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Document history

This Eurovent Industry Recommendation / Code of Good Practice supersedes all of its previous editions, which automatically become obsolete with the publication of this document.

Modifications

This Eurovent publication was modified as against previous editions in the following manner:

Modifications as against	Key changes
1st edition	Present document

Preface

In a nutshell

This Eurovent Recommendation aims to provide a sound interpretation of Regulation (EU) 2019/2018 and of Regulation (EU) 2024/2019. Specifically, it aims to provide the European Commission with the industry input for the future European Commission guidelines accompanying Regulation (EU) 2019/2018 and Regulation (EU) 2024/2019.

Authors

This document was published by the Eurovent Association and was prepared in a joint effort by participants of the Product Group 'Commercial Refrigeration Equipment' (PG-RDC), which represents a vast majority of all manufacturers of these products active on the EU market.

Disclaimer

This Eurovent Recommendation does not replace the Regulation (EU) 2019/2018 or the Regulation (EU) 2024/2019. A finally binding interpretation of EU legislation may only be provided by the European Court of Justice.

In case of disputes with the translations of Regulation (EU) 2019/2018 or Regulation (EU) 2019/2024 into other languages, Eurovent holds that the English text supersedes all the other translations.

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Contents

1 Background

Eurovent and its Members regard the European Ecodesign and Energy Labelling regulations as a powerful tool for achieving the European Union's energy saving targets, for ensuring a level playing field, and for contributing to the achievement of the EU vision of climate-neutrality by 2050.

This Eurovent Recommendation relates to Regulations (EU) 2019/2018 and 2024/2019 on Energy Labelling and Ecodesign requirements for refrigerating appliances having a direct sales function. With this paper Eurovent and its Members would like to provide input for the future European Commission Guideline Document covering the above-mentioned Regulations. In order to actively contribute to achieving the energy saving targets proposed, Eurovent and its Members deem an unambiguous interpretation of the requirements set out in these Regulations of fundamental importance.

2 Vocabulary

Backwall cabinet with integrated refrigerated reserve spaces with compartment volume ≥ 100 l/m: A vertical refrigerated cabinet in assisted service, placed behind the serving personnel, with a refrigerated reserve space ≥ 100 l/m.

Cluster: A set of cabinets identified as one model for the purposes of Ecodesign, Energy Labelling and EPREL.

Deducted model: A set of cabinets having the EEI (and all the other parameters to be declared according to the Energy Labelling) extrapolated from the same tested reference model.

Extrapolation rules: Set of common rules to be used in order to derivate the EEI of the deducted model from the one of tested reference model.

Horizontal display cabinet[1]: Refrigerated display cabinet with horizontal or slightly inclined display opening on its top and accessible from above, where the total vertical display height ($V_g + V_0$) is equal or less than 45 % of the total horizontal display depth (H_g+H_0).

Horizontal combined cabinet[1]: Refrigerated display cabinet consisted of two horizontal counters one superimposed to the other where the top is generally used for assisted service and the bottom for self-service, where the total vertical display height ($V_g + V_0$) is equal or less than 45 % of the total horizontal display depth ($H_g + H_0$).

Multiplexable units: Units mainly intended to have a modular development without end walls (not stand-alone units). They are mechanically joined in store installations and create a combined refrigerated space. They represent a combination of one or more modules which creates only one common refrigerated containment.

Refrigeration circuit: Vapour compression system made of several components including a compressor (variable speed/not variable speed), an evaporator, a condenser, an expansion device, and refrigerant.

Semi-Plugin cabinets/cabinets with incorporated liquid cooled condensing unit[2]: Refrigerated display cabinet that is designed to work with the condenser partially or fully cooled by a closed liquid circuit (e.g. water/glycol loop).

[1] According to the ongoing CEN TC44/WG1 activity
[2] According to the ongoing CEN TC44/WG1 activity

Semi vertical display cabinet[2]: Vertical refrigerated display cabinet whose overall height does not exceed 1,5 m and having either a vertical or inclined display opening, where the total display height (V_g+V_o) is greater than the 45 % of the total horizontal display depth (H_g+H_o).

Tested reference model: Tested reference model means a cabinet representative of a group of cabinets in terms of energy consumption and intended to be used as reference for the extrapolation of the energy consumption data and/or the EEI of a group of deducted models.

3 Scope

3.1 Products in scope of the Regulations

Electric mains-operated refrigerating appliances with a direct sales function, including appliances sold for refrigeration of items other than foodstuffs, specifically:

- Supermarket refrigerating (freezer or refrigerator) cabinets
- Beverage coolers
- Ice-cream freezers
- Gelato scooping cabinets
- Refrigerated vending machines

3.2 Products not in scope of the Regulations

- Refrigerating appliances with a direct sales function that are only powered by energy sources other than electricity
- The remote components, such as the condensing unit, compressors or water condensed unit, to which a remote cabinet needs to be connected in order to function
- Food processing refrigerating appliances with a direct sales function
- Refrigerating appliances with a direct sales function specifically tested and approved for the storage of medicines or scientific samples
- Refrigerating appliances with a direct sales function that have no integrated system for producing cooling, and function by ducting chilled air that is produced by an external air chiller unit; this does not include remote cabinets nor does it include category 6 refrigerated vending machines, as defined in Table 5 of Annex III
- Professional refrigerated storage cabinets, blast cabinets, condensing units and process chillers as defined in Regulation (EU) 2015/1095
- Wine storage appliances and minibars

3.3 Products covered by the resource efficiency and information requirements only

Refrigerating appliances having a direct sales function are tested according to:

- EN/ISO 23953-1-2 (Supermarket equipment)
- EN 16901 (Ice-cream freezers)
- EN 16902 (Commercial beverage coolers)

The above-listed standards provide clear testing methods on how to test, measure, and calculate the product performances and energy consumption.

It is not possible to calculate the standard energy consumption of the products (including those newly introduced to the market) not assessed within the above-mentioned standards.

Eurovent therefore holds that the requirements in points 1 and 3(k) of Annex II of Regulation (EU) 2019/2024 as well as those of Regulation (EU) 2019/2018 do not apply to the products not assessed or covered by any testing method or standard.

Eurovent holds that the below-listed products should be considered as covered only by the requirements in points 2 and 3 (not including point k) of Annex II of the Regulation (EU) 2019/2024:

- Refrigerating appliances with a direct sales function that do not use a vapour compression refrigeration cycle
- Refrigerating appliances with a direct sales function for the sale and display of live foodstuffs, such as refrigerating appliances for the sale and display of living fish and shellfish, refrigerated aquaria and water tanks
- Saladettes
- Horizontal serve-over counters with integrated storage designed to work at chilled operating temperatures
- Corner cabinets
- Vending machines designed to work at frozen operating temperatures
- Serve-over fish counters with flaked ice
- Backwall cabinets (remote and integral units, chilled and frozen) with integrated refrigerated reserve spaces having a compartment volume ≥ 100 l/m
- Fruit, vegetables or meat chilled cabinets (vertical and horizontal) using humidification systems
- Curved cabinets:
    - resulting from the assembly of several corner cabinets (e.g. 30° - 45° - 90°)
    - resulting from the assembly of linear cabinets plus corner cabinets (only the linear part is covered by all the ED energy efficiency requirements and by the and EL requirements; the same applies to cabinets having a recognisable longitudinal axis);
    - not having a recognisable longitudinal axis.

3.4 Additional clarification

Concerning Horizontal combined chilled cabinets having two or more separate horizontal refrigerated chest one over the other, Eurovent holds that the M/N coefficients to be used are the same as for horizontal chilled products.

4 Cluster approach

4.1 Preamble

According to customer needs, supermarket refrigerated cabinets are fully customisable. This entails different EEI per product per sales order.

Having regard to EPREL requirements, the industry regards the related efforts as very significant in terms of internal data management, in terms of IT infrastructure, and in terms of data-handling at the European level. In this respect, Eurovent would like to propose the so-called 'cluster approach' which is presented in the following.

4.2 Description

Manufacturers can group different models into one model, which is representative of the highest EEI (i.e. worst score) of the listed family.

The EEI of the model having the highest consumption can:

- derive from energy or performances tests in laboratory (i.e. tested reference model); or
- derive from the EEI of the tested reference model (i.e. deducted model).

It is at the discretion of the manufacturer to follow or not to follow the cluster approach.

4.3 Remote supermarket cabinets

4.3.1 Reference model standard configuration for testing and declarations

According to the product classification defined in the Regulations, the following standard configurations per product set of cabinets have been defined.

The standard configuration defines the configuration to be used to perform tests, particularly the test for reference model, for the benefit of repeatability, decrease the number of potentially different models, to ease comparison and standardise the entry into extrapolation methods. The standard configuration fixes some geometrical parameter available in a range, the accessories to be used among the available ones, some setting or product configuration in the hand of the end-user (e.g. shelf position).

The below-listed parameters provide the most used configuration.

4.3.1.1 Remote vertical/semi- vertical open supermarket refrigerators

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If undershelf lighting option is not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Price ticket holder	40-60 mm
Evaporator defrost	Electrical defrost if available

4.3.1.2 Remote vertical/semi- vertical closed supermarket refrigerators

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If mullion lighting option is available: Canopy lighting and vertical lighting (maximum available vertical lighting)
	If undershelf and vertical lighting option are not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Price ticket holder	40-60 mm
Doors	Hinged if available
Evaporator defrost	Electrical defrost if available
Door antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment

4.3.1.3 Remote vertical/semi-vertical closed supermarket freezers

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If mullion lighting option is available: Canopy lighting and vertical lighting (maximum available vertical lighting)
	If undershelf and mullion lighting option are not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Price ticket holder	40-60 mm
Doors	Hinged if available
Evaporator defrost	Electrical defrost if available
Door antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment

4.3.1.4 Remote horizontal supermarket refrigerator (service and self-service serve over counters)

Parameter	Configuration
Number of shelves	Base shelf + maximum number of available refrigerated shelves
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	Superstructure lighting if available (or foreseen as accessory)
	Undershelf lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.3.1.5 Remote horizontal supermarket refrigerators/freezers (islands open)

Parameter	Configuration
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid
Lighting	Handrail lighting if available (or foreseen as accessory)
	Air discharge lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.3.1.6 Remote horizontal supermarket refrigerators/freezers (islands closed)

Parameter	Configuration
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid
Lighting	Handrail lighting if available (or foreseen as accessory)
	Air discharge lighting if available (or foreseen as accessory)
	Lid lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.3.2 Extrapolation rules

4.3.2.1 Background

The below-presented extrapolation rules apply only to products having the same kind of refrigeration system (remote units) and can be used for extrapolating the related TEC and/or EEI.

The following extrapolation rules are based on the approach followed by the European Commission consultant JRC-IPTS in the preparatory study of Regulation (EU) 2019/2018 and of the Regulation (EU) 2024/2019.

$$EEI = \frac{AEC}{SAEC} = \frac{TEC*365}{P*(M+N*TDA)*C*365} \quad [1]$$

4.3.2.2 Length

The tested reference model should be always of a length of 2,5 m or the closest one (e.g. 2,44 m).

According to the above formula (1) the EEI_L results to be:

$$EEI_L = \frac{AEC_L}{SAEC_L} = \frac{TEC_L*365}{P*(M+N*TDA_L)*C*365} \quad [2]$$

$$TEC_L = TEC_{2,50} \times \frac{M+N*TDA_L}{M+N*TDA_{2,50}} \quad [3]$$

By replacing [3] into [2] it is possible to conclude that $EEI_L = EEI_{2,50}$

Conclusion

According to the above-presented extrapolation rules the Energy Efficiency Index (EEI) of a cabinet having its length different from 2,5 m can be assumed as equal to the EEI of the same cabinet of a length of 2,5 m ($EEI_L = EEI_{2,50}$).

4.3.2.3 Delta front opening height [remote vertical (open/closed) supermarket refrigerator/freezers]

This extrapolation rule applies under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return geometry
- Deducted model has air ducts shortened in length only
- Reference model and deducted model have the same temperature class
- Δheight = [+0; -10 %]
- Δheight = $\Delta(V_0 + V_g)$ (as EN/ISO23953-2 ANNEX A)

According to the above formula (1) the EEI of a deducted model (EEI_{DED}) results to be:

$$EEI_{DED} = \frac{AEC_{DED}}{SAEC_{DED}} = \frac{TEC_{DED}*365}{P*(M+N*TDA_{DED})*C*365} \quad [4]$$

$$TEC_{DED} = TEC_{REF} \times \frac{M+N*TDA_{DED}}{M+N*TDA_{REF}} \quad [5]$$

Where:

- TEC_{REF} = TEC Reference model
- TDA_{REF} = TDA Reference model

- TEC_{DED} = TEC Deducted model
- TDA_{DED} = TDA Deducted model

By replacing [4] into [5] it is possible to conclude that $EEI_{DED} = EEI_{REF}$

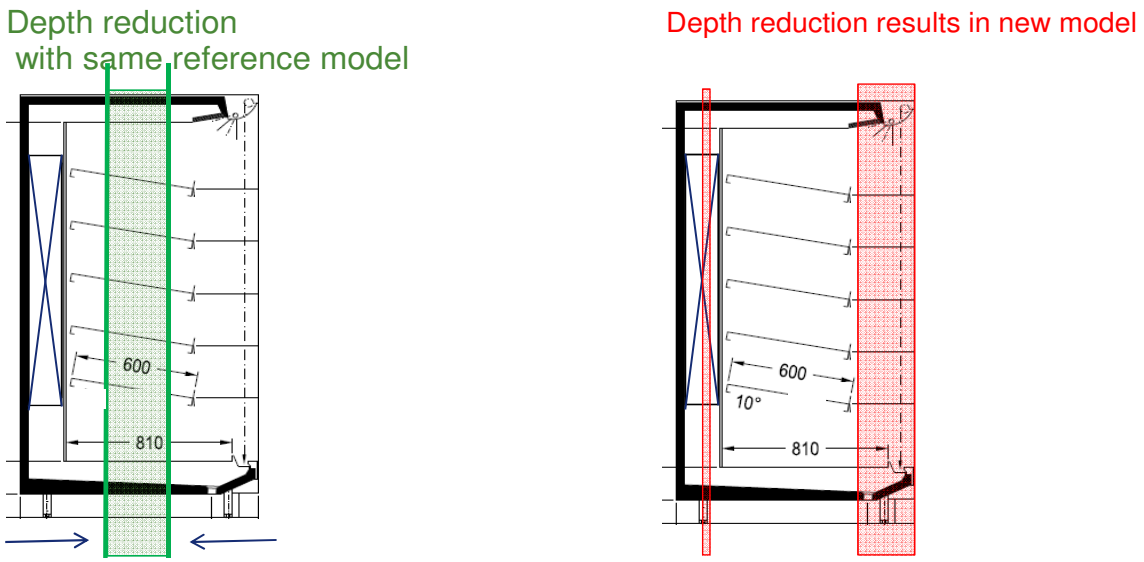
Conclusion

According to the above-presented extrapolation rules and conditions, it is possible to assume that the Energy Efficiency Index of a deducted cabinet can be assumed as equal to the EEI of the reference one ($EEI_{DED} = EEI_{REF}$).

4.3.2.4 Delta depth [remote vertical (open/closed) supermarket refrigerator/freezers]

This extrapolation rule applies under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return grid geometry and position to each other
- Reference model and deducted model have the same refrigeration components, and same backpanel pattern
- Reference model and deducted model have the same number of fans, same type of fans, and same fan speed
- The reduction of the depth of the cabinet must keep the same distance between air outlet and the load limit line
- Air ducts are shortened in length only
- Reference model and deducted model have the same temperature class
- Δdepth = [+0; -30 %]
- Δdepth = delta internal depth of the base shelf



Conclusion

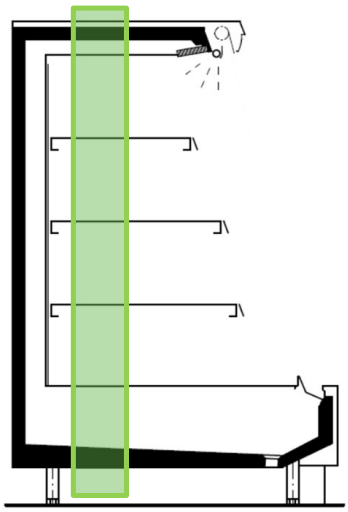
Under the above-presented conditions it is possible to conclude that the TEC of a deducted cabinet can be assumed as equal to the TEC of the reference one ($TEC_{DED} = TEC_{REF}$).

4.3.2.5 Delta depth [remote semi-vertical refrigerator]

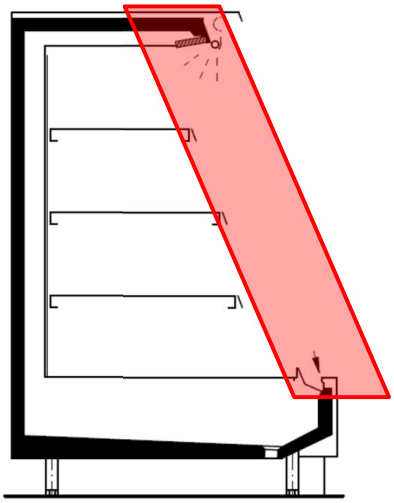
This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return grid geometry and position to each other
- Reference model and deducted model have the same refrigeration components, and same backpanel pattern
- Reference model and deducted model have the same number of fans, same type of fans, and same fan speed
- The reduction of the depth of the cabinet must keep the same distance between air outlet and the load limit line
- Air ducts are shortened in length only
- Reference model and deducted model have the same temperature class
- Δdepth = [+0; -30%]
- Δdepth = delta internal depth of the base shelf

Depth reduction
with same reference model



Depth reduction results in new model



Conclusion

Under the above-presented conditions it is possible to conclude that the TEC of a deducted cabinet can be assumed as equal to the TEC of the reference one (TEC_{DED} =TEC_{REF}).

4.4 Integral supermarket cabinets

4.4.1 Reference model standard configuration for testing and declarations

According to the product classification defined in the Regulations, the following standard configurations per product set of cabinets have been defined.

The standard configuration defines the configuration to be used to perform tests, particularly the test for reference model, for the benefit of repeatability, decrease the number of potentially different models, to ease comparison and standardise the entry into extrapolation methods. The standard configuration fixes some geometrical parameter available in a range, the accessories to be used among the available ones, some setting or product configuration in the hand of the end-user (e.g. shelf position).

The below-listed parameters provide the most used configuration.

4.4.1.1 Integral vertical/semi- vertical open supermarket refrigerators

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid (if available)
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If undershelf lighting option is not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Price ticket holder	40-60 mm
Evaporator defrost	Electrical defrost if available

4.4.1.2 Integral vertical/semi- vertical closed supermarket refrigerators

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid (if available)
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If mullion lighting option is available: Canopy lighting and vertical lighting (maximum available vertical lighting)
	If undershelf and vertical lighting options are not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Price ticket holder	40-60 mm
Doors	Hinged if available
Evaporator defrost	Electrical defrost if available
Door antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment

4.4.1.3 Integral vertical/semi-vertical closed supermarket freezers

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid (if available)
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If mullion lighting option is available: Canopy lighting and vertical lighting (maximum available vertical lighting)
	If undershelf and vertical lighting options are not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Price ticket holder	40-60 mm
Doors	Hinged if available
Evaporator defrost	Electrical defrost if available
Door antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment

4.4.1.4 Integral horizontal supermarket refrigerator (service and self-service serve over counters)

Parameter	Configuration
Number of shelves	Base shelf + maximum number of available refrigerated shelves
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid (if available)
Lighting	Superstructure lighting if available (or foreseen as accessory)
	Undershelf lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.4.1.5 Integral horizontal supermarket refrigerators/freezers (islands open)

Parameter	Configuration
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid (if available)
Lighting	Handrail lighting if available (or foreseen as accessory)
	Air discharge lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.4.1.6 Integral horizontal supermarket refrigerators/freezers (islands closed)

Parameter	Configuration
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid (if available)
Lighting	Handrail lighting if available (or foreseen as accessory)
	Air discharge lighting if available (or foreseen as accessory)
	Lid lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.4.2 Extrapolation rules

4.4.2.1 Background

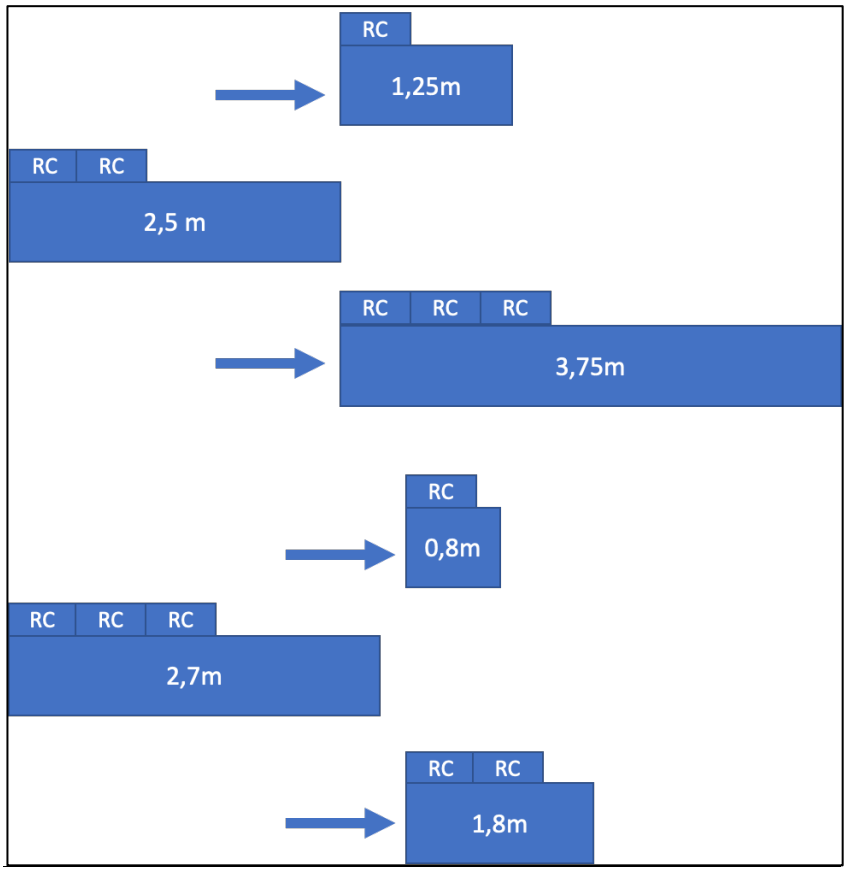
The following extrapolation rules are based on the approach followed by the European Commission consultant JRC-IPTS in the preparatory study of Regulation (EU) 2019/2018 and of the Regulation (EU) 2024/2019.

$$EEI = \frac{AEC}{SAEC} = \frac{TEC*365}{P*(M+N*TDA)*C*365} \quad [6]$$

4.4.2.2 Length

This extrapolation rule in terms of length **applies to multiplexable units only.**

The rule shall be used only **under the condition that the number of identical refrigeration circuits is modular and proportional with the cabinets' length** (the below-reproduced picture is to be intended just as indicative).



Where:

- RC = Refrigeration Circuit

The tested reference model should always be of a length of 2,5 m or the closest one (e.g. 2,7 m).

According to the above formula (1) the EEI_L results to be:

$$EEI_L = \frac{AEC_L}{SAEC_L} = \frac{TEC_L*365}{P*(M+N*TDA_L)*C*365} \quad [7]$$

$$TEC_L = TEC_{2,50} \times \frac{M+N*TDA_L}{M+N*TDA_{2,50}} \quad [8]$$

By replacing [3] into [2] it is possible to conclude that EEI_L=$EEI_{2,50}$

Conclusion

According to the above-presented extrapolation rules the Energy Efficiency Index (EEI) of a cabinet having its length different from 2,5 m can be assumed as equal to the EEI of the same cabinet of a length of 2,5 m (EEI_L = $EEI_{2,50}$).

4.4.2.3 Delta front opening height [integral vertical (open/closed) supermarket refrigerator/freezers]

This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return geometry
- Deducted model has air ducts shortened in length only
- Reference model and deducted model same temperature class
- Δheight = [+0; -10%]
- Δheight = $\Delta(V_0 + V_g)$ (as EN/ISO23953-2 ANNEX A)
- Reference model and deducted model must have the same refrigeration circuit

According to the above formula (1) the EEI of a deducted model (EEI_{DED}) results to be:

$$EEI_{DED} = \frac{AEC_{DED}}{SAEC_{DED}} = \frac{TEC_{DED}*365}{P*(M+N*TDA_{DED})*C*365} \quad [9]$$

$$TEC_{DED} = TEC_{REF} \times \frac{M+N*TDA_{DED}}{M+N*TDA_{REF}} \quad [10]$$

Where:

- TEC_{REF} = TEC Reference model
- TDA_{REF} = TDA Reference model
- TEC_{DED} = TEC Deducted model
- TDA_{DED} = TDA Deducted model

By replacing [4] into [5] it is possible to conclude that EEI_{DED} = EEI_{REF}

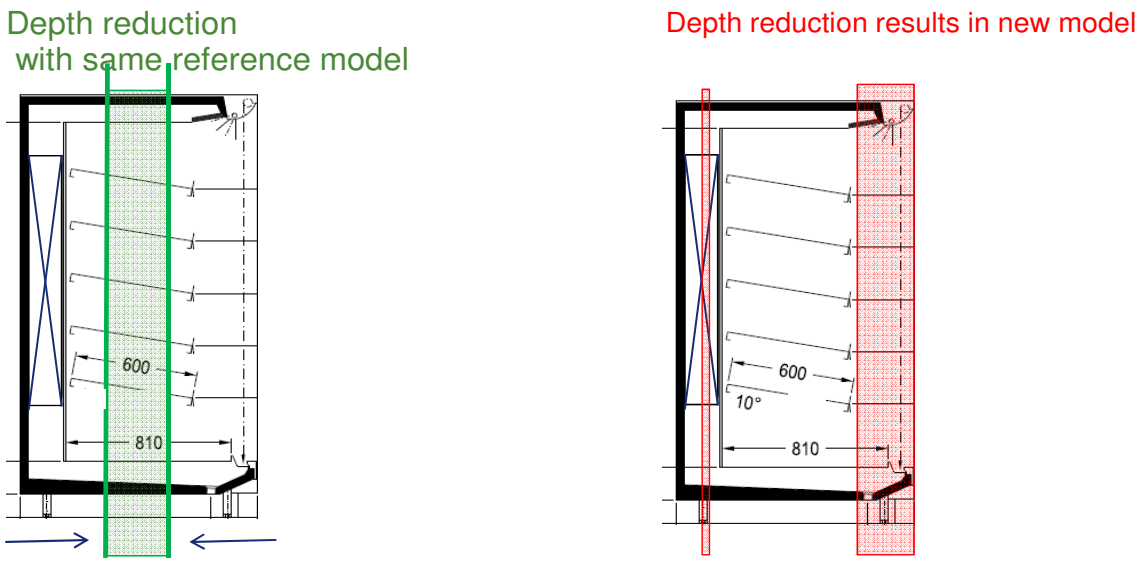
Conclusion

According to the above-presented extrapolation rules and conditions, it is possible to assume that the Energy Efficiency Index of a deducted cabinet can be assumed as equal to the EEI of the reference one (EEI_{DED} = EEI_{REF}).

4.4.2.4 Delta depth [integral vertical (open/closed) supermarket refrigerator/freezers]

This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return grid geometry and position to each other
- Reference model and deducted model have the same refrigeration components, and same backpanel pattern
- Reference model and deducted model have the same number of fans, same type of fans, and same fan speed
- The reduction of the depth of the cabinet must keep the same distance between air outlet and the load limit line
- Air ducts are shortened in length only
- Reference model and deducted model have the same temperature class
- Δdepth = [+0; -30%]
- Δdepth = delta internal depth of the base shelf
- Reference model and deducted model have the same refrigeration circuit



Conclusion

Under the above-presented conditions it is possible to conclude that the TEC of a deducted cabinet can be assumed as equal to the TEC of the reference one ($TEC_{DED} = TEC_{REF}$).

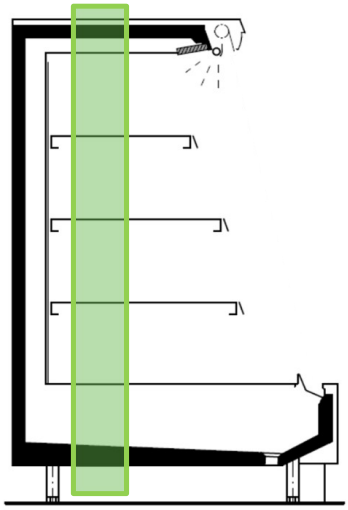
4.4.2.5 Delta depth [integral semi-vertical refrigerator]

This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

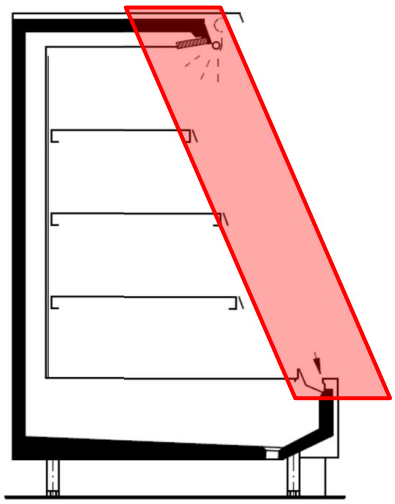
- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return grid geometry and position to each other
- Reference model and deducted model have the same refrigeration components, and same backpanel pattern

- Reference model and deducted model have the same number of fans, same type of fans, and same fan speed
- The reduction of the depth of the cabinet must keep the same distance between air outlet and the load limit line
- Air ducts are shortened in length only
- Reference model and deducted model have the same temperature class
- Δdepth = [+0; -30%]
- Δdepth = delta internal depth of the base shelf
- Reference model and deducted model must have the same refrigeration circuit

Depth reduction
with same reference model



Depth reduction results in new model



Conclusion

Under the above-presented conditions it is possible to conclude that the TEC of a deducted cabinet can be assumed as equal to the TEC of the reference one ($TEC_{DED} = TEC_{REF}$).

4.5 Semi-plugin supermarket cabinets

4.5.1 Reference model standard configuration for testing and declarations

According to the product classification defined in the Regulations, the following standard configuration per product set of cabinets have been defined.

The standard configuration defines the configuration to be used to perform tests, particularly the test for reference model, for the benefit of repeatability, decrease the number of potentially different models, to ease comparison and standardise the entry into extrapolation methods. The standard configuration fixes some geometrical parameter available in a range, the accessories to be used among the available ones, some setting or product configuration in the hand of the end-user (e.g. shelf position).

The below-listed parameters provide the most used configuration.

4.5.1.1 Semi-plugin vertical/semi- vertical open supermarket refrigerators

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If undershelf lighting option is not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Price ticket holder	40-60 mm
Evaporator defrost	Electrical defrost if available

4.5.1.2 Semi-plugin vertical/semi- vertical closed supermarket refrigerators

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If mullion lighting option is available: Canopy lighting and vertical lighting (maximum available vertical lighting)
	If undershelf and vertical lighting options are not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Price ticket holder	40-60 mm
Doors	Hinged if available
Evaporator defrost	Electrical defrost if available
Door antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment

4.5.1.3 Semi-plugin vertical/semi-vertical closed supermarket freezers

Parameter	Configuration
Number of shelf rows	Declared front opening height [mm] divided by 300, rounded up to next near integer
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	If undershelf lighting option is available: Canopy lighting and undershelf lighting shelf (number of shelves equal to the listed number of shelves)
	If mullion lighting option is available: Canopy lighting and vertical lighting (maximum available vertical lighting)
	If undershelf and mullion lighting options are not available: Canopy lighting only
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Price ticket holder	40-60 mm
Doors	Hinged if available
Evaporator defrost	Electrical defrost if available
Door antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment

4.5.1.4 Semi-plugin horizontal supermarket refrigerator (service and self-service serve over counters)

Parameter	Configuration
Number of shelves	Base shelf + maximum number of available refrigerated shelves
Shelf depth	Maximum shelf depth allowed by the cabinet's load limit line
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
Shelf inclination	0° unless differently specified by the manufacturer
End walls	Solid
Lighting	Superstructure lighting if available (or foreseen as accessory)
	Undershelf lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.5.1.5 Semi-plugin horizontal supermarket refrigerators/freezers (islands open)

Parameter	Configuration
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid
Lighting	Handrail lighting if available (or foreseen as accessory)
	Air discharge lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.5.1.6 Semi-Plugin horizontal supermarket refrigerators/freezers (islands closed)

Parameter	Configuration
Length	2,5 m or the closer length (e.g. 2,44 m)
Product temperature	Lowest applicable product temperature
End walls	Solid
Lighting	Handrail lighting if available (or foreseen as accessory)
	Air discharge lighting if available (or foreseen as accessory)
	Lid lighting if available (or foreseen as accessory)
	The declared EEI shall refer to the supplied lighting system which has to take into account the supplied wiring equipment (if the cabinet is prepared to have lighting, the EEI shall reflect it)
Night covers	Yes, if only delivered with night covers
Evaporator defrost	Electrical defrost if available
Glass antifog/antimist system	Antifog/antimist heaters if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment
Other heaters	If available the EEI shall refer to the maximum configuration for safe and reliable operation under ISO 23953 climate class rating conditions, taking account the supplied wiring equipment
Antifog fan	Antifog fan if available
	The declared EEI shall refer to the supplied antifog configuration which has to take into account the supplied wiring equipment

4.5.2 Extrapolation rules

4.5.2.1 Preamble

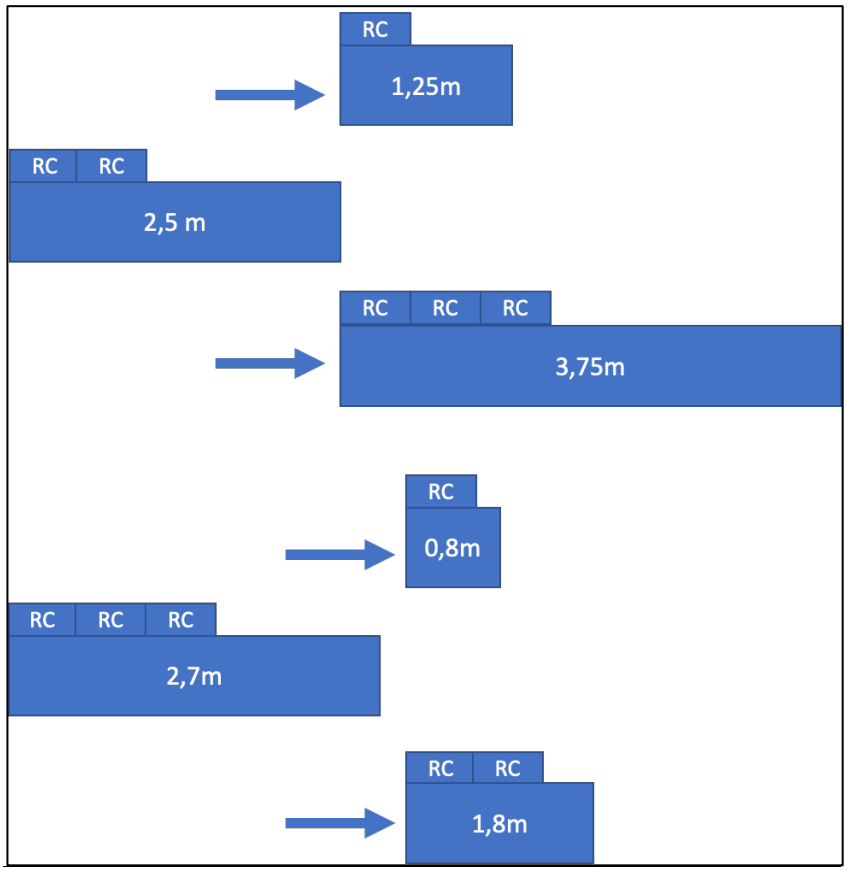
The following extrapolation rules are based on the approach followed by the European Commission consultant JRC-IPTS in the preparatory study of Regulation (EU) 2019/2018 and of the Regulation (EU) 2024/2019.

$$EEI = \frac{AEC}{SAEC} = \frac{TEC*365}{P*(M+N*TDA)*C*365} \quad [11]$$

4.5.2.2 Length

This extrapolation rule in terms of length **apply to multiplexable units only**.

The rule shall be used only **under the condition that the number of identical refrigeration circuits is modular and proportional with the cabinets' length** (the below-reproduced picture is to be intended just as indicative).



Where:

- RC = Refrigeration Circuit

The tested reference model should always be of a length of 2,5 m or the closest one (e.g. 2,7 m).

According to the above formula (1) the EEI_L results to be:

$$EEI_L = \frac{AEC_L}{SAEC_L} = \frac{TEC_L*365}{P*(M+N*TDA_L)*C*365} \quad [12]$$

$$TEC_L = TEC_{2,50} \times \frac{M+N*TDA_L}{M+N*TDA_{2,50}} \quad [13]$$

By replacing [3] into [2] it is possible to conclude that $EEI_L = EEI_{2,50}$

Conclusion

According to the above-presented extrapolation rules the Energy Efficiency Index (EEI) of a cabinet having its length different from 2,5 m can be assumed as equal to the EEI of the same cabinet of a length of 2,5 m ($EEI_L = EEI_{2,50}$).

4.5.2.3 Delta front opening height [semi-plugin vertical (open/closed) supermarket refrigerator/freezers]

This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return geometry
- Deducted model has air ducts shortened in length only
- Reference model and deducted model same temperature class
- Δheight = [+0; -10%]
- Δheight = $\Delta(V_0 + V_g)$ (as EN/ISO23953-2 ANNEX A)
- Reference model and deducted model must have the same refrigeration circuit.

According to the above formula (1) the EEI of a deducted model (EEI_{DED}) results to be:

$$EEI_{DED} = \frac{AEC_{DED}}{SAEC_{DED}} = \frac{TEC_{DED}*365}{P*(M+N*TDA_{DED})*C*365} \quad [14]$$

$$TEC_{DED} = TEC_{REF} \times \frac{M+N*TDA_{DED}}{M+N*TDA_{REF}} \quad [15]$$

Where:

- TEC_{REF} = TEC Reference model
- TDA_{REF} = TDA Reference model
- TEC_{DED} = TEC Deducted model
- TDA_{DED} = TDA Deducted model

By replacing [4] into [5] it is possible to conclude that $EEI_{DED} = EEI_{REF}$

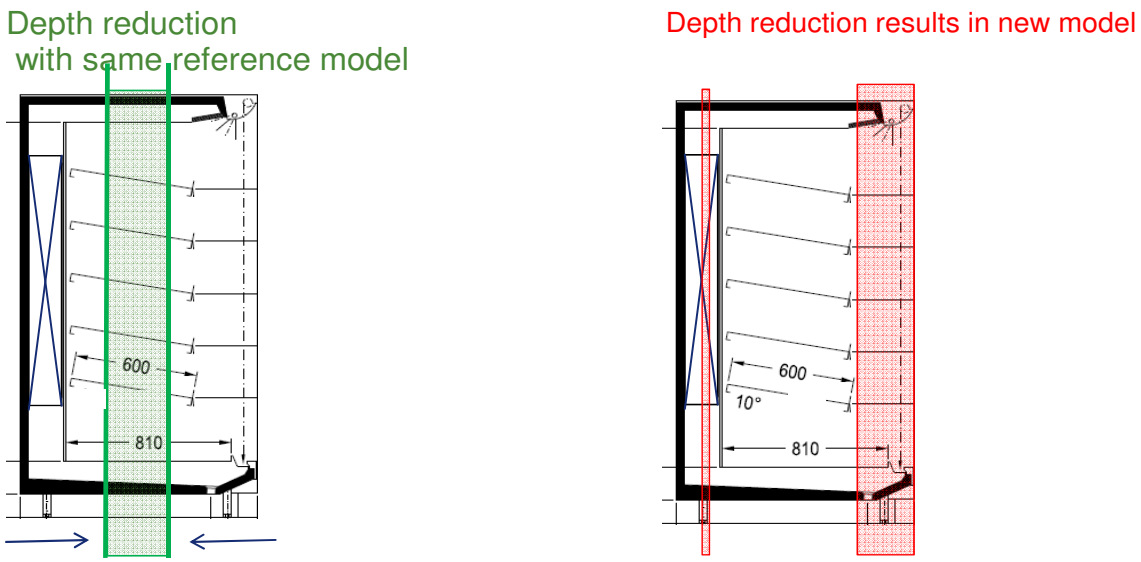
Conclusion

According to the above-presented extrapolation rules and conditions, it is possible to assume that the Energy Efficiency Index of a deducted cabinet can be assumed as equal to the EEI of the reference one ($EEI_{DED} = EEI_{REF}$).

4.5.2.4 Delta depth [semi-plugin vertical (open/closed) supermarket refrigerator/freezers]

This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return grid geometry and position to each other
- Reference model and deducted model have the same refrigeration components, and same backpanel pattern
- Reference model and deducted model have the same number of fans, same type of fans, and same fan speed
- The reduction of the depth of the cabinet must keep the same distance between air outlet and the load limit line
- Air ducts are shortened in length only
- Reference model and deducted model have the same temperature class
- Δdepth = [+0; -30%]
- Δdepth = delta internal depth of the base shelf
- Reference model and deducted model have the same refrigeration component



Conclusion

Under the above-presented conditions it is possible to conclude that the TEC of a deducted cabinet can be assumed as equal to the TEC of the reference one ($TEC_{DED} = TEC_{REF}$).

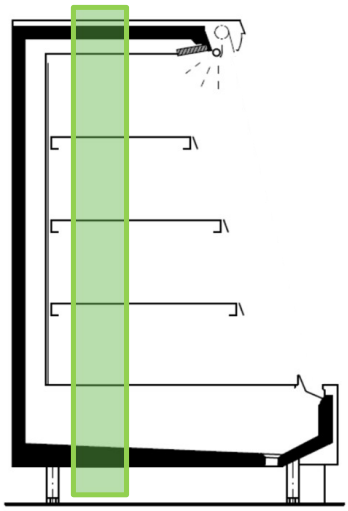
4.5.2.5 Delta depth [semi-plugin semi-vertical refrigerator]

This extrapolation rule applies to both multiplexable and non-multiplexable units under the following conditions:

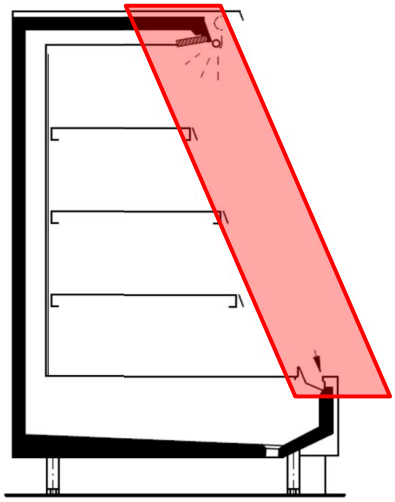
- Reference model and deducted model must belong to the same product segmentation (e.g. same M and N coefficients)
- Reference model and deducted model have the same air discharge and air return grid geometry and position to each other
- Reference model and deducted model have the same refrigeration components, and same backpanel pattern

- Reference model and deducted model have the same number of fans, same type of fans, and same fan speed
- The reduction of the depth of the cabinet must keep the same distance between air outlet and the load limit line
- Air ducts are shortened in length only
- Reference model and deducted model have the same temperature class
- Δdepth = [+0; -30%]
- Δdepth = delta internal depth of the base shelf
- Reference model and deducted model have the same refrigeration circuits

Depth reduction
with same reference model



Depth reduction results in new model



Conclusion

Under the above-presented conditions it is possible to conclude that the TEC of a deducted cabinet can be assumed as equal to the TEC of the reference one (TEC_{DED} =TEC_{REF}).

5 P Coefficient

In line with the Ecodesign and Energy Labelling Regulations, Eurovent holds that the below-proposed coefficient must be used:

- Remote units and semi plug-in units: P = 1
- Integral units: P = 1,1

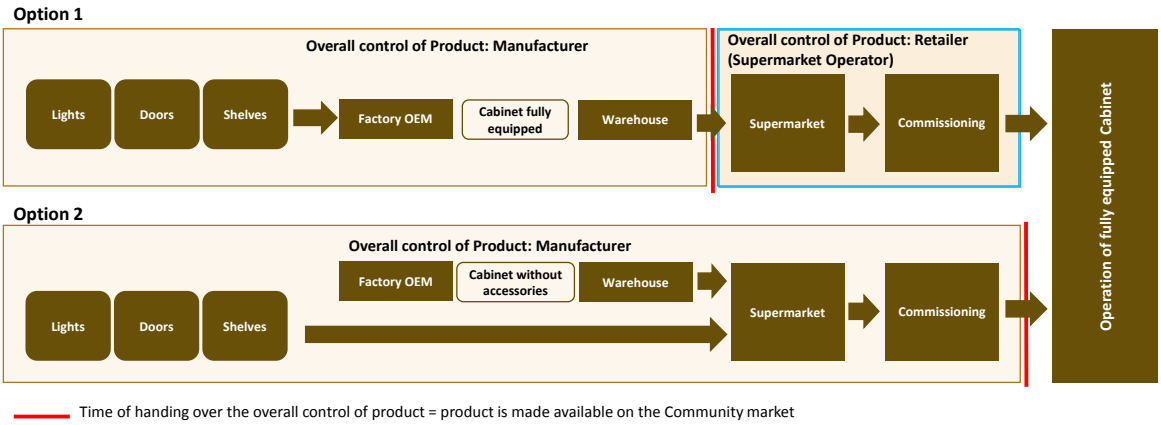
6 Incomplete delivery

According to article 2 of the Ecodesign Directive (2009/125/EC) and the related European Commission FAQ document, what is placed on the European market must meet the requirements (and it is subjected to the CE declaration of conformity). It is not possible to place on the market products which could meet the minimum requirements only in a later stage. The related product documentation (Energy Labelling, sales order, invoices, etc.) must relate to (and meet the requirements at) the time of placing on the market of the product itself.

With reference to the Ecodesign Directive and the related FAQ document, as well as the Blue Guide of the Machinery Directive, Eurovent holds that two different options of determining the time of placing on the market are foreseeable (see diagram below). Eurovent holds that according to article 2.6 of the above-recalled Ecodesign Directive (2009/125/EC), the manufacturers of refrigerating appliances having a direct sales function are responsible for the conformity of the product placed on the market.

To ensure this conformity and allow MSAs verifications, the manufacturer's product documentation, EPREL declaration, Energy Label, CE declaration, sales order, and associated invoices, must relate to the specific product as it is placed on the market. This documentation shall include all the components/accessories influencing the EEI of the specific unit at the time of placing on the market.

The below diagram summarises the overall process.



Option 1: The manufacturer provides the finished product "at the ramp" of its own factory and the customer picks it up there (or organizes the delivery with its logistic partner).

Option 2: The scope of the manufacturer's supply includes the product itself, the delivery, the unpacking, the installation and commissioning of the unit, and the EEI relevant accessories. The single point in time where the product is made available for the first time is the handover to the customer at the end of the commissioning process. Absolute precondition is that the manufacturer does not make the product available to his customer prior to that.

Appendix A: Testing method

Rounding of temperature measurements[3]

Concerning the temperature tests, it is to be reminded that, according to EN ISO23953-2 Table 1, the M-Packages temperatures are to be reported (in the temperature test report) rounded up to the nearest integer (0,5°C shall be rounded up).

Example: 4.4 °C is rounded to 4 °C; 4.5 °C is rounded to 5 °C.

Semi plug-in cabinets: testing methods[3]

Total Energy Consumption (TEC)

For cabinets with an incorporated liquid cooled condensing unit the total daily energy consumption (TEC) is equal to the direct daily electrical energy consumption (DEC) plus the Heat Removal Energy Consumption (HREC). TEC = DEC + HREC

Direct Energy Consumption (DEC)

The DEC is to be measured as described in EN 23953-2 Annex D.

Heat Removal Energy Consumption (HREC)

The HREC for a cabinet with an incorporated liquid cooled condensing unit shall be measured during the temperature test.

The HREC is defined as the contribution of the Cooling System (Dry Cooler) and energy consumption of the pump(s):

HREC = CSEC + CPEC

Where:

- CSEC: Cooling System Energy Consumption
- CPEC: Energy Consumption of the pump(s)

The inlet and outlet temperatures of the cooling liquid at the condenser shall be measured using temperature sensors directly inserted into the pipe or inserted into pockets (and not clamped between the piping and a copper recovery half-sleeve) on the inlet and outlet pipe-lines positioned no further than 150 mm from the cabinet.

The sensor cables shall be arranged such that external influences on the connection cables are eliminated by the use of insulation.

A flow measuring device (flow meter) shall be installed in the liquid inlet supply line to the cabinet in order to measure the flow rate of the liquid coolant.

Test conditions:

- Liquid coolant composition: water with 40 % (± 5 %) propylene glycol
- Liquid c_p (at 20 °C, 40 % glycol): 3,75 (± 0,1) kJ/kg
- The liquid inlet temperature θ_{in} = 30 °C (± 1 K) (fixed value)

[3] According to the ongoing CEN TC44/WG1 activity

- The pump shall run continuously during the test and provide a constant flow rate (in kg/h) within ± 3 % of that declared by the manufacturer
- The declared mass flow rate shall be reported in the technical documentation and in the test report
- The liquid outlet temperature: θ_{out} (measured)
- 5 minutes after at least one compressor starts the temperature difference between brine inlet and outlet shall be at least 3K
- Accuracy on θ_{out} - θ_{in} measurement shall be ± 0,1 K.

CSEC is calculated with the formula:

$$CSEC = \boldsymbol{P_{eff}} * \sum_{n=1}^{n=N_{max}} (q_L * (cp_{out} * \boldsymbol{\theta}_{out} - cp_{in} * \boldsymbol{\theta}_{in}))$$

Where:

- θ_{in}: instant brine inlet temperature over the test period
- θ_{out}: instant brine outlet temperature over the test period
- q_L: instant value of the mass flow of liquid coolant during test period in kg/h
- cp_{in}: liquid specific heat capacity at θ_{in}
- cp_{out}: liquid specific heat capacity at θ_{out}
- P_{eff}: Efficiency of Cooling System = 0,007 (based on a highly energy efficient dry cooler design)

The pumping electrical energy consumption is not measured and is dependent on the practical design of the cooling liquid circuit.

As a conventional rule, the pumping daily energy consumption (CPEC) in kilowatt hours per 24h period is calculated using the following equation; assuming a pressure drop in the system equalling 1,5 times the pressure drop over the cabinet and a pump efficiency of 0,5.

$$CPEC = \sum_{n=1}^{n=N_{max}} \left(\frac{2{,}5 * v * q_L(\mathbf{p}_{irun} - \mathbf{p}_{orun})}{0{,}5}\right)$$

Where:

- $p_{irun} - p_{orun}$: liquid pressure drop between inlet and outlet of cabinet during turn, in kPa
- v: specific volume of secondary refrigerant, in cubic metres per kilogram (simplification: v = const. = 0,001 m^3/kg)
- The HREC shall be determined from temperature, pressure and flow rate readings which allow a resultant accuracy of ± 5 %.

TDA Calculation[4]

This section aims to complement the current EN/ISO 23953-2 Annex A and refers to the ongoing CEN TC44/WG1 activity.

The TDA is determined by the sum of vertical and horizontal projected areas from visible foodstuff, in square metres. For multi-deck and semi-vertical cabinets, the horizontal projected area is measured

[4] According to the ongoing CEN TC44/WG1 activity

from a plane located at 1,55 m from the ground in order to take into account the visible foodstuffs located in the front part of the shelves (see Figure A.4). If the shelves are tilted and the loading is for sensitive foodstuffs, the horizontal projected area H0 shall be measured from the vertical plane passing through the shelves edge and the plane located at 1,55 m from the ground (see Figure A.4.1)

If also the top of the cabinet is transparent, see TDA calculations in example of figure A.4.3.

Stand-alone cabinets (not multiplexed) that enable visibility of foodstuff on all sides of the cabinet, visible foodstuff from positions of the customer related to the cabinet (front, back, both sides).

In the case the shelves are of different lengths the projected area H0 can be sensible affected by the height of the cabinet when the load level line could be above or below in respect of the plane located at 1,55 m from the ground as shown in Fig. A1

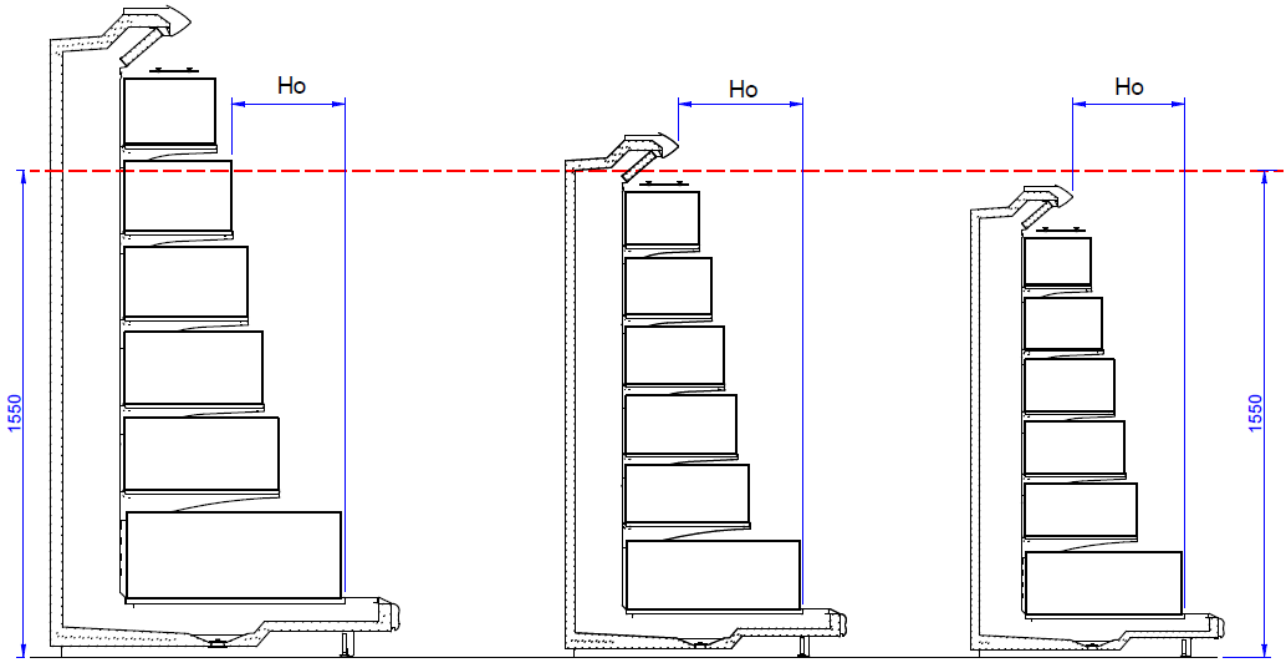


Figure A.1: Example of TDA calculation

Measurement of TDA in a refrigerated display cabinet

Calculation of TDA

The total display area shall be calculated as in the Formula (A.1):

$$TDA = (H_0 \times L_{0h}) + (H_g \times L_{gh}) + (V_0 \times L_{0v}) + (H_g \times L_{gh}) \quad [A.1]$$

where:

- H: Horizontal projection, in metres
- V: Vertical projection, in metres
- L: Cabinet length without end walls, in metres
- Index o: is the open surface
- Index g: is the glazing surface
- Index h: is the horizontal

- Index v: is the vertical
- Index t: is the top
- Index b: is the base
- Index w: is the end wall

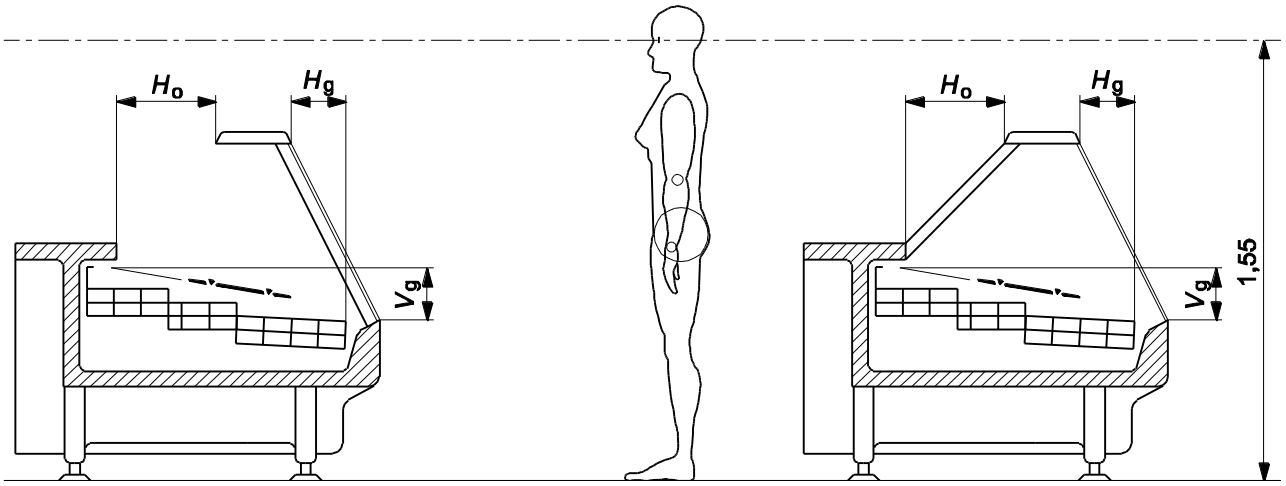
Vertical projections of items at the front of each shelf, such as price rails or air guides, of equal or less than 60 mm high shall not be deducted in the calculation of the TDA.

Vertical projections of items at the front of each shelf, such as price rails or air guides, of greater than 60 mm high shall be completely deducted in the calculation of the TDA.

The opaque areas of the frames and projected areas of handrails and handles shall be deducted from the measurement.

Figures A.1 to A.16 illustrate the calculation for the most common cabinets with a length of 2,5 m.

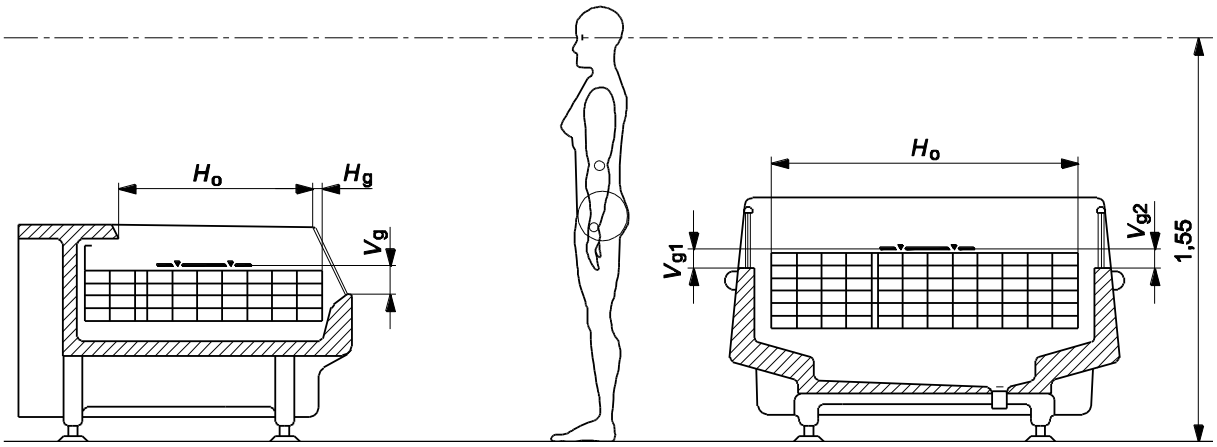
Dimensions in metres



Loh = 2,500	Ho = 0,291	Loh = 2,400	Ho = 0,350
Lgh = 2,500	Hg = 0	Lgh = 2,500	Hg = 0,194
Lov = 2,500	Vo = 1,367	Lov = 2,500	Vo = 0
Lgv = 2,500	Vg = 0	Lgv = 2,500	Vg = 0,185
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	1,785	TDA = (Ho × Loh) + (Hg × Lgh)+ (Vo × Lov) + (Vg × Lgv)	1,788

Figure A.2—Horizontal, serve-over counters

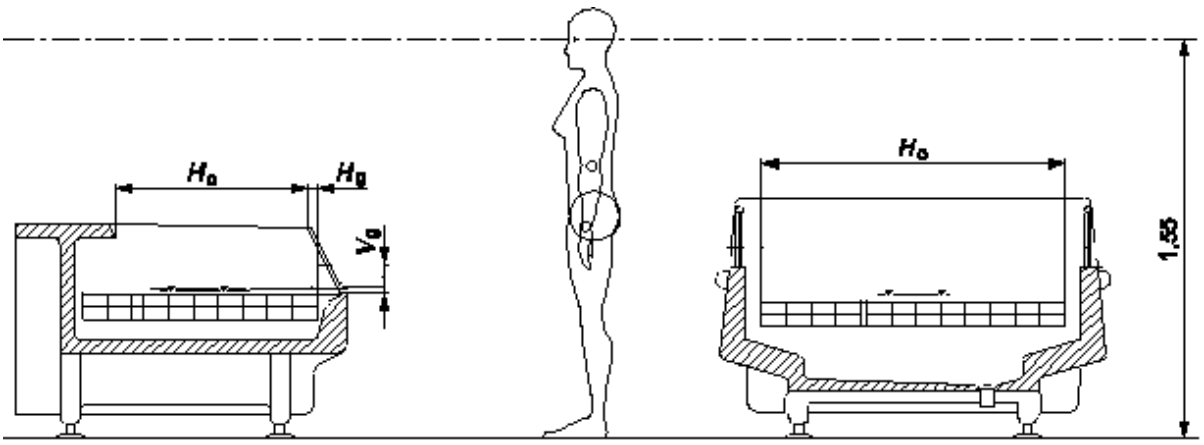
Dimensions in metres



		Loh = 2,500	Ho = 1,176
Loh = 2,500	Ho = 0,770	Lgh = 2,500	Hg = 0
Lgh = 2,500	Hg = 0,012	Lov = 2,500	Vo = 0
Lov = 2,500	Vo = 0	Lgv1 = 2,400	Vg1 = 0,058
Lgv = 2,500	Vg = 0,090	Lgv2 = 2,400	Vg2 = 0,058
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	2,18	TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg1 × Lgv1)) + (Vg2 × Lgv2)	3,218

Figure A.3—Horizontal, open, wall-site and island cabinets

Dimensions in metres

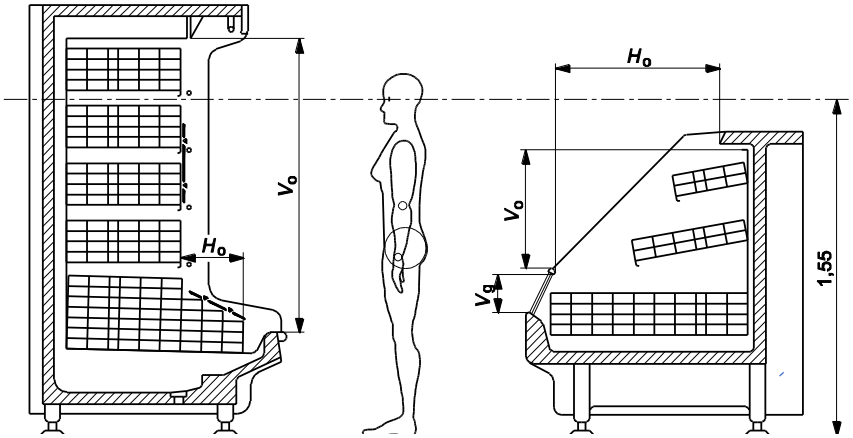


		Loh = 2,500	Ho = 1,176
Loh = 2,500	Ho = 0,770	Lgh = 2,500	Hg = 0
Lgh = 2,500	Hg = 0,012	Lov = 2,500	Vo = 0
Lov = 2,500	Vo = 0	Lgv1 = 2,400	Vg1 = 0

Lgv = 2,500	Vg = 0,010	Lgv2 = 2,400	Vg2 = 0
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	1,98	TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg1 × Lgv1)) + (Vg2 × Lgv2)	2,928

Figure A.3.1—Horizontal, open, wall-site and island cabinets with sensitive foodstuff load

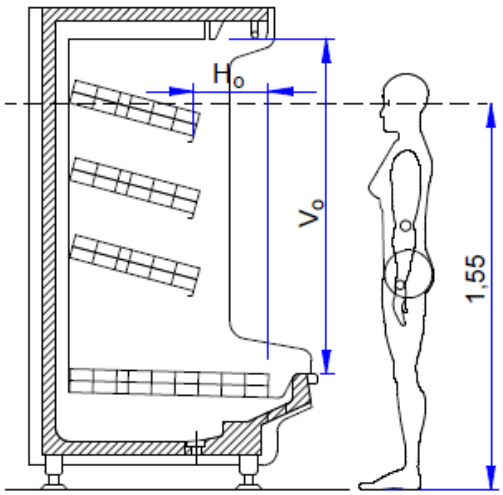
Dimensions in metres



Loh = 2,500	Ho = 0,291	Loh = 2,500	Ho = 0,761
Lgh = 2,500	Hg = 0	Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 1,367	Lov = 2,500	Vo = 0,546
Lgv = 2,500	Vg = 0	Lgv = 2,400	Vg = 0,175
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	4,145	TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	3,688

Figure A.4—Vertical, multi-deck and semi-vertical cabinets

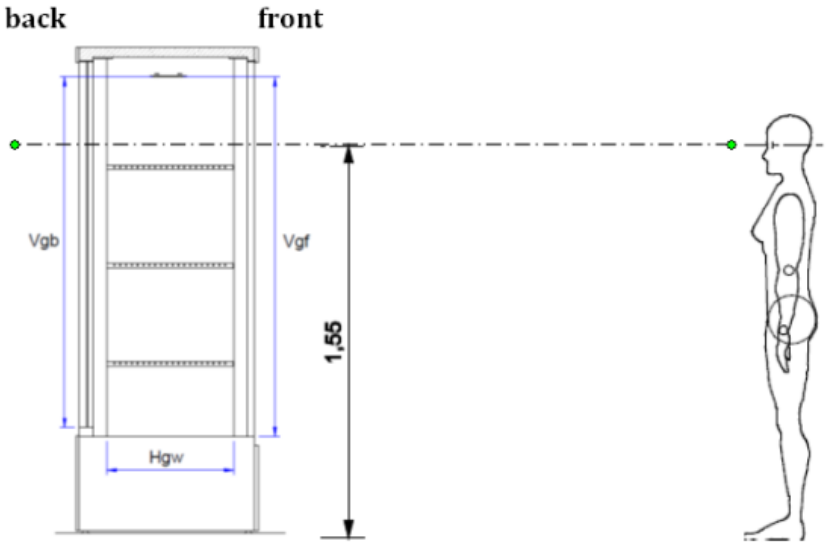
Dimensions in metres



Loh = 2,500	Ho = 0,321
Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 1,367
Lgv = 2,500	Vg = 0
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	4,220

Figure A.4.1—Vertical, multi-deck with tilted shelves and sensitive foodstuffs

Dimensions in metres

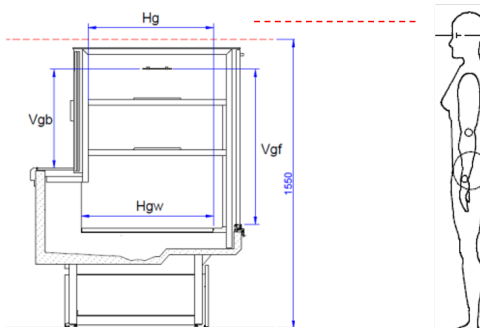


TDA= (Vgb x Lgvb) +(Vgf x Lgvf) +2 x (Hgw x Vgb)

Fig.A.4.2: Transparent back, front and sides cabinet

Dimensions in metres

back front

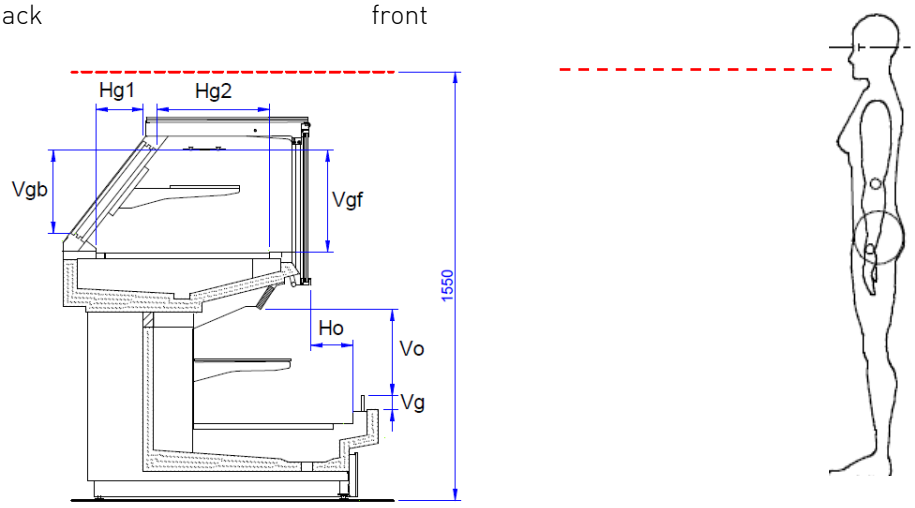


TDA = (Vgb x Lgvb) +(Vg f x Lgvf) + (Hg x Lgh)+ 2 x (Hgw x Vgf)

Fig.A.4.3 Transparent cabinet back, front, sides and top

Dimensions in metres

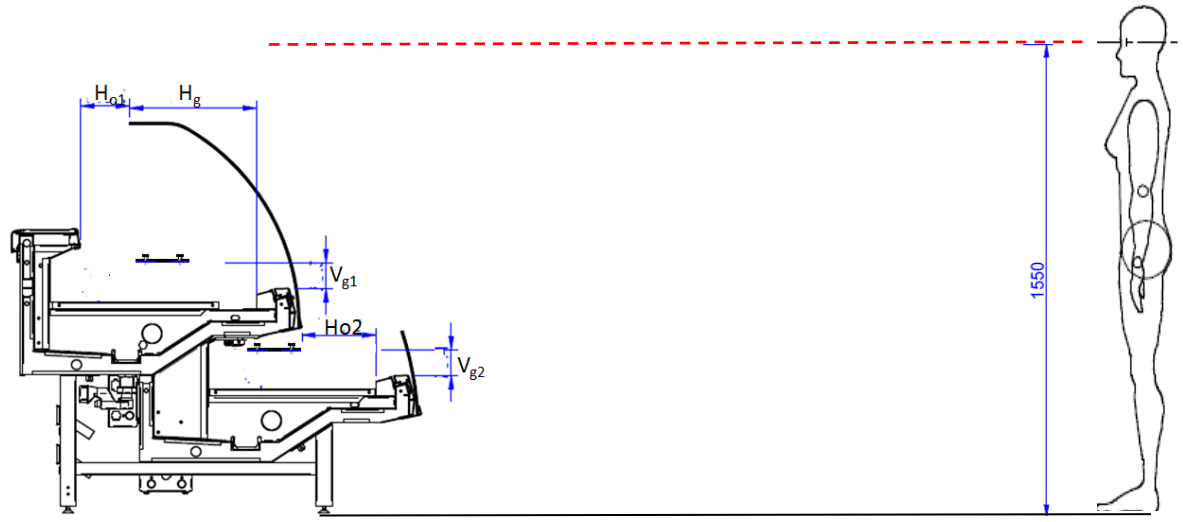
back front



(Vo + Vg + Vgb+ Vgf) ≥ 0,45 * (Hg1 + Hg2+ Ho)
TDA = (Vgb x Lgvb) +(Vgf x Lgvf) +(Vo + Vg) x Lv + (Hg1 x Lgh1) +(Hg2 x Lgh2)

Fig. A.5 Vertical combined - YC3 Chilled, glass door top, open bottom

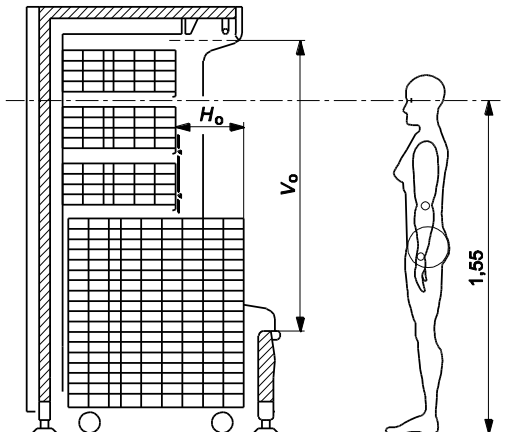
Dimensions in metres



(Vg2 + Vg1) ≤ 0,45 * (Ho1 + Hg +Ho2)
TDA = (Vg 2 x Lg2) +(Vg 1 x Lg1) + (Ho1 x Lho1) +(Hg x Lhg) + (Ho2 x Lho2)

Fig. A.6 Horizontal combined refrigerated cabinet - YC1 Chilled, open top, open bottom

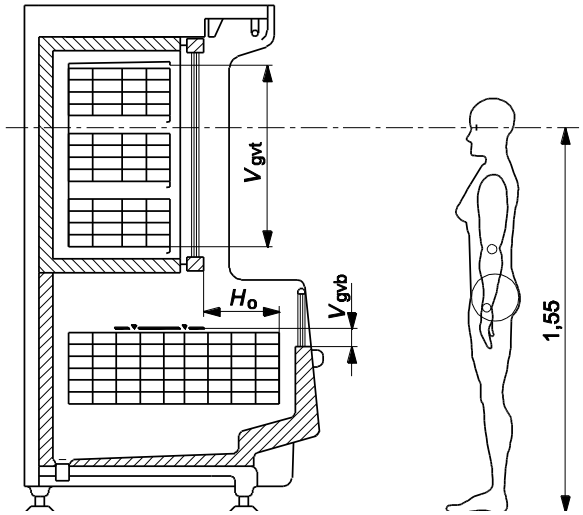
Dimensions in metres



Loh = 2,500	Ho = 0,321
Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 1,367
Lgv = 2,500	Vg = 0
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	4,220

Figure A.7—Vertical, roll-in cabinet

Dimensions in metres

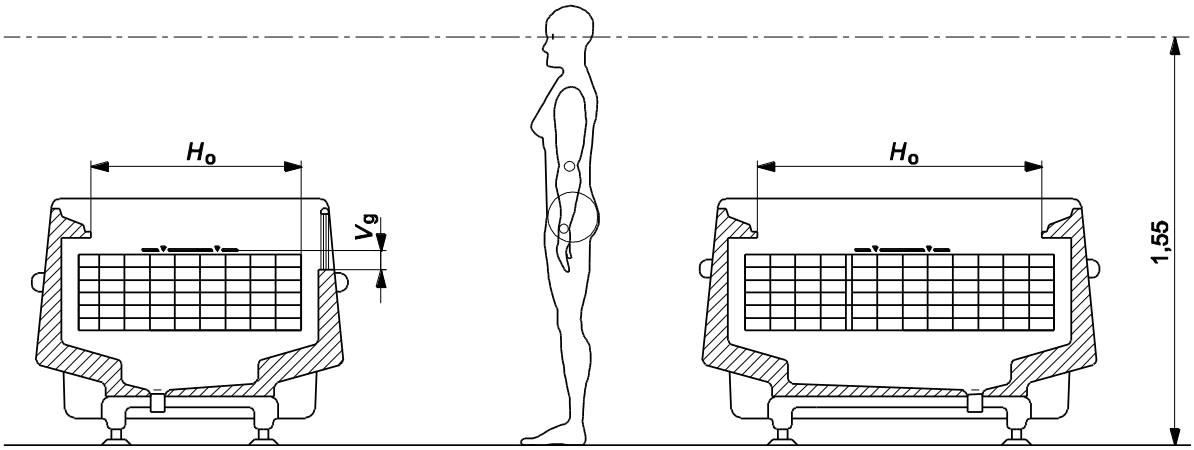


Loh = 2,500	Ho = 0,306
Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 0
Lgvt = 2,250	Vgt = 0,731

Lgvb = 2,400	Vgb = 0,058
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vgt × Lgvt) + (Vgb x Lgvb)	2,549

Figure A.8—Combined, glass door top, open bottom, cabinet

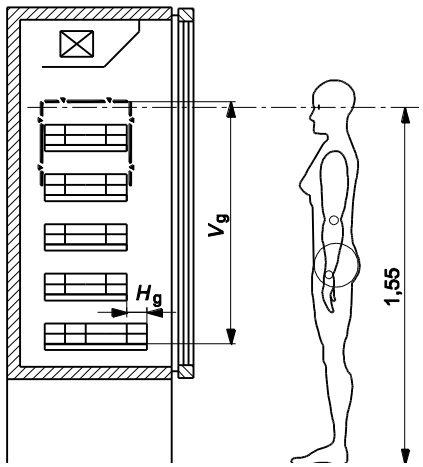
Dimensions in metres



Loh = 2,500	Ho = 0,800	Loh = 2,500	Ho = 1,084
Lgh = 2,500	Hg = 0	Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 0	Lov = 2,500	Vo = 0
Lgv = 2,400	Vg = 0,058	Lgv = 2,500	Vg = 0
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	2,139	TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	2,710

Figure A.9—Horizontal, open, island cabinets

Dimensions in metres

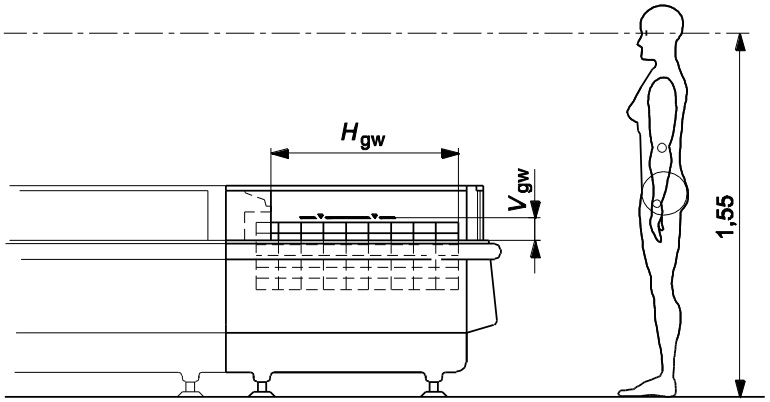


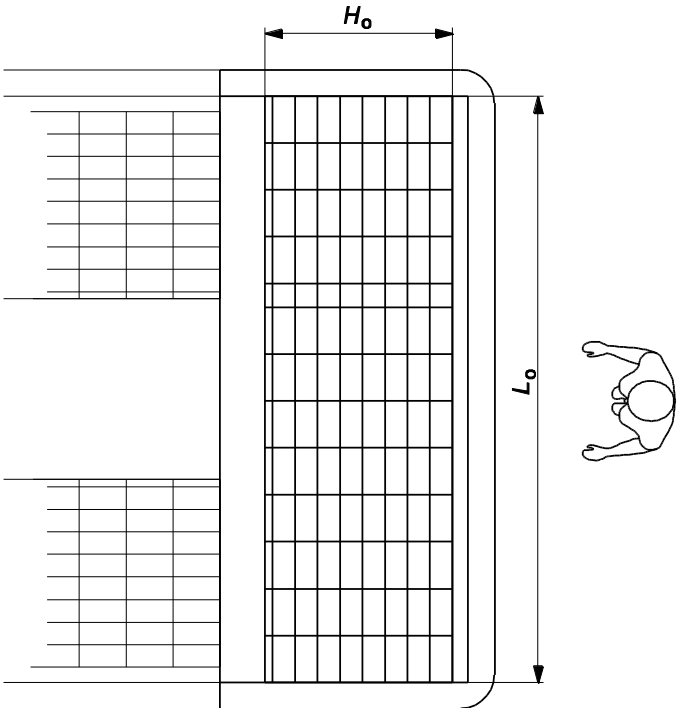
Loh = 2,500	Ho = 0
Lgh = 2,500	Hg = 0,25

Lov = 2,500	Vo = 0
Lgv = 2,250	Vg = 1,053
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv)	2,994

Figure A.10—Vertical, glass door, cabinet

Dimensions in metres



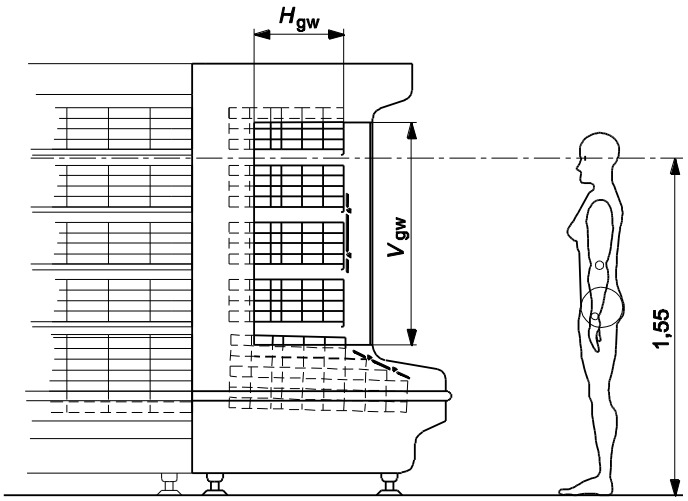


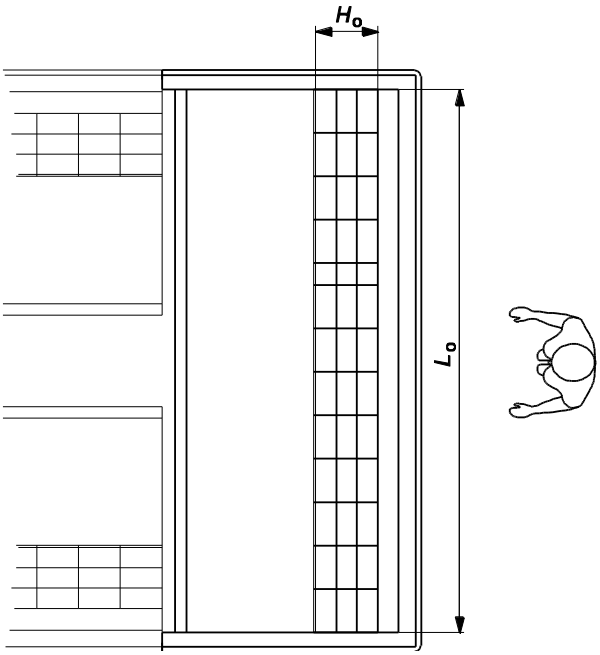
Loh = 2,500	Ho = 0,800
Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 0

Lgv = 2,400	Vg = 0,058
Vgw= 0,058	Hgw = 0,800
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv) + (2 × Vgw× Hgw)	2,232

Figure A.11—Horizontal, open, island end cabinet

Dimensions in metres





Loh = 2,500	Ho = 0,291
Lgh = 2,500	Hg = 0
Lov = 2,500	Vo = 1,367

Lgv = 2,500	Vg = 0
Vgw = 1,022	Hgw = 0,415
TDA = (Ho × Loh) + (Hg × Lgh) + (Vo × Lov) + (Vg × Lgv) + (2 × Vgw× Hgw)	4,993

Figure A.12—Vertical, multi-deck end cabinet

For semi vertical head case or stand-alone cabinets with a transparent side wall, the side area shall be calculated as the area resulting from the orthogonal projection of the loading line, the base plate line and the back-panel line. In case shelfs have limitation of loading with respect to full loading, each shelf must be calculated as a separate area. Any overlapping non transparent area, like silkscreen, shall be subtracted (see Figures A.13, A.14, and A.15, where the green area represents side TDA).

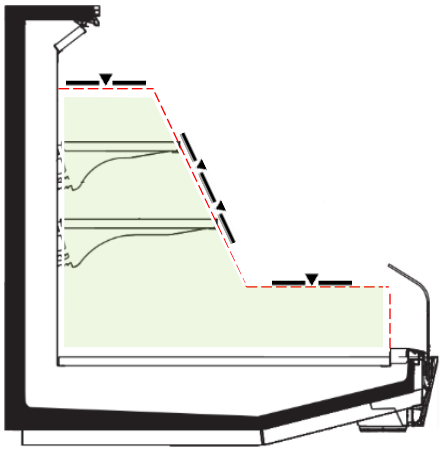


Figure A.13—Semi vertical, transparent end wall with oblique loading line

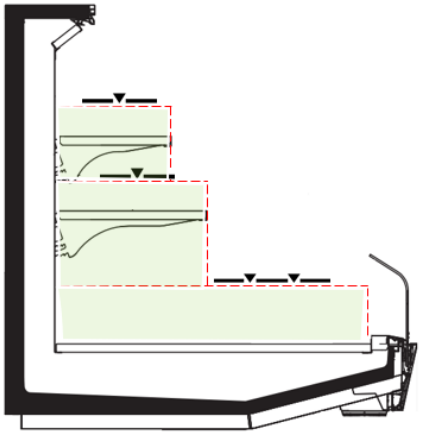


Figure A.14 —Semi vertical, transparent end wall with horizontal loading line

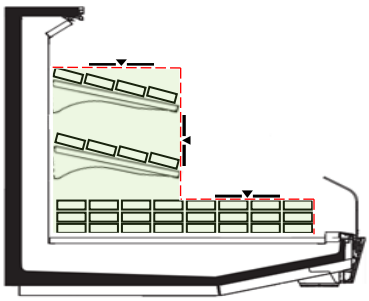
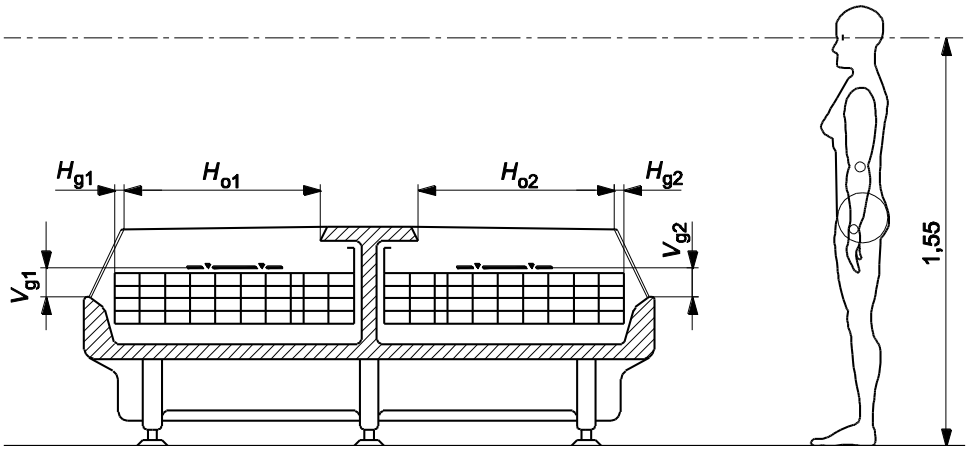


Figure A.15 —Semi vertical, transparent end wall with vertical loading line with sensitive foodstuff on top shelf

Dimensions in metres



Loh1 = 2,500	Ho1 = 0,770
Loh2 = 2,500	Ho2 = 0,770
Lgh1 = 2,400	Hg1 = 0,012
Lgh2 = 2,400	Hg2 = 0,012
Lgv1 = 2,400	Vg1 = 0,090
Lgv2 = 2,400	Vg2 = 0,090
TDA = (Ho1 × Loh1) + (Ho2 × Loh2) + (Hg1 × Lgh1) + (Hg2 × Lgh2) + (Vg1 × Lgv1) + (Vg2 × Lgv2)	4,340

Figure A.16—Island with air discharge in the middle

About Eurovent

Eurovent is Europe's Industry Association for Indoor Climate (HVAC), Process Cooling, and Food Cold Chain Technologies. Its members from throughout Europe represent more than 1.000 organisations, the majority small and medium-sized manufacturers. Based on objective and verifiable data, these account for a combined annual turnover of more than 30bn EUR, employing around 150.000 people within the association's geographic area. This makes Eurovent one of the largest cross-regional industry committees of its kind. The organisation's activities are based on highly valued democratic decision-making principles, ensuring a level playing field for the entire industry independent from organisation sizes or membership fees.

Our Member Associations

Our Member Associations are major national sector associations from Europe that represent manufacturers in the area of Indoor Climate (HVAC), Process Cooling, Food Cold Chain, and Industrial Ventilation technologies.

The more than 1.000 manufacturers within our network (Eurovent 'Affiliated Manufacturers' and 'Corresponding Members') are represented in Eurovent activities in a democratic and transparent manner.

→ For in-depth information and a list of all our members, visit www.eurovent.eu