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«SUPPORTING DEVELOPING AND EMERGING ECONOMIES TO ACCELERATE THE TRANSITION TO ENERGY-EFFICIENT AND CLIMATE-FRIENDLY EQUIPMENT»

MODEL REGULATION GUIDELINES

NOVEMBER 2021

ENERGY-EFFICIENT AND CLIMATE-FRIENDLY COMMERCIAL REFRIGERATION EQUIPMENT

U4E United for Efficiency

Department for Environment Food & Rural Affairs

Clean Cooling COLLABORATIVE

gef

United Nations Environment Programme – United for Efficiency (U4E)

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Foreword

These "Model Regulation Guidelines (Guidelines) for Energy-Efficient and Climate-Friendly Commercial Refrigeration Equipment" complement United for Efficiency's (U4E's) "Model Regulation Guidelines for Refrigerating Appliances" and other supporting resources.[1] This is voluntary guidance for developing and emerging economy governments that are considering a regulatory or legislative framework requiring new refrigeration equipment to be energy efficient and use refrigerants that have lower global warming potential (GWP) compared with typical legacy refrigerants. It covers types of refrigeration equipment commonly used in commercial applications. An accompanying supporting information document includes the underlying rationale and methods.

Refrigeration equipment (typically systems based on a vapor-compression cycle) requires electricity and a refrigerant to operate. When electricity is from fossil fuel power plants—which is the case for nearly 75 per cent of the electricity in countries not in the Organisation for Economic Co-operation and Development (OECD)—greenhouse gases (i.e., indirect emissions) and air pollution are emitted. Some refrigerants have a GWP well over 1,000 times as high as an equivalent molecule of carbon dioxide. Fortunately, technologies are widely available to improve energy efficiency and use refrigerants with a lower GWP.

Under the Kigali Amendment to the Montreal Protocol, countries will phase down hydrofluorocarbons (HFCs) by over 80 per cent over the next three decades. The climate benefits are significantly enhanced by improving energy efficiency while phasing down HFCs. U4E co-organized capacity-building "Twinning" workshops on sustainable cooling solutions for senior energy and environment officials from nearly 130 countries in 2018 and again in 2019. Many attendees expressed concerns about setting disjointed policies that only address efficiency or refrigerants and requested guidance on minimum energy performance standards (MEPS) and labels that addresses both topics.

The projected stock of equipment of the types covered by the Guidelines is expected to rise in developing and emerging markets. The key is expanding access to cooling while mitigating impacts on energy supplies, the environment, and the planet. Electricity consumption varies widely by equipment type, size, age, and maintenance practices. For example, inefficient commercial refrigeration equipment meant to be addressed by these Guidelines can consume over 10,000 kilowatt-hours (kWh) of electricity per year, whereas some of the best equipment can consume less than one fifth as much for the same display area or storage volume. Such savings have profound impacts on the cost to own and operate these devices.

[1] Available at https://united4efficiency.org/resources/publications/?fwp_products=refrigerators.

MEPS and energy labels, if well designed and implemented, are among the fastest and most effective approaches to transition markets toward more energy-efficient products. While many countries have MEPS and/or labels for refrigerating appliances, few developing and emerging economies have them for commercial refrigeration equipment. Inadequate MEPS and labels leave markets vulnerable to being dumping grounds for products that cannot be sold elsewhere.

These Guidelines address the following aspects of commercial refrigeration equipment:

- energy efficiency and functional performance,
- product information reporting and labelling,
- demonstration of compliance, and
- market surveillance and enforcement.

U4E consulted experts from various sectors and regions to assess best practices and new developments. The aim is to balance ambitious energy performance and refrigerant requirements while limiting adverse impacts on the upfront costs and availability of products. Further evaluations (e.g., market assessments and consumer, utility, and manufacturer impact analyses) are helpful for implementing this guidance. The Guidelines were developed assuming interested parties would put them into effect in approximately 2024, but the timing and text should be adjusted as appropriate.

Given existing regional standards and energy-efficiency improvement opportunities, the low-efficiency requirements in the Guidelines largely align with the Australian 2021 or EU 2021 MEPS. The intermediate- and high-efficiency requirements (30 per cent and 60 per cent more stringent, respectively, than the low-efficiency requirements), which can be considered for more ambitious MEPS, labelling, and/or incentive requirements (see the accompanying Supporting Information document for more information). While commonly used standards are referenced, others may work well for a particular context.

An energy rating system is recommended in the Guidelines to accelerate the adoption of higher-efficiency equipment. While reference safety standards are also included, the Guidelines do not specify unique requirements for safety or quality, because these are not primarily related to energy efficiency and functional performance. Safety is often incorporated in parallel regulations, while warranties are often in voluntary schemes (public procurement programs, incentives, etc.). Officials should investigate whether to include safety requirements, warranties, and other features (e.g., extended producer responsibility) that may be appropriate in the local context.

Each country has unique characteristics. These Guidelines are intended as a starting point to inform policies and programmes, rather than a final template to adopt “as is.” Regulatory processes should be undertaken transparently and with sufficient time to address local circumstances (e.g., availability and prices of products, income levels, utility tariffs). These

processes are typically led by an energy ministry with the support of a national standards body and conducted in consultation with many experts from the public and private sectors, consumer and environmental organizations, and civil society. The National Ozone Unit (often in the environment ministry, if available) should be closely involved.

Policymakers who are committed to market transformation and prepared to invest in the requisite market assessment, impact analyses, stakeholder consultations, monitoring, verification, enforcement, awareness raising, and beyond should strongly consider mandatory MEPS and labels. Neighbouring countries should align where practicable to reduce complexity and compliance costs for manufacturers and alleviate some of the challenges of oversight and enforcement for officials. Consistent approaches across countries help yield economies of scale for efficient products that save consumers money on electricity bills, reduce air pollution, mitigate greenhouse gas emissions, and enable greater electrical grid stability. U4E hopes these Guidelines help unlock the many benefits of energy-efficient and climate-friendly refrigeration equipment.

The work presented in this document represents the best available information at the time of publication, but the authors recognize that refrigeration technology is evolving, as are the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) standards that underpin the metrics and requirements set out in this supplement. Users of these Guidelines are therefore encouraged to investigate current requirements and standards at the time of adoption.

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Acronyms

af	adjustment factor
AEC	annual energy consumption
AHRI	Air Conditioning, Heating, and Refrigeration Institute
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CAR	conformity assessment report
CC	climate class
E_{daily}	total daily energy consumption (TEC)
EEI	energy efficiency index
EN	European Norm
E_{weekly}	total weekly energy consumption
GWP	global warming potential
HCFC	hydrochlorofluorocarbons
HFC	hydrofluorocarbon
IEC	International Electrotechnical Commission
IHC	integral horizontal chilled
IHF	integral horizontal frozen
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
IVC	integral vertical chilled
IVF	integral vertical frozen
kWh	kilowatt-hours
MEPS	minimum energy performance standards
ODP	ozone depletion potential
OECD	Organisation for Economic Co-operation and Development
RAEC	reference annual energy consumption
RDC	refrigerated display cabinet
RDC-BC	refrigerated display cabinet - beverage cooler
RDC-ICF	refrigerated display cabinet - ice cream freezer cabinet
RDC-SC	refrigerated display cabinet - scooping cabinet
RHC	remote horizontal chilled
RHF	remote horizontal frozen
RSC	refrigerated storage cabinet
RVC	remote vertical chilled
RVF	remote vertical frozen
RVM	refrigerated vending machine
T_c	compartment temperature
TDA	total display area
TEC	total daily energy consumption
T_v	product temperature in RVM
V_n	net volume
U4E	United for Efficiency

Article 1. Scope of Covered Products

1.1 Scope

This regulation applies to the following types of commercial refrigerating equipment:

a) refrigerated display (freezer or refrigerator) cabinets (RDCs),
b) refrigerated storage (freezer or refrigerator) cabinets (RSCs),
c) refrigerated drink cabinets or beverage coolers (RDC-BCs),
d) ice cream freezer cabinets (RDC-ICFs),
e) scooping cabinets (RDC-SCs), and
f) refrigerated vending machines (RVMs).

1.2 Exemptions

This regulation does NOT apply to the following refrigerating equipment:

a) equipment that is powered by energy sources other than electricity,
b) ice makers,
c) cabinets that are designed for both food processing and storage whether or not the cabinet includes an integral storage section,
d) RSCs that have liquid-cooled condensers,
e) refrigerating equipment specifically tested and approved for the storage of medicines or scientific samples,
f) blast cabinets,
g) wine storage appliances and minibars,
h) walk-in coolers (cold rooms),
i) solar direct drive or off-grid refrigeration equipment,
j) equipment covered by another energy-efficiency regulation for refrigerating appliances, and
k) the remote components, such as condensing units and compressors, to which an RDC must be connected in order to function.[2]

[2] Energy consumption in remote components is included in the total energy consumption in the entire RDC system in accordance with the reference standard.

Article 2. Terms and Definitions

This document refers to standards listed below to specify the following:

a) requirements relating to the refrigerated cabinets and RVMs covered,
b) test conditions and methods for checking that those requirements have been satisfied,
c) classifications of the refrigerated cabinets and RVMs,
d) markings for the refrigerated cabinets and RVMs, and
e) characteristics of the refrigerated cabinets and RVMs to be declared by the manufacturer.

ISO 23953:2015 Refrigerated display cabinets

Part 1: Vocabulary

Part 2: Classification, requirements and test conditions

ISO 22041:2019 Refrigerated storage cabinets and counters for professional use[3]

ISO 22043:2020 Ice-cream freezers — Classification, requirements and test conditions

IEC 63252:2020 Energy consumption of vending machines

EN 16838:2016 Refrigerated display scooping cabinets for gelato - Classification, requirements and test conditions

Below are the definitions of the relevant terms in this document. Unless otherwise specified, these definitions are harmonized with the reference standards, above.[4]

2.1 Cabinet types and components

Refrigerated cabinet means a device that

a) consists of an insulated cabinet with an opening (whether or not the opening has a lid or a door),
b) is capable of attaining and maintaining a specified temperature within the insulated cabinet within a range that overlaps the range -18°C to +10°C, and
c) is designed primarily for storage, display, or both storage and display of chilled or frozen foodstuffs.

[3] In the EU, EN ISO 22041 supersedes EN 16825.
[4] There are other widely used standards, such as ANSI/ASHRAE 72 Method of Testing Open and Closed Commercial Refrigerators and Freezers, and ANSI/AHRI 1200 Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets. They are different in many respects from the ISO standards listed above. The accompanying U4E Supporting Information document provides indicative benchmarking between standards and reference studies.

RDC means a refrigerated cabinet that is designed to store and display chilled or frozen items in a retail environment for access by consumers.

RSC means a refrigerated cabinet that

a) is designed to store chilled or frozen items in a retail environment but not for the display to, or access by, consumers, and
b) is integral (see definition below).

RDC-BC means an RDC that

a) is designed to store and display non-perishable drinks only, and
b) is integral.

RVM means a piece of equipment that is designed to accept consumer payments or tokens to dispense chilled foodstuffs or other items without on-site labour intervention.

RDC-ICF means a refrigerated cabinet that

a) is designed for storage and display of, and access by consumers to, pre-packaged frozen ice cream,
b) is integral,
c) can be accessed by opening a lid (whether non-transparent or transparent),
d) has a net volume (V_N) of no more than 600 L, and
e) has a ratio of its V_N to total display area (TDA) of greater than or equal to 0.35 m.

RDC-SC means a refrigerated cabinet that

a) is designed for the storage, display, and scooping of frozen gelato or ice cream, within prescribed temperature limits, and
b) is integral.

Refrigerator or chiller means a refrigerating appliance that continuously maintains the temperature of the products stored in the cabinet at chilled operating temperature.

Freezer means a refrigerating appliance that continuously maintains the temperature of the products stored in the cabinet at frozen operating temperature.

Integral refrigerated cabinet means a refrigerated cabinet that has its condensing unit housed within, or directly attached to, the cabinet.

Remote refrigerated cabinet means a refrigerated cabinet that is not integral.

Semi-integral refrigerated cabinet with liquid cooled condensing unit means a refrigerated cabinet that has a condenser partially or fully cooled by a closed liquid circuit.

Condensing unit means a combination of equipment that has one or more compressors, condensers, and liquid receivers (when required) and the regularly furnished accessories.

Horizontal RDC means a refrigerated cabinet that has an access opening only in its uppermost horizontal surface (whether or not the access opening can be closed by a door or a lid).

Horizontal RSC means a refrigerated cabinet that has an overall height, defined as counter in accordance with ISO 22041, of no greater than 1,050 mm, with one or more front doors or drawers accessing the same compartment.

Vertical refrigerated cabinet means a refrigerated cabinet that is not horizontal.

2.2 Operation and performance test

V_N means the volume containing foodstuffs within the load limit and is determined in accordance with:

a) for an RDC-ICF, 6.2 of ISO 22043,
b) for an RSC, clause 6.1 of ISO 22041, and
c) for an RVM, clause 6.4 of IEC 63252.

TDA means the total visible foodstuffs and other items area, including visible area through glazing, defined by the sum of horizontal and vertical projected surface areas of the V_N, expressed in m^2:

a) for an RDC, Annex A of ISO 23953-2, and
b) for an RDC-SC, clause 6.2 of EN 16838.

Normal conditions of use mean operating conditions that exist when the cabinet, including all permanently located accessories, has been set up and situated in accordance with the recommendations of the manufacturer and is in service.

Heavy-duty cabinet means an RSC for which the verification of the capability of maintaining the temperature in the compartment is performed when tested at test room climate class 5 and the measurement of energy consumption is verified when tested at test room climate class 4 in accordance with ISO 22041.

Normal-duty cabinet means an RSC for which the measurement of energy consumption and the capability of maintaining temperature in the compartment are verified when tested at test room climate class 4 in accordance with ISO 22041.

Light-duty cabinet means an RSC for which the measurement of energy consumption and the capability of maintaining temperature in the compartment are verified when tested at test room climate class 3 in accordance with ISO 22041.

M-package means the test package fitted with a temperature-measuring device defined in the reference standard, depending on equipment type.

Test package means the package without the temperature-measuring device defined in the reference standard, depending on equipment type, and used to simulate load.

M-package temperature class means a classification of the refrigerated cabinet according to temperatures of warmest and coldest M-packages during the temperature test as defined in the relevant standard, or in **Table 2** and **Table 3**.

Climate class means a classification of the test room condition according to the dry bulb temperature and relative humidity as defined in the relevant standard or in **Table 4**, which will be used for the energy consumption test and/or the temperature test.

2.3 Families of models

Two or more models are in the same family of models if the requirements of this section are satisfied in relation to the models and the family. The least efficient product in a family must undergo certified performance testing and be registered.

Parent model requirements

There must be a single model (the *parent model*) for each family that is manufactured by one manufacturer within a single equipment class, and this model and other models in the family must have the same primary energy source and essentially identical electrical, physical, and functional characteristics that affect energy consumption. The parent model, when compared to the other models in the family, must:

a) have the highest, or an equally high, specific energy consumption,
b) meet the requirements of the coldest, or an equally cold, M-package temperature class when tested in accordance with the relevant test standard,
c) have the largest, or an equally large, vertical or horizontal opening,
d) have the greatest, or an equally great, horizontal distance between the front and the rear of the cabinet, and
e) be included on a test report that was prepared prior to the application for registration for any model that is a member of the family.

Family model requirements

Each model in the family must:

a) be in the same product class as the parent model, and
b) meet the requirements of:
   i. the same M-package temperature class as the parent model, or
   ii. a warmer M-package temperature class than that of the parent model.

Additional requirements if parent model is an RDC If the parent model is an RDC, each model in the family must have:

a) the same characteristics as the parent model in relation to:
   i. whether it is open or closed, and
   ii. whether it is oversized[5];
b) a TDA that is the same as that of the parent model; and
c) the same ratio of cabinet length to TDA as that of the parent model if the family consists of models:
   i. that are remote, and
   ii. that are of modular construction,
   iii. some or all of which are of different lengths.

Additional requirements if parent model is an RSC If the parent model is an RSC, each model in the family must have:

a) the same V_N as the parent model, and
b) the same duty classification (light, normal, or heavy duty) as the parent model.

Additional requirements if parent model is an RDC-ICF If the parent model is an RDC-ICF, each model in the family must have:

a) the same V_N as the parent model, and
b) the same TDA as the parent model.

Additional requirements if parent model is an RDC-SC If the parent model is an RDC-SC, each model in the family must have the same TDA as the parent model.

[5] Oversized means that, as a result of the model's size, there is no testing laboratory in which the RDC can be tested in accordance with ISO 23953-2, and it has been approved by [Agency Name]. Compliance methods of oversized products can be considered in the implementation process, for example, by determining a hypothetical electrical energy consumption of a reference low-efficiency version of the cabinet.

Article 3. Requirements

Refrigerating equipment falling within the scope of Article 1 shall meet the energy consumption requirements of Article 3.

3.1 Test methods and energy consumption calculation

Compliance with the energy consumption requirements shall be tested according to the conditions in **Table 1**, **Table 2**, **Table 3**, and **Table 4**.

Table 1. Test conditions for package temperature and test room climate class

Equipment	M-package or test package temperature classes	Test room climate class	Measurement standards
RDC	M0, M, M1, M2, H1, H2, L1, L2, L3	3	ISO 23953-2[a]
RDC-BC	M2	3	ISO 23953-2[a]
RDC-SC	G1, G2, G3, L1, L2, L3	3	EN 16838
RDC-ICF	C1, C2	4	ISO 22043
RSC	M1, L1	3, 4	ISO 22041
RVM[b]	Maximum measured product temperature (T_v) Category 1: 7°C Category 2: 12°C Category 3: 3°C Category 4[c]: $(T_{V1}+T_{V2})/2$ Category 6[c]: $(T_{V1}+T_{V2})/2$	3	IEC 63252

a. ISO 23953-2 was under revision at the time these Guidelines were written.

b. Category 1 = refrigerated closed fronted can and bottle machines where the products are held in stacks; category 2 = refrigerated glass fronted can and bottle, confectionery, and snack machines; category 3 = refrigerated glass-fronted machines entirely for perishable foodstuffs; category 4 = refrigerated multi-temperature glass-fronted machines; category 6 = combination machines consisting of different categories of machine in the same housing and powered by one chiller.

c. For multi-temperature vending machines, T_V shall be the average of T_{V1} (the maximum measured product temperature in the warmest compartment) and T_{V2} (the maximum measured product temperature in the coldest compartment).

Table 2. M-package temperature classes for RDC, RDC-BC, RDC-SC, and RSC

M-package temperature class	Highest temperature, θah, of warmest M-package colder than or equal to: [°C]	Lowest temperature, θb, of coldest M-package warmer than or equal to: [°C]	Highest minimum temperature, θal, of all M-packages colder than or equal to: [°C]
G1	-10	-14	-
G2	-10	-16	-
G3	-10	-18	-
H1	+10	+1	-
H2	+10	-1	-
L1	-15	-	-18
L2	-12	-	-18
L3	-12	-	-15
M0	+4	-1	-
M	+6	-1	-
M1	+5	-1	-
M2	+7	-1	-

Table 3. Temperature classes and corresponding average compartment temperatures (T_c) for RDC-ICF

M-package temperature class	Warmest M-package colder or equal to in all tests except lid opening test [°C]	Warmest M-package maximum temperature rise allowed [K]	T_c [°C]
C1	-18	2	-18.0
C2	-7	2	-7.0

Table 4. Test room climate classes

Climate class	Dry bulb temperature [°C]	Relative humidity [%]	Dew point [°C]	Water vapor mass in dry air [g/kg]
3	25	60	16.7	12.0
4	30	55	20.0	14.8

RDCs with liquid-cooled condensing units shall be tested in accordance with the method described in ISO 23953-2 for remote indirect refrigerating systems. The inlet chilled water flow

temperature shall be set at 20°C. A tolerance of ±1°C shall be allowed for the inlet chilled water flow temperature.

Calculation of energy efficiency index (EEI) and energy consumption

The EEI of a refrigerated cabinet that is covered by this regulation is calculated in accordance with the following formula:

$$EEI = \frac{AEC}{RAEC} \times 100$$

where:

AEC is the equipment's annual energy consumption, expressed in kWh per year, and is calculated in accordance with the relevant standard.

RAEC is the equipment's reference annual energy consumption, expressed in kWh per year, and is calculated in accordance with the relevant standard.

AEC and RAEC are defined in **Table 5**.

Table 5. AEC and RAEC by equipment class

Equipment class	AEC	RAEC
RDC	E_{daily} x 365	(M + (N x TDA)) x 365
RDC-BC	E_{daily} x 365	(M + (N x TDA)) x 365
RDC-SC	E_{daily} x 365	(M + (N x TDA)) x 365
RDC-ICF	E_{daily} x 365	(M + (N x V_N)) x 365
RSC	E_{daily} x 365	(M + (N x V_N) x 365
RVM	E_{weekly} x 52	(M + (N x V_N)) x *af* x 52

where:

Daily energy consumption (E_{daily}) is the energy used by the equipment over 24 hours at reference conditions, expressed in kWh per day.

Weekly energy consumption (E_{weekly}) is the calculated energy consumption per week in kWh.

M and **N** are coefficients that take into account TDA or V_N dependence of the energy use, with values as set out in **Table 6**.

TDA is the total display area of the refrigerated cabinet, in m^2.

V_N is the net volume of the refrigerated cabinet or RVM in L.

af is the adjustment factor for RVM: 1+(12-T_V)/25. The values for T_v are set out in **Table 1**.

The RAEC and AEC calculations shall be rounded off to the nearest kWh per year. If the calculation is halfway between the nearest two kWh per year values, the RAEC and AEC shall be rounded up to the higher of these values.

RDCs that can operate as either air-cooled or liquid-cooled cabinets shall be tested in both air-cooled and liquid-cooled modes. E_{daily} (i.e., total daily energy consumption, TEC, defined in ISO 23953) for these hybrid types of water-loop cabinets shall be calculated as the average of E_{daily} in air-cooled mode and E_{daily} in water-cooled mode.

Table 6. M and N values

Equipment category				Equipment class code	M	N
RDC	Integral	Horizontal	Chiller	RDC-IHC	3.7	3.5
			Freezer	RDC-IHF	4.2	9.8
		Vertical	Chiller	RDC-IVC	9.1	9.1
			Freezer	RDC-IVF	1.6	19.1
	Remote	Horizontal	Chiller	RDC-RHC	3.7	3.5
			Freezer	RDC-RHF	4.2	9.8
		Vertical	Chiller	RDC-RVC	9.1	9.1
			Freezer	RDC-RVF	1.6	19.1
RDC-BC				RDC-BC	0.69	5.97
RDC-SC				RDC-SC	10.4	30.4
RDC-ICF				RDC-ICF	1	0.009
RSC	Integral	Horizontal	Chiller	RSC-IHC	4.9	0.007
			Freezer	RSC-IHF	6.5	0.016
		Vertical	Chiller	RSC-IVC	1.7	0.005
			Freezer	RSC-IVF	4.0	0.014
RVM				RVM	4.1	0.004

3.2 Maximum energy consumption requirements

Energy performance for all refrigeration equipment within the scope of this document shall meet the low-efficiency requirements set out in **Table 7**.[6] For a product to meet a higher efficiency performance grade, it shall meet the levels in **Table 7**.

[6] This applies to products with varying technical characteristics and functionalities. For this reason, energy consumption requirements are set according to the functionality of the equipment. In this functionality approach, a minimum breakdown of product categories is used to bring clear signals to the market about more/less energy-

Table 7. EEI thresholds for refrigerating equipment

Equipment category				Equipment class code	Low efficiency (high EEI)
RDC	Integral	Horizontal	Chiller	RDC-IHC	130
			Freezer	RDC-IHF	130
		Vertical	Chiller	RDC-IVC	130
			Freezer	RDC-IVF	130
	Remote	Horizontal	Chiller	RDC-RHC	130
			Freezer	RDC-RHF	130
		Vertical	Chiller	RDC-RVC	100
			Freezer	RDC-RVF	130
RDC-BC				RDC-BC	100
RDC-SC				RDC-SC	100
RDC-ICF				RDC-ICF	100
RSC	Integral	Horizontal	Chiller	RSC-IHC	95
			Freezer	RSC-IHF	95
		Vertical	Chiller	RSC-IVC	95
			Freezer	RSC-IVF	95
RVM				RVM	100

For commercial refrigeration equipment with two or more compartments, the RAEC for each model shall be the sum of the RAEC values for all of its compartments. For each compartment, measure the TDA or volume of that compartment and determine the appropriate equipment class based on that compartment's equipment family, condensing unit configuration, and designed operating temperature. The RAEC for each compartment shall be the calculated value obtained by entering that compartment's TDA or volume into the equation determined in **Table 5** and **Table 6** for that compartment's equipment class. The EEI limit for each model shall be the lowest value in the set of EEI limits each compartment shall meet.

efficient refrigerating equipment with the same function. Inefficient refrigerating equipment will have difficulties reaching a certain energy labelling class, and it may not meet MEPS.

3.3 Refrigerant and foam-blowing agent[7]

Refrigerants and foam-blowing agents used in refrigerating appliances shall comply with requirements based on their ozone depletion potential (ODP) and GWP over a 100-year time horizon according to the limitations listed in **Table 8**. Refrigerant GWP values refer to those specified in the Intergovernmental Panel on Climate Change's (IPCC's) Fourth Assessment Report on which the GWPs of hydrochlorofluorocarbons (HCFCs) and HFCs listed in Annex C and Annex F of the Montreal Protocol are based. GWP values not included in the IPCC Fourth Assessment Report shall be based on the latest IPCC Assessment Report.

Table 8. Requirements for refrigerant and foam-blowing agent characteristics (numbers shown are upper limits)

Equipment class	GWP	ODP
All types	150	0

3.4 Safety requirements

Refrigerating equipment shall comply with:

a) IEC 60335-2-89: 2019 for RDCs and RSCs, and
b) IEC 60335-2-75: 2012/AMD2: 2018 for RVMs.

or subsequent revisions, or nationally modified editions of the above standards.

3.5 Product information

A label shall be affixed on the product in a location that is readily visible for the consumer. The label shall indicate:

a) type of equipment,
b) model number,
c) family model name,
d) country where the product was manufactured,
e) name and address of the manufacturer,
f) name and address of the supplier,
g) size of product (V_N or TDA),
h) rated energy performance in EEI,

[7] Countries may wish to vary the date by which these requirements come into effect based on the availability and cost of viable refrigerant gases, which may not coincide with the availability and cost of meeting the energy-efficiency requirements.

i) energy-efficiency class (in accordance with local labelling requirements),
j) yearly energy consumption in kWh, and
k) refrigerant and foam-blowing agent designation in accordance with ISO 817 or ASHRAE 34, including ODP and GWP.

All representations of energy performance shall indicate that the performance rating is an indicative value, and not representative of actual annual energy consumption in all situations.

Instruction manuals for installers and end users as well as free-access websites of manufacturers, importers, and authorized representatives shall include:

a) the recommended setting of temperatures in each compartment for optimum food preservation,
b) an estimation of the impact of temperature settings on food waste,
c) for RDC-ICFs, the statement, "This appliance is intended to operate in climates where the temperature and the humidity ranges from [fill in the applicable minimum temperature] to [fill in the applicable maximum temperature] and from [fill in the applicable minimum relative humidity] to [fill in the applicable maximum relative humidity], respectively,"
d) instructions for the correct installation and end-user maintenance, including cleaning, of the refrigerating equipment,
e) for integral cabinets, the statement, "If the condenser coil is not cleaned [the recommended frequency for cleaning the condenser coil, expressed in times per year], the efficiency of the equipment will decrease significantly,"
f) access to professional repair such as internet webpages, addresses, contact details,
g) relevant information for ordering spare parts, directly or through other channels provided by the manufacturer, importer, or authorized representative such as internet webpages, addresses, contact details,
h) the minimum period during which spare parts, necessary for the repair of the refrigerating appliance, are available,
i) the minimum duration of the guarantee of the refrigerating appliance offered by the manufacturer, importer, or authorized representative, and
j) instructions on how to find the model information in the product database, as set out in [national standard title], by means of a weblink that links the model information as stored in the product database or a link to the product database and information on how to find the model identifier on the product.

Technicians who service the equipment must be certified as [technician type] or earn [certification type] under [national regulation].

Article 4. Entry into Force

This regulation shall enter into force no earlier than [date] and at least [six months / 1 year] after adoption.

Article 5. Declaration of Conformity

Compliance with the requirements of Article 3 and any additional optional claims shall be demonstrated in the conformity assessment report (CAR), which:

a) demonstrates that the product model fulfils the requirements of this regulation,
b) provides any other information required to be present in the technical documentation file, and
c) specifies the reference setting and conditions in which the product complies with this regulation.

The CAR shall be submitted to [agency name] for review prior to making the product available for sale. If the CAR for the designated model is approved, which is confirmed by written correspondence from [agency name][8] and listing of the product on any applicable [product registration system], the model may be sold in the market. If the CAR is rejected, a written explanation will be provided to the submitter. All aspects identified in the written explanation shall be addressed in a revised CAR. Until the CAR is approved, the product is ineligible for sale in the market. The CAR is valid for the designated model for 24 months. An updated CAR or a notice of withdrawal shall be submitted to [agency name] at least 90 days prior to the change in specifications of or cancelation of production of the currently certified product.

Article 6. Market Surveillance

The designated authority implementing this regulation shall develop a program to check compliance with this standard and surveil the market for noncompliance. The program should include details on sample size, lab accreditation requirements (ISO/IEC 17025 certified), and a challenge process that manufacturers can utilize if their product is found to be out of compliance upon initial testing.[9]

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[8] Responsibilities are often split across various agencies, so list whichever are appropriate for each step.

[9] For further guidance on how to develop and implement compliance certification, market surveillance, and enforcement programs, refer to the U4E policy guide, *Ensuring Compliance with MEPS and Energy Labels* (https://united4efficiency.org/wp-content/uploads/2021/01/U4E-Compliance-Guidance-20210115.pdf). Additional stipulations regarding such protocols are often included in MEPS and labelling legislation as well as policy documents. However, given the variance in approaches based on national context, a specific example is not provided here.

[Agency name][10] will be responsible for enforcement activities that include potential assessment of penalties for noncompliant products in the country. [Agency name] shall establish written policies that clearly spell out its authority, procedures, and penalties. All testing done for compliance and market surveillance purposes shall be done using the measurement and calculation methods set out in this regulation.

For market surveillance purposes, manufacturers should be allowed to refer to the product database if the technical documentation as per [national standard title] contains the same information. The designated authority shall apply the verification tolerances that are set out in **Table 9**.

Table 9. Verification tolerances

Parameters	Verification tolerances
V_N, and net compartment volume where applicable	The determined value shall not be more than 3% or 1 L lower—whichever is the greater value—than the declared value.
TDA, and compartment TDA where applicable	The determined value shall not be more than 3% lower than the declared value.
E_{daily}	The determined value shall not be more than 10% higher than the declared value.
AEC	The determined value shall not be more than 10% higher than the declared value.

Article 7. Revision

This regulation shall be strengthened by an administrative rulemaking based on an updated market assessment conducted on the cost and availability of new technologies once every five years after this regulation enters into force. A review of this regulation should assess the appropriateness and effectiveness of its provisions in achieving [Agency's] goals. The timing of the review should allow for all provisions to be implemented.

[10] Responsibilities are often split across various agencies, so list whichever are appropriate for each step.

Annex 1. Performance Grade Requirements

Labels indicating achievement of a higher performance grade may be applied to units that meet the levels specified in Article 3 during testing for compliance with the Article 3 requirements. **Table 9** shows possible thresholds of labelling requirements or more ambitious minimum efficiency requirements.

Table 10. EEI thresholds for refrigerating equipment

Equipment category				Equipment class code	Low efficiency (high EEI)	Intermediate efficiency (intermediate EEI)	High efficiency (low EEI)
RDC	Integral	Horizontal	Chiller	RDC-IHC	130	90	50
			Freezer	RDC-IHF	130	90	50
		Vertical	Chiller	RDC-IVC	130	90	50
			Freezer	RDC-IVF	130	90	50
	Remote	Horizontal	Chiller	RDC-RHC	130	90	50
			Freezer	RDC-RHF	130	90	50
		Vertical	Chiller	RDC-RVC	100	75	50
			Freezer	RDC-RVF	130	90	50
RDC-BC				RDC-BC	100	70	40
RDC-SC				RDC-SC	100	70	50
RDC-ICF				RDC-ICF	100	70	50
RSC	Integral	Horizontal	Chiller	RSC-IHC	95	60	35
			Freezer	RSC-IHF	95	70	50
		Vertical	Chiller	RSC-IVC	95	70	50
			Freezer	RSC-IVF	95	70	50
RVM				RVM	100	70	50

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