# Product Definition: Integral Refrigerated Retail Display Cabinets

***V1.1 April 2012*** *(minor change to dates of change of Canadian ice cream temperatures)*

## 1. Summary Definition and Categorisation

This work covers two certain types of integral refrigerated retail display cabinets. Following consultation with all participant countries, the definition and categorisation shown in Table 1 is proposed for these products. Section 2 explains the rationale for this in more detail. Section 3 explains the performance metrics proposed to be used, and Section 4 lists the data that will be requested on the basis of the foregoing analysis. For further information about the proposed analysis process including normalisation, see the document 'Product Analysis Proposal and Budget: Integral Refrigerated Display Cabinets'.

**Table 1: Simplified Product Categorisation Matrix**

| | | |
|---|---|---|
| Definition & scope | Scope is limited to:<br>*"Refrigerated integral retail display cabinets of types a) vertical chilled with glass door(s) as used for beverages and b) horizontal/semi-horizontal freezers as used for ice cream merchandising. Cabinets must enable customers to view the contents stored in the cabinet even when it is closed either through an opening in the cabinet, or through a transparent door or lid, and also enable customers to self-serve contents. 'Integral' means 'plug in' or self-contained, such that the cabinet incorporates a compressor and condensing unit within its housing."* | |
| Intended purpose / content | Beverage display or similar uses, i.e. vertical chilled cabinets with glass door(s) | Ice cream display or similar, i.e. horizontal/semi vertical freezer cabinets |
| Temperature class (storage temperature) | Vertical cabinets with glass door for chilled storage at:<br>a) -1 to +10°C ('H1' class, EU)<br>b) 3.3°C ±1.1°C (USA/Canada)<br>c) 'As manufacturer stipulates' (Australia)<br>d) Others TBD | Horizontal and semi-horizontal ice cream cabinets for frozen storage at:<br>a) -15 and below ('L1' class, EU)<br>b) -21°C (USA, prior to 01Jan2010; Canada prior to 12Apr2012)<br>c) -26.1°C (USA since 01Jan2010; Canada since 12Apr2012)<br>d) 'As manufacturer stipulates' (Australia)<br>e) Others TBD |
| Cabinet orientation and doors / covers (not night covers) | Vertical chilled cabinet with:<br>a) Single door full height<br>b) Double doors full height<br>c) Single under-counter<br>d) Double under-counter | Horizontal frozen cabinet of:<br>a) Small size (TDA and volume definition TBD)<br>b) Standard size (TDA and volume definition TBD) |

| | |
|---|---|
| Other characteristics to be noted: | Refrigerant type - according to international naming convention (R134a etc).<br>Total Display Area (TDA) or usable refrigerated storage volume<br>Presence of lighting.<br>Presence of circulation fan.<br>Test methodology used.<br>Defrost type<br>Outer dimensions (mm/inch)<br>Ambient test conditions class |

*Note that this category only includes electrically driven (single phase) vapour compression refrigeration units. It also only includes refrigerated cabinets for which the contents are visible from the outside – either via glass doors or through being open type cabinets. Cabinets with solid (i.e. opaque) doors are excluded.*

# 2. Product Sub-Category Rationalisation

This section explains the rationale behind the summary definition presented in Section 1, and how this was developed. Table 2 shows the first proposed way to break down the product category, and each aspect is discussed sections 2.1 to 2.2.

**Table 2**: Initial matrix definition of possible refrigerated retail display cabinet sub-categorisation.

| | | **Aspect** | **Possible Permutations** | | | |
|---|---|---|---|---|---|---|
| A | Technology | Refrigerant type | Any one of several common refrigerants, including R134a, R407C, R290, R404A and others. | | | |
| B | Functionality | Style and intended purpose / contents | At least 18 different types of integral retail display cabinet are possible including variations of vertical/horizontal/serve-over counter design, temperature range, variations of doors/covers, also including focus on particular food/drink contents to be displayed. | | | |
| C | Functionality | Storage temperature | 'High' temperature, ranging around 7°C to 10°C. | 'Medium' temperature, ranging around -1°C to 7°C. | 'Low' temperature, less than -12°C. | Multi-temperature (different compartments in one cabinet) |
| D | Functionality | Cabinet orientation and doors / covers (not night covers) | Horizontal (chest or well type cabinet), with or without glass / solid door(s) | Vertical (shelf type cabinet) , with or without glass / solid door(s) | Combination (shelf unit over horizontal unit in one cabinet) , with or without glass / solid door(s) | |
| E | Functionality | Display area | Total Display Area (TDA) in square inches or square metres | | | |
| F | Functionality | Storage Volume | Various possible. | | | |
| G | Functionality | Outer dimensions | Various possible. | | | |
| H | Functionality | Lighting | Lighting present, or not. | | | |
| J | Functionality | Fans | Circulation fan present, or not. | | | |
| K | Functionality | Defrost type | Electric defrost; 'hot gas' defrost (refrigeration system works briefly in reverse); passive/off cycle defrost; no defrost. | | | |

## 2.1 Technology

***Matrix Row A): Refrigerant type***

There are several different types of refrigerant that are used in integral retail display cabinets. Each cabinet model will generally be optimised for one refrigerant type and as such it is not generally a user specified option. The type of refrigerant generally used in this market may be of interest to policymakers and so this information will be requested in the data request. To display each of the

graphs in the mapping and benchmarking analysis documents for two or more refrigerants would double or triple the length of the documents. However, the facility can be provided for interested users to display results by refrigerant using the data analysis spreadsheet which is made available to readers. Refrigerant can be set up as a 'switch function' in the analysis spreadsheet. This means that readers can choose between displaying results for all refrigerants together, or by each of the separate ones on their own (i.e. filter on refrigerant). Any notable differences in refrigerant performance arising in mapping documents can be mentioned in the notes under the graphs. And a section on influence of refrigerant can be inserted within the benchmarking document to note any key points.

- *Proposal: To request data on which refrigerant is used in the product and to provide a refrigerant switch in the benchmarking analysis spreadsheet so that users can see the results for all or single refrigerants. Notes will be inserted in the mapping documents where any refrigerant based observations are apparent, and a section on the influence of refrigerants placed in the benchmarking document.*

## 2.2 Functionality

***Matrix Row B): Cabinet type***

Cabinets can be of two fundamental types: Integral (or 'plug in' or self-contained) cabinets for which the refrigeration system is included in the product housing; and remote cabinets which require attachment via pipework to a separate refrigeration compressor/condenser pack. This analysis focuses only on integral cabinets. The European eco-design preparatory study[1] identifies at least 18 different styles of integral refrigerated display cabinet with various permutations of temperature range, door/cover types, and orientation, including intended purpose (i.e. product intended to be displayed). It is the supermarket type cabinet that accounts for the majority of variations in cabinet style.

The categorisation of display cabinets is significantly simplified through focus on particular product types. The pie charts below, Figure 1, Figure 2 and Figure 3 illustrate the proportion of the main product types in three regions for which data was available: EU, Australia and New Zealand. Whilst the category names and scope of the categories in each study are slightly different, the figures serve to illustrate that vertical glass door cabinets (used for beverage display for example), and horizontal frozen cabinets (used for ice cream display), constitute a significant proportion of each market.

[1] European Commission DG TREN, Bio Intelligence Services, Preparatory Studies for Eco-design Requirements of EuPs, [TREN/D1/40-2005/LOT12/S07.56644], Lot 12: Commercial refrigerators and freezers, Final Report, December 2007.

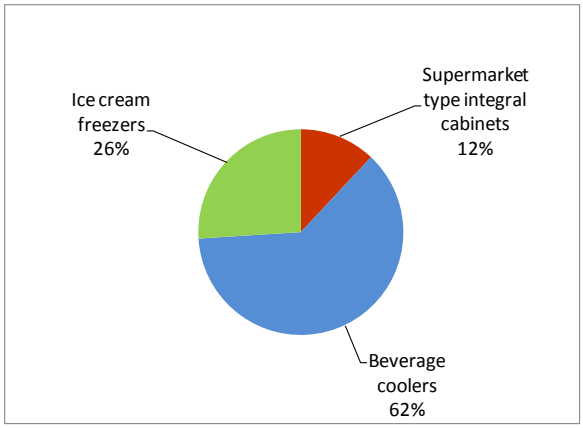


**Figure 1. EU stock of integral refrigerated display cabinets by style/purpose[1]**

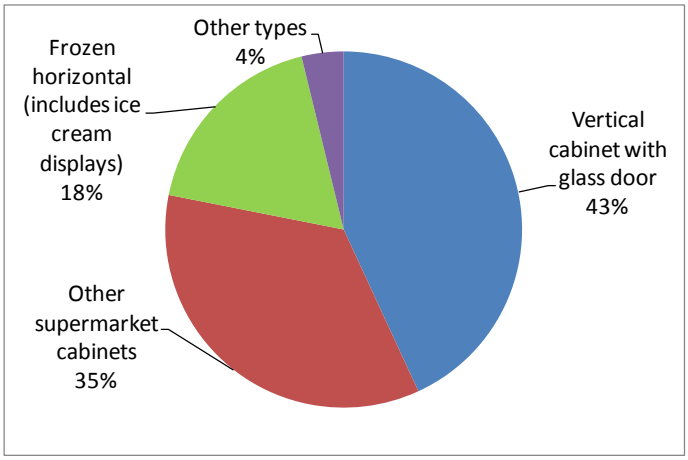


**Figure 2. Australia integral refrigerated cabinet product registrations on the Federal database by style/type[2]**

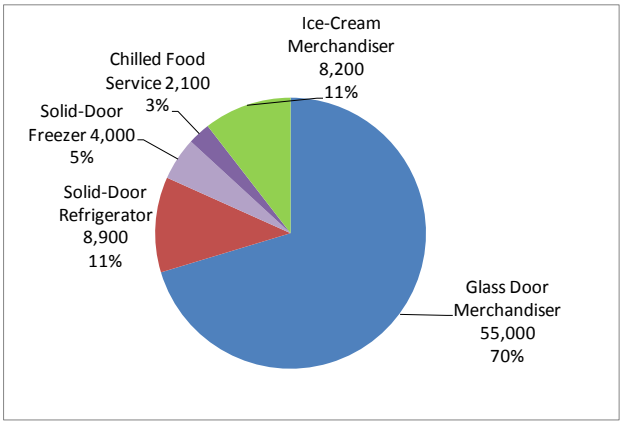


**Figure 3. New Zealand stock of integral refrigerated display cabinets by style/purpose[3]. Note that the solid door refrigerators and freezers included in this study are not ' display' cabinets and so not strictly comparable with data from the preceding two figures.**

Data from the EU study showed that 70% of the merchandiser type cabinets were for display of beverages and 90% of those have one or more glass doors. The other 30% of EU merchandisers were ice cream display freezers. Overall, these studies indicate that the majority of integral display cabinet sales are of the merchandiser type with the remaining minority of the supermarket display cabinet type. This is because the vast majority of supermarket display cabinets use remote refrigeration units rather than integral type.

Combination units with two or more compartments with different temperatures are not mainstream products, particularly amongst integral products, and also normalisation for these would be complex and inaccurate due to the many different configuration possibilities.

This market breakdown is taken as indicative of other major economies and so it is proposed to focus on the type of cabinet used for ice cream display / merchandising, and vertical glass-door cabinets, which together appear to account for the majority of the integral display cabinet market.

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[2] Mark Ellis & Associates Pty Ltd, October 2009, In From The Cold: Strategies To Increase The Energy Efficiency Of Nondomestic Refrigeration In Australia And New Zealand; Background Technical Report Volume 1, paper prepared for the Equipment Energy Efficiency Committee under the auspices of the Australian and New Zealand Ministerial Council for Energy, page 12.

[3] Mark Ellis & Associates, Minimum Energy Performance Standards for Commercial Refrigeration Cabinets, Prepared for the Energy Efficiency and Conservation Authority of New Zealand, June 2003. Fifth of

Since the supermarket display style cabinets and combination cabinets would add considerable complexity to the analysis but represent a minority of the market, it is proposed to exclude that type of product and focus instead on vertical glass door and horizontal frozen cabinets.

- *Proposal: To focus the study on integral cabinets of types:*
  *a) Vertical glass door chilled display cabinets, as used for beverage display for example. These correspond with cabinet type VC4 according to ISO EN 23593 (see Annex 1). And*
  *b) Horizontal and 'semi-horizontal' frozen cabinets, as used for ice cream merchandising with or without cover(s). These correspond with cabinets types HF5 and HF6 according to ISO EN 23593 (see Annex 1).*

***Matrix Row C): Storage temperature***

Energy consumption per day and efficiency will vary according to the temperature at which the goods are stored. The lower the storage temperature, the higher the energy consumption if all else remains equal. The various test methodologies define several classes of temperature for the various refrigerated display products, according to the food or drink product intended to be displayed. The European test methodology provides for the largest number of temperature classes, many of which overlap and many are not relevant to beverage and ice cream type cabinets. To simplify the temperature class approach, only temperature classes relevant to the vertical glass door cooler and ice cream cabinet are considered here.

There are several different ways of categorising the temperature ranges but the simplest is to split into chilled and frozen types. However, this leaves scope for significant differences in set-point temperatures and energy consumptions and so more detail will be requested to enable further breakdown by temperature if necessary and possible. The section below explains the temperature class options that are likely to be found.

The table below shows how different countries and schemes subdivide average classes.

**Table 3. Comparing temperature classes across different test methodologies.**

| **Region / country** | **Test methodology** | **Frozen (ice cream application) temperature (target / range)** | **Chilled temperature (target / range)** |
|---|---|---|---|
| USA/Canada | AHRI 1200 (or AHRI 1201 for SI version) | For 'ice cream applications', integrated average test pack temperature: Prior to 1Jan2010 for USA and 12Apr2012 for Canada: -5°F ±2°F (-21°C±1.1°C); since 1Jan2010 for USA and 12Apr2012 for Canada: -15°F ±2°F (-26.1°C±1.1°C) | For 'Medium Temperature' applications, integrated average test pack temperature of -38°F ±2°F (3.3°C±1.1°C) |
| EU | EN ISO 23953 | "L1" is <-15°C | "H1" is +1°C to +10°C, although "M1" (-1 to +5°C) or "M2" (-1 to +7°C) are more often used as the basis for appliance requirements |
| Australia | AS 1731 | As specified by manufacturer. | As specified by manufacturer. Generally specified as 3.3°C by most suppliers in Australia, with a 5°C maximum. |

Note: ASHRAE Standard 72 does not directly specify temperature classes.

Since data for these additional sub-divisions will not be available from all countries, it is proposed to subdivide products for benchmarking principally into a refrigerated (chilled) or a frozen category and also ask for the mean product simulation pack temperature achieved during test, and information about the temperature classification to enable further sub-categorisation or normalisation if/as necessary.

- *Proposal: To divide products into chilled (-1 to +10°C) for vertical glass door cabinets only, and frozen (-15 and lower) for horizontal/semi-horizontal cabinets only for this analysis. Mean pack temperature and product temperature classification details will be invited to enable more detailed sub-classes if/as possible and required. Only single temperature storage units will be included (i.e. no combined temperature units).*

***Matrix Row D): Cabinet orientation and doors***

It has been proposed in section B above to focus only on chilled vertical display cabinets with glass doors, and on ice cream merchandisers. This section D is in effect a subset of cabinet style (section B) but is explained separately for completeness. Cabinets can be of the following designs:

1. Horizontal or chest units, also called 'well' or chest units. These are mostly for frozen foods and almost always have a glass or plastic cover.
2. Vertical units with shelves. Usually for chilled temperature display without doors in supermarkets, chilled bottle/beverage/dairy display with doors in corner shops/take-aways etc, and frozen display with doors in supermarkets. Can be full height (1.8 m to 2 m) or under-counter design (around 0.8 m high).
3. Or a combination of the two types with shelves or glass door unit over a frozen well unit (although this is rarely seen for integral units, more common for remote refrigeration units).

The table in Annex 1 shows the various types of retail display cabinet design as defined for the European market by EN23953.

The amount of heat gain, and therefore energy consumption, depends heavily on the orientation of the cabinet and whether or not it has doors. Horizontal, chest or well units do not suffer significant cool air loss/warm air ingress and so overall efficiency can be fairly high even without a cover. Open vertical units rely on careful design of the airflow over the shelves, down the front of the units and re-capture of the cooled air at the bottom to minimise overall losses and maintain appropriate temperatures of goods; performance of these types of unit can vary significantly. A door on the cabinet significantly reduces losses and so efficiency can be much higher (depending upon how often the door is opened).

From a technical standpoint for this analysis, there would be little point in combining horizontal, vertical and units with and without doors in the same benchmarking/mapping category because their functionalities and energy performance are quite different. Combination units are a niche product which may not even be available in an integral design, and cannot be compared fairly with these other types anyway.

The type of door – glass or solid - is fundamental to whether or not the cabinet is for retail display, or for commercial storage. These are different purposes with different usage profiles and different products. For this analysis it is proposed only to analyse retail display cabinets, i.e. those for which the products stored are visible from the outside – via glass doors or open cabinets. The US ENERGY STAR criteria define a 'glass door' as when at least 75% of the area is glass; 25% or more being solid/opaque is counted as a solid door.

The important attributes for cabinet design are therefore whether it is horizontal or vertical orientation, height (full or under-counter), whether or not it has glass doors, and how many doors it has.

- *Proposal: In-line with proposals in section B above, to analyse only vertical chilled cabinets with glass doors and horizontal/semi-horizontal frozen cabinets and to invite data on number of doors/covers. The following definition is proposed to be adopted:* ***'Glass door'*** *means a door of which at least 75% of the area is of glass; otherwise counted as solid and so excluded from this study.*

***Matrix Row E): Total Display Area (TDA)***

As well as ensuring goods are stored at an appropriate temperature, the useful feature of retail display cabinet is how much display area is available to present goods to customers. Standards in the USA, EU and Australia define the Total Display Area (TDA) as an aspect of the functionality for cabinets, which is used in efficiency metrics (see metrics section later) but the ENERGY STAR program does not consider TDA. In Canada, self-contained ice-cream application units with glass doors manufactured after January 1, 2012 will use TDA as efficiency metric. This involves calculating the area of the flat the plane(s) presented to customers through which products are visible, see Figure 4. For example, for a glass door beverage cabinet this would be equal to the glazed area of the door. If glazed at the side, the area of side panels would be added to that of the front glass. If the cabinet type and external dimensions are known then the TDA could be estimated. There is a further complication on this issue: the European and ISO standard (ISO 23593) includes a factor for the light transmission of the glass used, reducing the effective TDA of cabinets with glass of lower transmittance by a factor of 0.6 to 0.8. The Australian standard has a simplified approach[4] to reduction of light transmission, but TDA is also modified. This effectively means that cabinets in regions with this factor included in the methodology would yield an average glazed area-related energy consumption (TEC/TDA) that is larger than those without it (assuming an equal spread of high and low transmittance glass in each market). Normalisation of this issue at the cabinet level would require detailed information on the glass type and confirmation of whether or not such factors had already been taken into account - this is unlikely to be available. Normalisation at the market average level would require data on the proportion of cabinets on that market with high or low transmittance glass - also unlikely to be available. Hence this glass transmittance issue will probably have to be ignored, in the absence of detailed information.

- *Proposal: To invite data on total display area to enable calculation of efficiency (TEC/TDA) and separation of products into subcategories by size of TDA if/as required. And to invite information about glass transmittance if available, but in the absence of this detail to ignore the issue of glass transmittance.*

[4] Includes factors for "Single anti-reflection glass" (98%), "Single glass" (90%) and "All other configurations" (81%). Introduced in Amendment 1 to AS 1731.

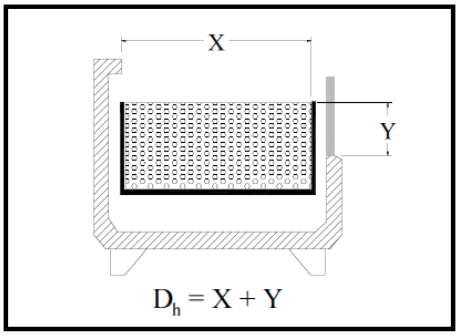


**Figure D10: Horizontal Single-deck Island with Transparent Wall**

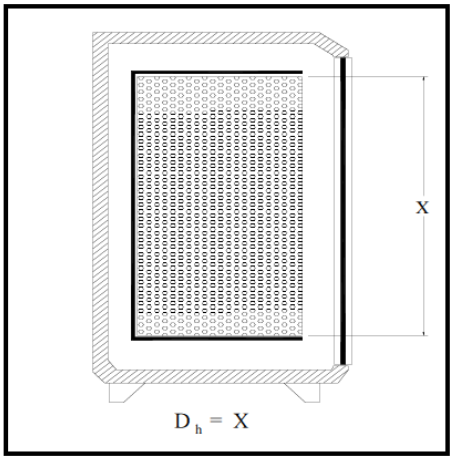


**Figure D12: Vertical Multi-deck with Transparent Door**

**Figure 4. Cross sections of a horizontal freezer cabinet and glass door in the vertical cabinet showing how total display area is calculated, Dimensions X and Y are multiplied by the width (perpendicular to the plane of the cross-section). Extract taken from USA standard AHRI 1200:2005.**

### *Matrix Row F): Storage volume*

Since total display area may not be available for all products in all countries, data will also be invited on the internal usable volume of the refrigerated space to distinguish product size/capacity in litres or cubic feet. In Canada, self-contained commercial refrigerators with glass doors and self-contained ice-cream application units with glass doors manufactured before January 1, 2012 are regulated using the refrigerated volume as efficiency metric.

Depending upon the cabinets design, it is possible to have a large storage volume but only a small usable volume, which may not be an efficient solution.
Useful volume is defined as that which can be used to store products for sale, and will exclude inaccessible and unusable parts of the refrigerated space. If necessary, the definition included in ISO EN 23593 will be adopted for this.

The aim would be to be able to split products into three size categories to fairly compare consumption and efficiency.

- *Proposal: In case total display area (TDA) data is not available, data will also be invited on internal useful volume in litres or cubic feet as a means to group products into small, medium and large sizes. As described above, beverage type cabinets would be divided into full height and under-counter styles and units with single or double doors; ice cream cabinets would be divided into three size categories by volume or TDA.*

***Matrix Row G): Outer dimensions***

If all types of cabinet were to be included (e.g. supermarket display variants), dimensions would probably be necessary to distinguish quite different product types and sizes. However, given the product scope restrictions proposed in section B above, outer dimensions are less important. Product storage volume is relatively easy to define for these product types, and is likely to be available. In case this is not available, dimension data can be invited as a proxy from which volume can be estimated.

- *Proposal: To invite outer dimension data for use only in case volume or total display area are both unavailable.*

***Matrix Row H): Lighting***

Any lighting that is inside the refrigerated space will affect energy consumption through direct consumption and also heat generated by the lights to be removed by the refrigeration system. Some products are designed with lighting located outside the refrigerated space but these are in a minority. Hence it is of interest to note whether the cabinet is lit and if possible the lighting energy consumption and type, but more importantly to understand in test measurements whether lighting is on or off during testing (see *Metrics* section below).

- *Proposal: To invite data as to presence of internal cabinet lighting, and its rated power and type, as a secondary issue.*

***Matrix Row J): Fans***

Some cabinets use fans to circulate cooled air within the refrigerated space. This provides better uniformity of temperature and more effective cooling of contents. A further advantage is possible as the improved heat transfer with air circulation can allow maintenance of product temperature using higher air temperatures. Higher air temperature means less energy consumption. Conversely, the fans will also consume electricity and the heat generated by their motor may end up in the refrigerated space, requiring further energy to remove it. Hence it may be of interest to know whether a cabinet is fitted with such fans as a secondary data item.

- *Proposal: To invite data on whether or not a circulatory fan is fitted as a secondary issue.*

***Matrix Row K): Defrost type***

Defrosting of cooling elements is necessary to ensure effectiveness and efficiency, Particularly of frozen units. There are at least four options for how defrost of a cabinet might be achieved: manually (requiring intervention by the user); electrically using heaters; by temporarily reversing the direction of refrigerant flow; off cycle or passive defrost (refrigeration system simply automatically shuts down for a period). The energy penalty for each of these is different, but the usefulness (i.e. net benefit) of this feature depends heavily on how it is used. The European and USA test methodologies require any automated defrost to continue during the test. Requirements of other test methodologies will be investigated to determine whether this is a normalisation issue or not.

- *Proposal: To invite data on the type of defrost used as a secondary issue. The treatment of defrost during test will be separately investigated (see metrics section below).*

# 3. Metrics

Two performance metrics are relevant here:

- **Consumption**: kWh per 24 hour period. This is used for at least European and USA products. This becomes comparable only when products of similar utility (i.e. temperature, type and size) are compared.
- **Energy efficiency**: There are three possible metrics for efficiency:
  - Total Electrical Consumption / Total Display Area (TEC/TDA). This is used for at least European, USA and Australian products.
  - Total Electrical Consumption / Refrigerated Volume per 24 hour period (usually kWh/litre/day).
  - Total Electrical Consumption / linear metre of cabinet length per 24 hour period (usually kWh/m/day). This metric is used in the US for large supermarket cabinets, and could be applied to the horizontal frozen cabinets.

  These three efficiency metrics are not comparable and so would have to be plotted separately. Cabinets intended for display purposes, for which the contents are visible from the outside, are generally specified with TEC/TDA. Which of these is selected as the primary metric will depend upon the data made available.

Whilst these metrics appear to be widely used, there may be differences in test methodology which are explored below.

**Test methodologies**

The following test methodologies have been identified that are likely to be used by participants for data to be submitted. Known differences that are likely to give rise to a requirement for normalisation before data is comparable are described in the following section. Note that analysis of these test methodologies has not been completed, pending input from participating countries:

1. ANSI/ASHRAE Standard 72-2005, "Method of Testing Commercial Refrigerators and Freezers" (used for horizontal and vertical **open** supermarket style cabinets in USA and Canada).
2. ANSI/ASHRAE Standard 117- 2002 "Method of Testing Closed Refrigerators" (used for beverage coolers in USA, Canada (also for California MEPS)). (Note: May have been withdrawn, with content assimilated into ASHRAE Standard 72, according to ANSI web site).
3. AHRI (previously ARI) Standard 1200 (2010) "Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets" (I-P version; SI units version is AHRI 1201). This standard defines how various efficiency metrics are calculated using test results from ASHRAE standard 72, including calculation of total display area (TDA).
4. ISO 23953-1:2005 Refrigerated display cabinets -- Part 1: Vocabulary used in conjunction with ISO EN 23953 Refrigerated display cabinets -- Part 2: Classification, requirements and test conditions. This international standard is the basis of test methodologies in Europe, Australia and China.
5. CAN/C657-04: "Energy performance standard for commercial refrigerated display cabinets and merchandisers" applies to remote condensing commercial equipment with and without doors, and self-contained commercial equipment with and without doors, except as covered by CSA C82798 (R2003). Commercial refrigerators and commercial freezers with doors (including commercial ice-cream freezers) are covered in a separate test procedure and

standard, CSA C82798 (R2003), Energy Performance Standard for Food Service Refrigerators and Freezers. Further guidance is required on scope and content.

6. JRA 4032(1993): "Commercial refrigerators, refrigerator-freezers and freezers" (only in Japanese). Further guidance is required on scope and content.
7. AS 1731 "Refrigerated display cabinets" (Australia and New Zealand). This is a comprehensive document providing test methodology and requirements for classification, installation and maintenance, user guides, minimum energy performance standards and more and was closely based on the previous European test methodology EN 441. Update of AS1731is currently under consideration. Further guidance would be required on content.
8. EN441 (superseded by ISO EN23953 in 2005).

# 4. Data requirements

To enable the most effective analysis of data and comparison between countries, we would like to collect the data listed below:

- **Black text** indicates the main data requirements for this process.
- **Blue text** indicates data that is not necessary to undertake the mapping and benchmarking for this product but that will bring other benefits to the process and/or allow more detailed analysis at a later date.
- Where the data is not available in the format requested, ***italic text*** indicates alternative formats in which the data may be provided.

***Information on new products on sale***

For all years available between 1996 and 2010 and for all categories as defined in Table 3, ideally this will be in the form of **individual model information** including (in approximate order of priority)**:**

1. Product type: Chilled vertical display cabinet with glass doors, or horizontal / semi-horizontal frozen cabinet. For chilled cabinets, configuration:
    a. Single door full height
    b. Double doors full height
    c. Single door under-counter
    d. Double doors under-counter
2. Total Electrical Consumption (TEC): Energy consumed in kWh/24 hours.
3. Efficiency: Total Electrical Consumption / Total Display Area (TEC/TDA, kWh/day/$m^2$)
4. Total Display Area (TDA) in square inches or square m.
5. Product useful internal refrigerated volume, in litres or cubic feet.
6. Storage temperature. Typical storage temperature classification (ideally as a temperature class corresponding to an established standard definition such as H1, L1 etc, but also possible as a mean product pack temperature, or temperature range (°C or °F)).
7. Test methodology used, including confirmation of:
    - Whether door openings were used under test and their duration and timing
    - Timing regime for lighting
    - Any usage of night blinds.
8. Number of doors on the cabinet.
9. Confirm that any doors are glass (at least 75% glazed area).
10. Whether cabinet has internal lighting or not, and its rated power and type (fluorescent, LED etc).
11. *Outer cabinet dimensions*
12. Refrigerant type.

13. Any additional product details available such as:
    a. defrost type used
    b. whether fan assisted circulation
    c. presence of single, double or triple glazed doors
    d. presence of night covers / blinds for open cabinets

***Information on stock and sales***

For all years available between 1996 and 2010:

14. Total national stock of products in service (in thousands of products) broken down by type.
15. Total national annual sales (in thousands of products) broken down by type.

***Additional Information Required for Data Processing***

16. Test methodology(ies) used to derive the data, and any relationship to known international standards (e.g. ISO EN 23953 / ASHRAE Standard 72; clone of test method XYZ [with these amendments: A, B and C], etc.)
17. Dates at which any changes to test methods and/or storage temperatures occurred during period of reported data.
18. Indicative statistics on how national sales break down, particularly typical TDA or most common type. This is in order to provide at least qualitative analysis of comparability of typical cabinets between countries.
19. List of local regulations that define and affect product efficiency

***Additional Information Required for Other Planned Analysis***

20. Summary of all major policy actions affecting refrigerated retail display cabinets over the period data is available including whether voluntary or mandatory, the year when policy was first considered, the year of formal announcement of the policy plans, and the year when the policy came into force.
21. Summary of any cultural or other issues that are thought to affect this product at the local level.

# Annex 1. Cabinet categorisation according to ISO EN 23953-2:2004.

**Classification for product families** (See Annex A of EN ISO 23953-2:2004(E) - Informative)

| Application | Positive Temperature | | Negative Temperature | |
|---|---|---|---|---|
| To be used for | Chilled foodstuffs | | Frozen, quick frozen foodstuffs and ice cream | |
| Horizontal | Chilled, serve-over counter open service access | **HC1** | Frozen, serve-over counter open service access | **HF1** |
| | 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** |
| | Chilled, serve-over counter with integrated storage closed service access | **HC8** | | |
| 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** |

| Codification: | |
|---|---|
| R = Remote condensing unit | V = Vertical (see 3.1.1.2) |
| I = Incorporated condensing unit | Y = Combined (see 3.1.1.11, 3.1.1.12 and 3.1.1.13) |
| A = Assisted service (see 3.1.1.6) | C = Chilled |
| S = Self service (see 3.1.1.7) | F = Frozen |
| H = Horizontal (see 3.1.1.4) | M = Multi-temperature |

| | | |
|---|---|---|
| EXAMPLE: | The general classification can be used as follows: | HC1, VF1, YM5, … |
| | When necessary, the classification can be more precise as follows: | 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 2. Cabinet storage temperature classes and climate classes according to ISO EN 23953-2:2004.

Classification of test room climate class

| test room climate class | dry bulb temperature ℃ | relative humidity % | Dew point ℃ | water vapour mass in dry air g/kg |
|---|---|---|---|---|
| 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 |
| 4 | 30 | 55 | 20 | 14.8 |
| 6 | 27 | 70 | 21.1 | 15.8 |
| 5 | 40 | 40 | 23.9 | 18.8 |
| 7 | 35 | 75 | 30 | 27.3 |
| 8 | 23.9 | 55 | 14.3 | 10.2 |

Classification of M-package temperature

| Class | the highest temperature of the warmest M-package equal to or lower than | the lowest temperature of the coldest M-package equal to or higher than | the lowest temperature of the warmest M-package equal to or lower than |
|---|---|---|---|
| | ℃ | ℃ | ℃ |
| L1 | -15 | - | -18 |
| L2 | -12 | - | -18 |
| L3 | -12 | - | -15 |
| M1 | 5 | -1 | - |
| M2 | 7 | -1 | - |
| H1 | 10 | 1 | - |
| H2 | 10 | -1 | - |
| S | special classification | | |