

Danish Technological Institute  
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## **The "positive list" for energy efficient professional kitchen cabinets - Processes and procedures**

### **Summary**

The positive list includes the most energy efficient professional kitchen refrigerators and freezers. The scheme covers professional kitchen refrigerators and freezers with an integrated refrigeration system (plug-in).

The scheme functions with as little administration as possible. A small secretariat manages the scheme and Danish Technological Institute is in charge of the secretariat. In order to get a product entered on the "positive list" the manufacturer (or importer) has to forward an application. The application shall include the necessary information for documentation. The application form shall include a test report, a photo and a signed contract in duplicate. The test report shall document that the test has been carried out in accordance with the criterion and the standard according to which the test will be performed. As a starting point, test reports prepared by the manufacturer will be used.

If doubt should arise to the value of the test report, random checks will be carried out by making a cabinet - supplied by the manufacturer/importer - available for testing in the climate chamber according to the standard in question. In addition, regular random sampling will be carried out. Random sampling routines have been prepared so products can be cancelled or re-entered on the list.

### **Secretariat**

The scheme will be managed by a secretariat which Danish Technological Institute is in charge of. The scheme will function with a minimum amount of administration and will be based on applications stating the properties, energy consumption and energy efficiency index of the cabinets.

In addition to approving applications, Danish Technological Institute will ensure continued updating of the positive list and preparation of info material to be used by the Danish Electricity Saving Trust etc. Danish Technological Institute also handles random sampling.

Danish Technological Institute shall on a regular basis inform the Danish Electricity Saving Trust about how matters are progressing.

The positive list and the application material will be available from [www.prof-hvidevarer.dk](http://www.prof-hvidevarer.dk)

## **Application form**

The scheme is partly based on a corresponding British scheme and therefore it will be possible for the manufacturer/importer to use the test reports that were also used in the British scheme – of course, if the cabinets are identical.

Therefore, manufacturers/importers do not have to carry out new tests or prepare new test reports in order to be included in the Danish scheme, if the test already has been carried out in connection with the British scheme. Please note, that the threshold value for refrigerators is lower in the Danish scheme. The tested cabinet has to be identical with the cabinet to be entered on the positive list.

In order to apply for entry on the positive list the manufacturer/importer first of all has to sign a contract with the Danish Electricity Saving Trust. The contract concerns the conditions required for entry on the positive list. The signed contract shall be forwarded in duplicate to Danish Technological Institute. Then they will be signed by the Danish Electricity Saving Trust and afterwards one copy will be returned. When the contract has been entered into it is possible to apply for entry on the positive list.

The application material required to get a cabinet entered on the positive list consists of an application form and a test report for the cabinet in question. The application shall be sent to Danish Technological Institute. Normally, the application will be considered within a fortnight after which the product in question will be entered on the list. If the application material is incomplete or unclear, the applicant will be notified in writing. Then it will be possible for the applicant to forward additional documentation.

The application shall include:

- Completed standard application form for each cabinet<sup>1</sup>.
- A test report concerning each cabinet.
- A photo of each cabinet (in digital form - jpg format and of high quality).

Application forms etc. will be available on [www.prof-hvidevarer.dk](http://www.prof-hvidevarer.dk)

The application can be sent by post or fax to:

Danish Technological Institute  
Industry and Energy  
P.O. Box 141  
DK-2630 Taastrup  
Denmark  
Attn: Per Henrik Pedersen  
Fax: +45 72 20 25 00

The material has to be of high graphic quality so not doubts arise about test results, etc.

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<sup>1</sup> Please note that you on the application form can state if several types of cabinets are in question. It is a condition that the cabinets otherwise are identical with regard to the insulation, refrigeration system and energy consumption and that they do not exceed the stated threshold values/energy efficiency index.

Within a fortnight, the applicant will be informed by e-mail whether or not application has been granted. During holiday seasons longer time might pass.

According to the procedure, the application will be treated by Danish Technological Institute. If the documentation is in order and if the cabinet complies with the threshold value of the type of cabinet in question, then Danish Technological Institute will enter the cabinet on the positive list.

### **Test report**

The manufacturer/importer is obliged to prove that the product meets the criterion demanded in order to be entered on the positive list.

The test report shall be prepared according to EN441, (alternatively according to the successor of EN441 when it is finally approved – but so far it is according to EN441). The test shall be carried out on a standard refrigeration cabinet identical with the type of cabinet that is for sale. If a cabinet is modified for the Danish market, then the test has to be carried out on that specific type of cabinet.

A new test report has to be forwarded if changes are made and if the cabinets on the market are not identical with the cabinet entered on the list. The cabinets have to be identical with regard to net volume, energy consumption, relative energy consumption and energy efficiency index.

Besides showing the load plan (load) and measurement results the test report has to state information about:

- Category of cabinet (e.g. "professional kitchen refrigerator")
- Brand name (e.g. Gram, Foster, Electrolux, Porkka,...)
- Name of manufacturer and contact information (telephone no./e-mail address)
- Name of importer (telephone no./e-mail address)
- Type description
- Number of doors
- External dimensions (H\*W\*D in mm incl. legs)
- Net volume
- Temperature class according to EN441 (e.g. M1)
- Energy consumption (kWh/year)
- Energy efficiency index (in kWh/48/m<sup>3</sup>)
- Refrigerant type (e.g. R290 or R134a)
- Cell gas in insulation gas (e.g. "cyclopentane")
- Relative operating hours for refrigeration system during testing
- Noise level (in dB(a)) (optional if informed or not).

### Random sampling

When the scheme has been established and when a certain number of cabinets have been entered on the positive list, random sampling will be carried out to ensure that the values informed by the applicant concerning net volume, energy consumption and energy efficiency have not been fiddled with.

A number of cabinets will be selected for climate chamber testing according to EN441 with the stated modifications.

Danish Technological Institute will single out the cabinets and carry out the test. Selection takes place by ordering a cabinet from the manufacturer/importer. The cabinet will be made available free of charge and will be returned after testing.

If the test result deviates more than 15% from the informed value, the manufacturer/importer will be contacted so an explanation can be found. Then another cabinet can be tested and if it has an energy consumption or an energy efficiency index greater than 10% compared with the stated value, the product in question has to be removed from the positive list.

The manufacturer or importer has to pay for the tests if the cabinet does not live up to the previously forwarded information and the cabinet will be removed from the list.

If a cabinet does not pass the random check (please refer to the above threshold values), but nevertheless fulfils the threshold value of the type of cabinet in question, the cabinet can remain on the list with corrected information. At the same time, the manufacturer will receive a protest from the Danish Electricity Saving Trust.

### Cancellation and entry of cabinets

If a cabinet is cancelled from a list because the informed and measured energy consumption and energy efficiency values deviate, the product in question will be removed from the list for at least 6 months. A new test report has to be forwarded in order to re-enter the cabinet on the list.

If repeated cases of deviations appear, the specific brand can be excluded from the list.

However, that will only take place according to agreement with the Danish Electricity Saving Trust, who has the right to inform the trade and the press about what has happened.

### Example of a positive list

An example of a "positive list" for professional kitchen refrigerators, where the threshold value is 15 kWh/48h/m<sup>3</sup>, is shown below:

*Graded according to net volume:*

Brand	Model	V <sub>net</sub> (litre)	Energy consumption (kWh/year)	I = E / V <sub>net</sub>	Refrigerant	Cell gas in insulation
TI	Cabinet A	400	825	11,30	R290	Pentane
TI	Cabinet E	475	900	10,38	R290	Pentane
TI	Cabinet B	500	1000	10,96	R290	Pentane
TI	Cabinet D	550	800	7,97	R600a	Pentane
TI	Cabinet C	600	1250	11,42	R404A	Pentane

**Graded according to energy efficiency index I:**

<b>Brand</b>	<b>Model</b>	<b>V<sub>net</sub> (litre)</b>	<b>Energy consumption (kWh/year)</b>	<b>I = E / V<sub>net</sub></b>	<b>Refrigerant</b>	<b>Cell gas in insulation</b>
TI	Cabinet D	550	800	7,97	R600a	Pentane
TI	Cabinet E	475	900	10,38	R290	Pentane
TI	Cabinet B	500	1000	10,96	R290	Pentane
TI	Cabinet A	400	825	11,30	R290	Pentane
TI	Cabinet C	600	1250	11,42	R404A	Pentane

Two lists shall be prepared:

1. Commercial refrigeration (M1)
2. Commercial freezing (L1)

**Evaluation of the scheme**

The scheme is evaluated annually. The objective is to evaluate the efficiency of the scheme and to carry out possible adjustments.

**Threshold values**

The criteria of entrance of professional kitchen cabinets on the positive list should be more strict than those used in connection with the British scheme. The Danish Electricity Saving Trust demands that only the most efficient cabinets (e.g. 25% quantile which is app. 25% of the cabinets on the market) can be entered on the list. Therefore, the threshold value for refrigerators in the 400 litre and 600 litre class is lower than in connection with the corresponding British threshold value.

Three cabinet sizes are in question:

- a) Gross volume of 400 litre (+-20%)
- b) Gross volume of 600 litre (+-20%)
- c) Gross volume of 1300 litre (+-20%)

Two temperature classes are in question:

- L1 (freezer) according to EN441 (the warmest package has a max. temperature less than or equal to -15°C and a min. temperature less than or equal to -18°C).
- M1 (refrigerator) according to EN441 (the warmest package has a max. temperature less than or equal to +5°C and the coldest package is warmer than or equal to -1°C).

The test shall comply with EN441 regarding the use of test and M-packages, measuring points, power supply, conditions in climate chamber, measuring equipment etc. When the measuring period starts, the refrigerated cabinet shall be in temperature equilibrium, cf. EN441.

Test conditions:

The test is carried out in the course of at least 48 hours  
 Climate class 4 according to EN441 (+30°C, 55% RH)  
 The test shall be carried out with door openings.

In the course of a 12 hour period, door openings have to take place. Each door has to be opened 6 times/hour. Each door opening takes 12 seconds, of which the 10 seconds have a door opening angle of at least 60°. If there are two doors, the first door has to be opened at time 0 and the second door 5 minutes later, the first door again after another 5 minutes etc. At the beginning of the 12 hours, all doors are kept open for 3 minutes straight after one another.

After the 12-hour door opening period, door openings again take place for 12 hours and then a new 12-hour door opening cycle starts with the same procedure as mentioned above.

During the test, defrosting has to be carried out as predetermined for a standard cabinet.

The test report shall include plots of the following temperatures of the M-packages:

- The temperature of the warmest M-package
- The temperature of the coldest M-package
- The arithmetic temperature of all M-packages.

The total energy consumption (kWh/48 hours) is measured and stated in the test report (according to EN-441).

The following is informed:  $I = \text{Energy efficiency index} = E/V$ .  
 $E = \text{Total energy consumption during 48 timer}$   
 $V = \text{Net volume (in m}^3\text{)}$

In order to be entered on the positive list the energy efficiency index has to be less than or equal to the values in the following table:

Criteria for I [kWh/48h/m <sup>3</sup> ]	Refrigerators (M1)	Freezers (L1)
400 and 600 litre	15	40
1300 litre	12	36