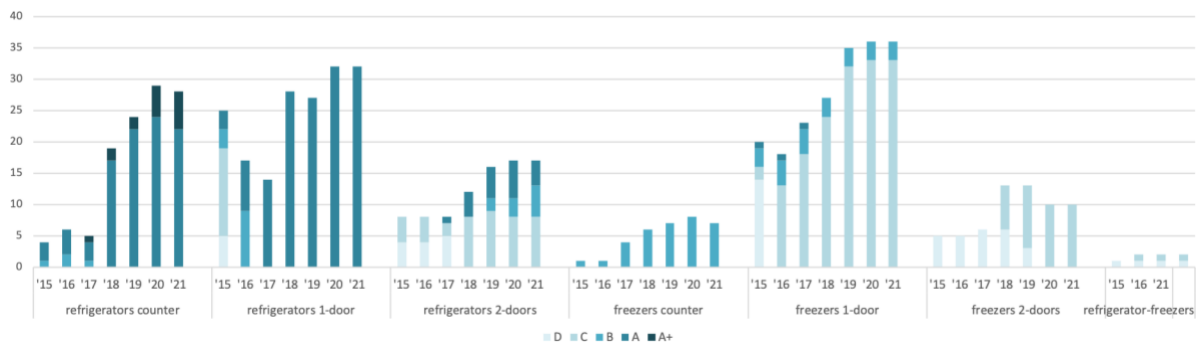


Figure 1: Number of models of professional refrigerated storage cabinet BAT models on the European market by category and energy class from 2015 - 2021 (source: Topten.eu).

For 1-door refrigerators, the BATs in the year before the introduction of the energy labelling regulation ranged from the classes A to D and totaled only to 25 products. One year after the entry into force of the regulation, Topten could strengthen its selection criteria to Class A and above. The number of class A 1-door refrigerators has increased steadily since then: 32 models from 17 manufacturers are listed on Topten. There is still a lot of potential to increase the energy efficiency of these products, and this should be reflected in the future MEPS.

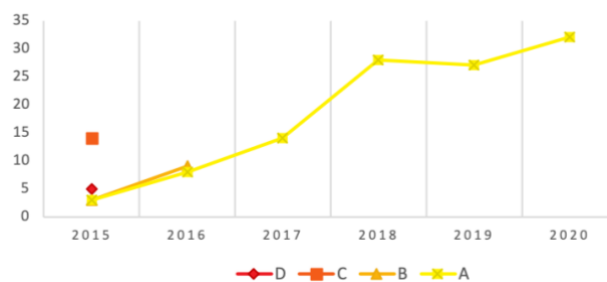


Figure 2: Market evolution of BAT models for 1-door storage refrigerators from 2015 – 2020. Number of models in the different energy classes (source: Topten.eu)

2 Scope

2.1 Inclusion of medicine cabinets and laboratory grade refrigerators and freezers

Medicine cabinets are in every pharmacy, hospital, and doctor's office. Recent months have shown the need of proper refrigeration for the storage of medicine and vaccines. Other refrigerated appliances for medical use could also be included into the regulation such as laboratory refrigerators, refrigerators for blood storage and ultra-low temperature refrigerators.

These devices are constructed in a similar way to other storage cabinets. Their energy consumption can be measured thanks to a well-established measurement method (BFE, 2021). The inclusion of these products can easily be achieved. The test standard also provides quality assurance that the contents are refrigerated uniformly and safely.

A first analysis of the medicine cabinets available showed that the energy consumption varies greatly amongst products (BFE, 2021). Based on the product analysis, with an efficient device, energy savings could be 455 kWh per year per device when comparing to an average device.

Details from the study about medicine and laboratory cabinets (BFE, 2021) can be found in Annex III.

2.2 Inclusion of ice machines

A study from the Swiss Federal Office of Energy (BFE, 2021), investigated the market for ice machines and estimated that 200'000 to 500'000 units were sold in the EU every year. The market for ice-machines is larger than the market for blast cabinets. The study also provides an overview of all types of ice making machines and technologies. It estimated a stock of 1.5 million ice machines in the EU. Interviews with manufacturers confirmed that yearly sales will increase with time as the demand for chilled drinks is increasing. Based on these numbers, we strongly support the inclusion of these products in the scope of the regulation as they are significant in number and in terms of energy consumption. An advanced test standard for ice machines is established in the form of the DIN 18873-10 – providing both energy and water consumption – and can serve as base for the development of an EN.

The Commission should at least strive to establish mandatory information requirements for the energy and water consumption. These information requirements should already include an energy efficiency index to facilitate informed decision making by buyers and as further preparation for the subsequent steps of energy labelling and MEPS in the next review process.

Details from the study about ice machines (BFE, 2021) can be found in Annex II and the enclosed Excel table.

3 Further Requirements

3.1 Exemption of "heavy-duty cabinets"

Currently tier 2 and tier 3 MEPS of the Ecodesign regulation do not apply to "heavy-duty" cabinets. However, data shows that these products are energy efficient, and they represented a large share of the products on the market. Of the 131 professional refrigerated storage cabinets listed on Topten (Table 1), 90% (118 models) of these are "heavy-duty". The high percentage of heavy-duty cabinets of

those BAT models holds true for all energy classes and all product types. These products reach the highest energy classes and do not require the exemption for them to be competitive.

Table 1: Overview of heavy-duty (HD) cabinets professional refrigerated storage cabinets in comparison to other models listed on Topten.eu in April 2021. Heavy-duty cabinets are marked blue. The energy classes that do not fulfill the Topten selection criteria are grayed out.

Category	A+		A		B		C		Total	
	Total	HD	Total	HD	Total	HD	Total	HD	Total	HD
Storage counter refrigerators	6	5	22	19					28	24
Storage refrigerators 1-door	0	0	32	31					32	31
Storage refrigerators 2-doors	0	0	4	4	5	5	8	5	17	14
Storage counter freezers	0	0	0	0	7	5			7	5
Storage freezers 1-door	0	0	0	0	3	3	34	31	37	34
Storage freezers 2-doors	0	0	0	0	0	0	10	10	10	10
Total	6	5	58	54	15	13	52	46	131	118

3.2 Introduction of MEPS and an energy label for refrigerator-freezers

Refrigerator-freezers were covered in the scope of the Ecodesign regulations (EU 2015/1095), making the declaration of the daily energy consumption in kWh/24h mandatory since July 2016. This was set to gather information on the products on the market to define further Ecodesign requirements for the next review.

We support setting Ecodesign requirements for these products starting with the definition of an Energy Efficiency Index (EEI) and introduction of an energy label. We believe that the market could strongly benefit from these measures as shown in a Topten overview of the Swiss market in 2021 using data from the websites of 9 Swiss retailers and 6 European manufacturers. It shows that over 41 models the daily energy consumption ranges from 1.4 to 9.3 kWh/24 h. While no volume was declared for some of the models, both models with minimum and maximum energy consumption are of one-door-width. This indicates a **saving potential of multiple factors** between models of a similar size.

All units were vertical units with forced-air. Of these products, 40% used R290 or R600a as a refrigerant. The remaining 60% used R134a, R404a or R452a. Generally, it could be observed that data availability was better for the newer models using R290 as refrigerant.

An important point to consider while defining the upcoming EEI formula, is setting clear instructions for the testing of the different compartments as there are gaps that can lead to different interpretation of the text.

3.3 Introduction of MEPS and an energy label for blast cabinets

Information requirements for blast cabinets were also part of the Ecodesign regulations (EU 2015/1095). Manufacturer are required to declare the energy consumption per kg of foodstuffs per standard temperature cycle in kWh/kg. These information requirements were also set with the intention to achieve market transparency for setting further Ecodesign requirements and a potential Energy label in the next revision.

A 2021 Topten overview of the Swiss market covering 220 models and using product data from the websites of 7 Swiss retailers and 6 European manufacturers showed that the energy consumption per kg of foodstuffs of less efficient units was 35% higher than efficient models for the freezing cycle,

ranging from 0.2016 to 0.2739 kWh/kg and 30% higher for the refrigerating cycle, ranging from 0.0798 to 0.0921 kWh/kg. In several cases, the mandatory product information was not declared:

- Full load capacity: 91% provided data about the full load capacity
- Standard temperature cycle and cycle duration: 89% of models had data about temperature and 59% about the cycle duration
- Refrigerant: 70% named the refrigerant used inside the product, 2 products used R290, the other 153 models used R407a, R404a or R452a

4 Mandatory Product Data Declaration

Some product categories that are not within the scope of either the Energy Labelling or Ecodesign regulations have significant market shares and are likely to show energy savings a like to those of other categories. As such, the reviewed Ecodesign regulation should include mandatory information requirements for the following products:

- Walk-in cold rooms
- Pass-through and roll-in cabinets
- Cabinets with a remote condensing unit

These information requirements should already include an energy efficiency index to facilitate informed decision making by buyers and as further preparation for the subsequent steps of energy labelling and MEPS in the next review process.

Previous market surveys by Topten have shown that often information requirements are not respected, and the information cannot be found. It is crucial for the information requirement to have an impact on market transparency that these requirements are fulfilled through the oversight of the market surveillance authorities.

5 Gap in Scope

Static-air and horizontal storage cabinets are currently excluded from (EU) 2015/1095 for professional refrigerated storage cabinets. Only professional chest freezers are explicitly covered in another regulation:

Regulation (EU) 2019/2016 *“with regard to energy labelling of refrigerating appliances” – repealing Commission Delegated Regulation (EU) 1060/2019* – excludes in its scope *“professional refrigerated storage cabinets, with the exception of professional chest freezers”*.

That means that static-air cabinets and horizontal storage refrigerators occupy a gap in the regulation. The review committee shall identify options for including those categories in the regulation to close the gap.

Note: 2 counter and 3 1-door static storage freezers – measured according to EN 16825 – comply with the Topten criteria for BAT products and can be found on Topten.eu -> [Storage Freezers](#).

6 References and links

6.1 Useful links

Topten.eu storage refrigeration product lists with more product data, list prices and other information:

- [Counter Refrigerators](#)
- [1-Door Refrigerators](#)
- [2-Door Refrigerators](#)
- [Counter Freezers](#)
- [1-Door Freezers](#)
- [2-Door Freezers](#)
- [Refrigerator-Freezers](#)
- [Refrigerated Medicine Cabinets](#)

6.2 Topten.eu selection criteria:

- [Selection criteria for professional storage refrigeration](#)

6.3 References

Bundesamt für Energie (2021), 5x Grundlagen effiziente Gewerbegeräte (advanced)

Commission issued FAQ of April 2018 related to Regulation (EU) No 2015/1094 with regard to the energy labelling of professional refrigerated storage cabinets and Regulation (EU) No 2015/1095 with regard to ecodesign requirements for professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers

Annex I: Benchmarks

Best available technologies on the market are shown on Topten.eu. An overview of the current best products on the European market are shown in Table 2.

Table 2: Number of professional refrigerated storage cabinets listed on Topten.eu (April 2021). For refrigerator-freezers the energy efficiency class equivalent is declared, energy classes not listed as “best products” on Topten are marked in grey

Category	A+	A	B	C	Total
Storage counter refrigerators	6	22			28
Storage refrigerators 1-door	0	32			32
Storage refrigerators 2-doors	0	4	5	8	17
Storage counter freezers	0	0	7		7
Storage freezers 1-door	0	0	3	34	37
Storage freezers 2-doors	0	0	0	10	10
Storage refrigerator-freezers	0	0	0	2 x C, 1 x D	2
Total	6	58	15	54 + 1 x D	133

Benchmarks for the different categories of refrigerated storage cabinets are shown in Table 3. The table shows the products with the lowest EEI values for each product type and the products with the lowest energy consumption for each product type for comparison.

Table 3: BAT models on Topten.eu, April 2021. The table shows the product with the lowest EEI and the lowest AEC for each product type

Category		Brand & Model	Net. Vol.	kWh/year	kWh/year/l	EEI	Energy Class
Storage counter refrigerators	Lowest EEI	Gram Compact K 220	78 l	227	2.91	11.40	A+
	Lowest kWh/year	Gram Compact K 220	78 l	227	2.91	11.40	A+
Storage refrigerators 1-door	Lowest EEI	Gram Superior Plus K 72 G	462 l	285	0.62	20.80	A
	Lowest kWh/year	Gram Superior Euro K 62 G	322 l	264	0.82	23.20	A
Storage refrigerators 2-doors	Lowest EEI	Desmon HEM14	964 l	529	0.55	24.10	A
	Lowest kWh/year	Gemm XFN/140	876 l	504	0.58	24.60	A
Storage counter freezers	Lowest EEI	Adande VCS R2 Side Engine	86 l	761	8.85	26.40	B
	Lowest kWh/year	Adande VCS R2 Side Engine	86 l	761	8.85	26.40	B
Storage freezers 1-door	Lowest EEI	Gemm XFB/70	438 l	1046	2.39	28.80	B
	Lowest kWh/year	Gram Compact F 310 G	152 l	886	5.83	39.90	C
Storage freezers 2-doors	Lowest EEI	Gemm XFB/140	876 l	2049	2.34	35.40	C
	Lowest kWh/year	Gemm XFB/140	876 l	2049	2.34	35.40	C

Refrigerators reach better energy efficiency classes than freezers. Smaller appliances perform better than larger appliances. Only counter refrigerators have models in class A+. The differences in performance could be because the sales of counter refrigerators and 1-door refrigerators are higher, and therefore manufacturers invest more in R&D to develop efficient products. Another explanation could be that the EEI calculation somehow favors these product types.

The review study should examine this matter and find out which driver is more accurate and whether the factors for calculating the EEI for a particular product types should be adjusted.

Annex II: Study Results Ice Machines

The study from the Swiss Federal Office of Energy (BFE, 2021) includes a manufacturer survey and market survey of online available product data. The manufacturer survey was conducted among large manufacturers of ice machines in Europe of which 4 participated.

The most relevant findings of the **manufacturer survey** are summarized below:

1. EU stock: a stock of approximately 1.5 million ice machines in the EU is realistic. Statistics across the EU show 1.4 million active restaurants, bars and catering companies in the EU-27 in 2006¹ and 1.66 million enterprises in the food and beverage service industry in the EU-28 in 2016². Continually producing ice machines (24 hour cyclically producing ice machines) are more common than cyclical producing ice machines. Manufacturers confirm the growing market as chilled drinks are more and more common. Additive or subtracting factors like large locations with more than one ice-machine (e.g. for different types), small locations without ice-machines and the Brexit do not significantly change this estimate.
2. EU yearly sales: 200'000-500'000 units
3. Lifetime: average of 8 years
4. "Efficient" machines: energy consumption between 0.2-0.4 kWh/kg ice
5. Saving potential on the market: the difference between an average market model and an efficient ice machine was estimated by the manufacturers between 20% and 80%
6. Future saving potential: a further efficiency increase over the next 10 years from current best models of 20-30% seems possible
7. Important factors in purchase decisions: ice type, production volume, maintenance, cleaning, price

The survey results in more detail are shown in the table below:

Question	Manufacturer 1	Manufacturer 2	Manufacturer 3	Manufacturer 4
Number of relevant manufacturers in the EU	6-12	4-5	10-15	
Yearly sales in EU?	300'000 – 550'000	300'000 – 550'000	200'000	200'000
When is an ice machine "efficient"?	0.2-0.25 kWh/kg	0.30 kWh/kg	0.30 kWh/kg	0.40 kWh/kg
Difference average to most efficient model	20%	30%	50%	80%
Further increase of best models over next 10 years	30%	30%	30%	20%
Average lifetime 8 years?	Yes	Yes	Yes	Yes

¹ https://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:Restaurants,_bars_and_catering_statistics_-_NACE_Rev._1.1

² <https://www.statista.com/statistics/684174/number-of-enterprises-in-the-food-and-beverage-service-industry-in-the-eu/>

The *market survey* of online available product data resulted in

- 164 models
- by 5 manufacturers from 10 sources (websites of manufacturers, retailers and three emails with product data from 1 manufacturer and 2 different retailers)

Methodology: Products from websites where no relevant data was shown were not included in the data collection; where at least some energy relevant data was listed, approx. 50 % of models were included in the data collection.

Results with regards to saving potential:

- For each model with both maximum daily production and energy consumption per kg ice (59 of 164 models), the *maximum daily energy consumption* was calculated. The average value is *15.7 kWh/24h*.

The values *for connected load* ranged between *0.19 kW and 4.9 kW*

- Figure 3 shows the energy consumption in kWh/kg ice plotted along the maximum daily production capacity for those appliances with available data. Considerable differences in energy consumption for models of similar capacity can clearly be observed, indicating a *significant saving potential*.

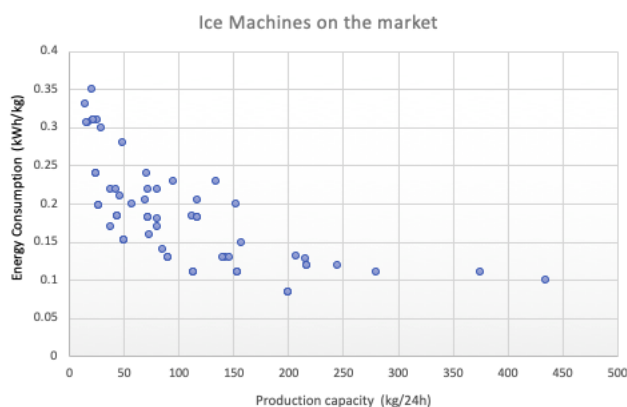


Figure 3: Energy consumption per kg ice of ice-machines on the European market, including the daily production capacity of each model (source: BFE, 2021).

Further results:

- The average energy consumption per kg ice according to the market survey is 0.13 kWh/kg ice, this includes ice machines of greatly differing sizes. The median value for maximal daily ice production is 80 kg; this matches with answers in the questionnaires from chapter 3.2 about most commonly sold model sizes. The minimum value in the survey data is 15 kg/24, the maximum 25'000 kg/24h.
- Production capacity: the mean value for production capacity was 1444 l, the median was at 80 l. Values ranged from 15 kg/24h to 25'000 kg/24h
- Cooling system: Out of 157 models with system data, 66% used air cooling, 31 % used air or/and water cooling and 3 % used only water cooling
- Test conditions: Test conditions ranged from 10°C air and water temperature to 25°C air and 15°C water temperature with various combinations in between. Where product data was available under different conditions, the resulting values normally varied as well, though in individual cases with greatly varying test conditions, the declared data was the same
- Refrigerants: 73 % R290 (climate friendly) , 27 % R134a / R404a / R452a/ R507 (higher GWP). Data availability within survey: 100%

Annex III: Study Results Medicine and Laboratory Appliances

The study from the Swiss Federal Office of Energy (BFE, 2021) includes an overview over the different types of refrigerated medicine and laboratory appliances, their characteristics, established (and recommended) test norms and resulting policy options.

Category	Test norms available	Temperature range + application	Data available	Policy options
Refrigerated Medicine Cabinets	DIN 58345:2007-09 Refrigerators for drugs (definitions, requirements, testing)	+2... +8 °C Drug stores, medical practices, hospitals, pharma companies	Topten.eu -> Medicine Cabinets	Test conditions almost identical to EN 16825; first medical cabinets reach class A+ equivalency. As construction and energy consumption are almost identical, can be covered by the same energy label
Refrigerators for Conserved Blood	DIN 58371:2010-09 Refrigerators for conserved blood (definitions, requirements, testing). Based on ISO 13485:2016 (Medical Device Quality Systems, for product safety and quality)	+2... +6 °C Medical practices, hospitals, pharma companies	-	As construction and energy consumption are similar, can be covered by the same energy label. Require more sensors and more precision in functionality requirements than storage appliances.
Refrigerators for Blood Plasma Storage	DIN 58375:2004-11 Refrigerators / frosters for plasma storage (definitions, requirements, testing). The responsible German national committee is the NA 063.02-06 AA - Refrigerators and freezers for pharmaceuticals	-30... -41 °C Medical practices, hospitals, pharma companies	-	Are to be treated as separate group due to the temperature range.
Laboratory Grade Refrigerators	DIN 13221 Refrigerators and Freezers for Laboratory use (definitions, requirements, testing)	+2... +8 °C (/ +1...+15 °C) Laboratories	-	As construction and energy consumption are similar, can be covered by the same energy label. Require more sensors and more precision in functionality requirements than storage appliances.
Laboratory Grade and Ultra-Low Temperature Freezers	DIN 13221 Refrigerators and Freezers for Laboratory use (definitions, requirements, testing)	Up to -150 °C Laboratories	-	Ambient range +10...+35°C, RH 75%. Are to be treated as separate group due to the temperature range.

The energy testing procedure from EN 16825 (often under almost identical conditions as in the DINs) can well be combined with the functionality tests and requirements from the individual DINs to form complete and comparable test norms that allow for the inclusion of refrigerated medicine cabinets and laboratory grade refrigerators and freezers into the scope of the regulation for professional refrigerated storage cabinets. Necessary additions would be an increased amount of sensors as well as clear specifications regarding internal temperatures and the compliance with selected temperature settings.