



RS 14/C/001-2017

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**EUROVENT RATING STANDARD
for the
CERTIFICATION
of
REMOTE
REFRIGERATED DISPLAY CABINETS**

RS 14/C/001-2017

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No.	Modifications	Section	Page
1	Update of the ISO 23953 Standard version	All document	
2	Particular specifications for testing	IV.2	9
3	Clarification note for the comparison between laboratory and in-store conditions	V	11

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I. PURPOSE

The purpose of this Rating Standard is to establish definitions and specifications for testing and rating of Remote Refrigerated Display Cabinets for the related Eurovent Certita Certification Programme, in accordance with Eurovent Certita Certification Operational Manual OM-7.

II. SCOPE

This programme concerns 100 pre-defined categories of Remote Refrigerated Display Cabinets (RRDC), as specified in Table 1 of OM-7.

III. DEFINITIONS

Table 1: Classification for product families (See Annex A of EN ISO 23953-1:2015 - Informative)

Application	Positive Temperature		Negative Temperature	
To be used for	Chilled foodstuffs		Frozen, quick frozen foodstuffs and ice cream	
Horizontal	Chilled, serve-over counter open service access	HC1	Frozen, serve-over counter open service access	HF1
	Chilled, serve-over counter with integrated storage open service access	HC2		
	Chilled, open, wall site	HC3	Frozen, open, wall site	HF3
	Chilled, open, island	HC4	Frozen, open, island	HF4
	Chilled, glass lid, wall site	HC5	Frozen, glass lid, wall site	HF5
	Chilled, glass lid, island	HC6	Frozen, glass lid, island	HF6
	Chilled, serve-over counter closed service access	HC7	Frozen, serve-over counter closed service access	HF7
	Chilled, serve-over counter with integrated storage closed service access	HC8		
Vertical	Chilled, semi-vertical	VC1	Frozen, semi-vertical	VF1
	Chilled, multi-deck	VC2	Frozen, multi-deck	VF2
	Chilled, roll-in	VC3		
	Chilled, glass door	VC4	Frozen, glass door	VF4
Combined	Chilled, open top, open bottom	YC1	Frozen, open top, open bottom	YF1
	Chilled, open top, glass lid bottom	YC2	Frozen, open top, glass lid bottom	YF2
	Chilled, glass door top, open bottom	YC3	Frozen, glass door top, open bottom	YF3
	Chilled, glass door top, glass lid bottom	YC4	Frozen, glass door top, glass lid bottom	YF4
	Multi-temperature, open top, open bottom			YM5
	Multi-temperature, open top, glass lid bottom			YM6
	Multi-temperature, glass door top, open bottom			YM7
	Multi-temperature, glass door top, glass lid bottom			YM8
Codification:				
R = Remote condensing unit		V = Vertical (see 3.1.1.2)		
I = Incorporated condensing unit		Y = Combined (see 3.1.1.11, 3.1.1.12 and 3.1.1.13)		
A = Assisted service (see 3.1.1.6)		C = Chilled		
S = Self service (see 3.1.1.7)		F = Frozen		
H = Horizontal (see 3.1.1.4)		M = Multi-temperature		
EXAMPLE: The general classification can be used as follows:			HC1, VF1, YM5, ...	
When necessary, the classification can be more precise as follows:			RHC1A, IVF1S ...	

Note: Serve over counters are primarily in assisted service but may be in self service Chilled multi-deck cabinets are primarily in self service but may also be in assisted service

Refrigerated Display Cabinet (RDC): Cabinet cooled by a refrigerating system which enables chilled and frozen foodstuff placed therein for display to be maintained within prescribed temperature limits.

Remote Refrigerated Display Cabinet (RRDC): Refrigerated Display Cabinet connected to a remote refrigerating unit.

Product family: Group of cabinets in accordance with the standard terminology (see *EN ISO 23953-1:2015 Annex A*, also Table 1 above).

Internal fitting type:

- HNLS: Horizontal Non Lighted Shelves & HLS: Horizontal Lighted Shelves
- TNLS: Tilted Non Lighted Shelves & TLS: Tilted Lighted Shelves
- MNLS: Mirror and tilted Non Lighted Shelves (available for vertical only)
- MLS: Mirror and tilted Lighted Shelves (available for vertical only)
- HNL: Horizontal Non Lighted
- HL: Horizontal Lighted

M-package temperature class: Classification in test room climate class 3: 3H2, 3H1, 3M2, 3M0, 3M, 3M1, 3L3, 3L2, 3L1 according to Table 1 of *EN ISO 23953-2:2015*. For cabinets with night covers and lighting the M-package temperature class is only based on the second test part b) of *EN ISO 23953-2:2015 chapter 5.3.2.7* with 12 hours day and 12 hours night.

Table 2: Temperature classes

Class		L1	L2	L3	M0	M*	M1	M2	H1	H2
The lowest temperature θ_b of the coldest M-package equal to or higher than	[°C]	-	-	-	-1	-1	-1	-1	1	-1
The highest temperature θ_{ah} of the warmest M-package equal to or lower than	[°C]	-15	-12	-12	4	6	5	7	10	10
The lowest temperature θ_{al} of the warmest M-package equal to or lower than	[°C]	-18	-18	-15			-	-		-

* Applicants/participants are not allowed to declare 3M cabinets expected further to a rerating of a 3M1 cabinet

Average Heat Extraction Rate ($\Phi_{24\text{-deft}}$ or HER_{avg}) [kW/24h]: According to *EN ISO 23953-2:2015 chapter 5.3.6.3.2*, with a measurement interval of 20s according to *EN ISO 23953-2:2015*

Evaporating temperature (θ_{mrun} or Evap T) [°C]: According *EN ISO 23953-2:2015 chapter 5.3.6.3*.

Refrigeration Electrical energy Consumption (REC) [kWh/24h]: According to *EN ISO 23953-2:2015 chapter 5.3.6.3*, calculated with the following formula:

$$REC_{RC} = (24 - t_{\text{deft}}) \times \Phi_{24\text{-deft}} \times \frac{T_c - T_{mrun}}{0.34 \times T_{mrun}}$$

rounding all terms in the formula to the second decimal. Example:

- $t_{\text{deft}} = 3.266$; rounded to: 3.27
 - $\Phi_{24\text{-deft}} = 3.325$; rounded to: 3.33
 - $T_c = 308.18$
 - $T_{mrun} = -11.4^\circ\text{C} = 261.78\text{K}$
- $\Rightarrow REC_{RC} = 35.28 \text{ kWh/24h}$

Direct Electrical Energy Consumption (DEC) with 12h lighting [kWh/24h]: According to *EN ISO 23953-2:2015 chapter 5.3.5*.

TEC [kWh/day]: for remote cabinets, TEC is the sum of REC and DEC ($TEC_{remote} = REC + DEC$) rounding all terms in the formula to the second decimal.




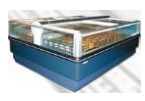

Total Display Area (TDA) [m2]: According to *EN ISO 23953-2:2015 Annex A* rounding all terms in the formula to the second decimal.

Energy Efficiency Index EEI [-]: Efficiency according to the following equation:

$$EEI = \frac{\left(\frac{TEC}{TDA} \right)_{measured}}{\left(\frac{TEC}{TDA} \right)_{reference}} \times 100$$

with the following reference figures:

Table 3: Reference values for definition of Energy Efficiency Index (update: 27/09/2016)

Type of cabinet	Application: ISO Temperature class	Reference value for (TEC/TDA)	
	RVC1, RVC2	3H	10.1
		3M2	12.3
		3M1 /3M	13.4
		3M0	14.5
	RVC3	3H	13.8
		3M2	16.0
RVF1	3L3	29.0	
	RVF4	3L1	28.5
	RVC4	3H	6.1
		3M2	7.4
		3M1 /3M	8.0
3M0		8.7	
	RHC1	3H	6.2
		3M2	6.7
		3M1 /3M	7.2
	RHF1	3L3	21.0
	RHC3, RHC4	3H	5.5
		3M2	5.8
3M1 /3M		6.2	
	RHF3, RHF4	3L1	15.0
		3L2	14.0
		3L3	13.0
	RHC5, RHC6	3H	4.3
		3M2	4.7
		3M1 /3M	5.0
	RHF5, RHF6	3L1	12.0
		3L2	11.2
		3L3	10.4
	RYF3	3L2	30.0
		3L3	29.0
	RYF4	3L2	28.5
3L3		27.6	

Energy Efficiency Classification [-]: Energy efficiency class according to the following table:

Table 4: Energy efficiency classification for Remote Refrigerated Display Cabinets

Energy Efficiency Index EEI	Energy efficiency class Class (EEI)
<40	A+
$40 \leq EEI < 50$	A
$50 \leq EEI < 53,5$	B
$53,5 \leq EEI < 60$	C
$60 \leq EEI < 90$	D
> 90	E

IV. TESTING REQUIREMENTS

IV.1 Test standard

Verification of performance characteristics shall be carried out in accordance with the European Standard *EN ISO 23953-1/2:2015*:

Table 5: Testing requirements

<i>EN ISO 23953-1:2015</i>	<i>Terms and definitions</i>
<i>EN ISO 23953-2:2015</i>	<i>Classification, requirements and test conditions</i>

- 1) The laboratory will check on receipt of the cabinet the content of the marking plate and the definition of the cabinet to verify that physical data are in accordance with the specifications given by Eurovent Certita Certification for this cabinet. If the marking plate or the definition of the cabinet is not in accordance with the specifications, the laboratory shall contact Eurovent Certita Certification.
- 2) The laboratory will perform tests according to *EN ISO 23953-1/2:2015*:
 - All tests have to be performed according to the general test conditions and procedures defined *EN ISO 23953-1/2:2015 chapters 5.3.1 and 5.3.2*. The tolerance on power supply shall apply *EN ISO 23953-1/2:2015 chapter 5.3.2.10* in relation to the nominal values which are given on the marking plate (230 V).
 - The results of the yearly check of the empty test room according to *EN ISO 23953-1/2:2015 5.3.1.2* must be sent to Eurovent Certita Certification.
 - When necessary (see *EN ISO 23953-1/2:2015 chapter 5.3.2.1*) a vertical partition wall according *EN ISO 23953-1/2:2015 chapter 5.3.1.3.2* shall be mounted and the cabinet shall be loaded taking into account if the cabinet is intended or not for sensitive foodstuffs. A loading cross section (as *5.3.2.3.2 of the EN ISO 23953-2:2015 Standard*) could be proposed by the manufacturer and should be followed by the laboratory if it is in accordance with *EN ISO 23953-1/2:2015 chapter 5.3.2.3* and if not, shall be submitted to Eurovent Certita Certification for decision.

- Only the second test concerning lighting and night covers (*EN ISO 23953-1/2:2015 chapter 5.3.2.7*) will be performed to represent 12 hours day and 12 hours night. This means that in 5.3.2.7), the two § (a) are not considered, only (b).
 - On models with lights, all lights must be lit.
 - Chilled serve over counters with integrated storage closed service access must be tested with the storage unloaded; without any temperature check within this volume.
 - All islands with air discharge in the middle and closed cabinets must be tested following *EN ISO 23953-1/2:2015*. Doors that are used for service, cleaning or loading of the cabinet only shall not be opened during the test of closed cabinets.
 - Roll-in cabinets must be loaded for test according *EN ISO 23953-1/2:2015* and the following specifications: If not otherwise stated in the manufacturer's manual or marked inside the cabinet, the packages and the wood shall be loaded on standard europallets (1200 x 800 x 144 mm) or if not applicable on a similar tray of the same height. The surface of the pallet should be covered by a sheet of plastic or carton so that the packages can be loaded properly. Metallic grids can be used to support the test package loading on M-package rows and the adjacent ones.
 - Temperature test according to *EN ISO 23953-1/2:2015 chapter 5.3.3*, but without defrost check (§ 5.3.3.3).
 - Water vapour condensation test according to *EN ISO 23953-1/2:2015 chapter 5.3.4*, but it shall only be reported and additionally documented by photographs if there is "R" zone = running water.
 - Electrical energy consumption test according to *EN ISO 23953-1/2:2015 chapter 5.3.5*.
 - Heat extraction rate measurement according to *EN ISO 23953-1/2:2015 chapter 5.3.6*. Additionally, HER shall be provided separately for 12h at day and for 12h at night.
 - Before applying *EN ISO 23953-1/2:2015 chapter 5.3.2.7.2 b)* concerning lighting and night covers, stable conditions have to be reached with night cover ON, as defined in 5.3.2.5 (*EN ISO 23953-1/2:2015*). In addition, for open frozen cabinets fitted with lighting and night covers, stable conditions are reached with the cabinet continuously closed with light switch on continuously.
 - *The laboratory shall measure independently the consumption of the evaporation fan and the secondary (air curtain) fan.*
 - *When measuring DEC, the laboratory shall evaluate separately electrical box, controller, electronic expansion valve and night blind motor.*
- 3) The laboratory will check all dimensional characteristics specified in the *declaration list with* admitted tolerances and all components fitted in the cabinet as described in *declaration list* (see Appendix of the OM)
- 4) The laboratory will send the test report to Eurovent Certita Certification within four weeks after completion of test.
- 5) The laboratory will preserve all measurement data obtained with the data acquisition system (temperatures, pressures, flow etc.) for at least one year after completion of the test and provide them to the participant.

Running water is not accepted in the cabinet due to safety reasons. A decision on failure will be taken by Eurovent Certita Certification in accordance with the Compliance Committee.

IV.2 Particular specifications for testing

The tests shall be performed with CO₂ (R744). It is considered that testing with this refrigerant is representative of the refrigerated display cabinets market. The goal of a reference refrigerant is to ensure the comparability of test results between certified cabinets.

Note : For the 2017 campaign, the first round will be performed with R404A refrigerant and the second round with R744.

The horizontal air velocity during the test shall lie between 0,12 and 0,15 m/s during the test.

An external electrical component can be provided for testing in order to control the suction pressure according to declared value.

The component is not described in the declaration file because is an element that could be installed in the field in a line of many cabinets to adjust different levels of pressure among cabinets.

V. RATING REQUIREMENTS

In order to rate cabinets with options, the following approximations shall be used:

We always refer to class 3.

Electrical defrost for chilled cabinets:

$$DEC_{total} \approx DEC_{declared} + DEC_{defrost}$$

where $DEC_{defrost} = 1/2$ time the natural defrost x heat input from electrical defrost heater

The natural defrost time can be available on the technical documentation, otherwise it can be found on the lab reports of the cabinet.

$$REC_{total} \approx REC_{declared}$$

Additonal lighting inside the cabinet (ex: shelves):

$$DEC_{total} \approx DEC_{declared} + DEC_{extra \text{ inside light}} \text{ where } DEC_{extra \text{ inside light}} = 12h \times P_{lamp} \times nb \text{ of lamps}$$

$$REC_{total} \approx REC_{declared} + DEC_{extra \text{ inside light}}$$

P_{lamp} does include the ballast or the transformer.

Alternative lighting inside the cabinet (ex: shelves):

$$DEC_{total} \approx DEC_{declared} + DEC_{alternative \text{ inside light}} \text{ where } DEC_{alternative \text{ inside light}} = 12h \times (P_{alternative \text{ lamp}} - P_{declared \text{ lamp}}) \times nb \text{ of lamps}$$

$$REC_{total} \approx REC_{declared} + DEC_{alternative \text{ inside light}}$$

Additional lighting outside the cabinet (ex: canopy):

$$DEC_{total} \approx DEC_{declared} + DEC_{extra \text{ outside light}} \text{ where } DEC_{extra \text{ light}} = 12h \times P_{additional \text{ lamp}} \times nb \text{ of additional lamps}$$

$$REC_{total} \approx REC_{declared}$$

Alternative lighting outside the cabinet (ex: canopy):

$DEC_{total} \approx DEC_{declared} + DEC_{alternative\ outside\ light}$ where $DEC_{alternative\ outside\ light} = 12h \times (P_{alternative\ lamp} - P_{declared\ lamp}) \times nb\ of\ lamps$

$REC_{total} \approx REC_{declared}$

Cabinets without night blind:

$DEC_{total} \approx DEC_{declared}$

$REC_{total} \approx 2 \times REC_{with\ no\ night\ blind\ 12h}$

Internal fitting:

For internal fittings of open cabinets: $G/400 - 1 < \text{Number of shelves} < G/200 - 1$:

$DEC_{total} \approx DEC_{declared}$

$REC_{total} \approx REC_{declared}$

G is the display opening [mm].

It will be necessary to declare the open cabinet if the internal fitting is not compliant with the rule above. The cabinets cannot be declared without shelf.

Regarding closed cabinets, number of shelves is free.

Shelves depth, mirror, tilted shelves, full loading or 100mm do not influence our calculation of DEC and REC.

Fan option:

$DEC_{total} \approx DEC_{declared} + (Power\ input_{alternative\ fan} - Power\ input_{declared\ fan}) \times \text{running time of the fan}$

$REC_{total} \approx REC_{declared}$

Additional anti-condensation heater:

$DEC_{total} \approx DEC_{declared} + DEC_{anticondensdation}$ where $DEC_{anticondensdation} = P_{anticondensdation} \times \text{running time}$

$REC_{total} \approx REC_{declared}$

The anti-condensation running time can be available on the technical documentation, otherwise it can be found on the lab reports of the cabinet.

Alternative anti-condensation heater:

$DEC_{total} \approx DEC_{declared} + DEC_{anticondensdation}$ where $DEC_{anticondensdation} = (P_{anticondensdation\ optional} - P_{declared\ anticondensdation}) \times \text{running time}$

$REC_{total} \approx REC_{declared}$

Electrical box, controller, electronic expansion valve, night blind motor:

$DEC_{total} \approx DEC_{declared}$

$REC_{total} \approx REC_{declared}$

When published on the Eurovent Certita Certification website and in Participant documentation, characteristics shall be displayed in store conditions. Performances (Evaporating temperature and Heat Extraction Rate) in store conditions have to be equal to performances in laboratory conditions (as declared) corrected by a coefficient function of the temperature (T). Correction is detailed below, where α and β are given in Table 6:

VI. CERTIFIED CHARACTERISTICS AND PERFORMANCE

The dimensional characteristics and performance items (see Table 7) shall be certified, in addition to warmest product temperature and performance under store conditions.

In table below, D means Declared only, D&P means Declared and Published, C&P means Calculated by Eurovent Certita Certification and Published

Table 7: Certified ratings (update 30 Dec. 2012)

		R/O	R/WD	R/I	R/CF	R/SC	
General	Height	V/m ²	D&P	D&P		D&P	
	Width	mm	D&P	D&P			
	Front height	mm	D&P				
	Top width	mm	D&P				
	Front glass height	mm			D&P	D&P	
	Ext width	mm			D&P		
	Loading depth	mm			D&P		
	Display width	mm				D&P	
	Lid				D&P	D&P	
	Light (true or false)			D	D		D&P
	Structure						D&P
	Internal storage						D&P
	TDA	m ²	D&P	D&P	D&P	D&P	D&P
	Cross-section	Display width type	mm				C&P
		Ext width type	mm			C&P	
Front height type		mm	C&P				
Frozen or chilled				D&P	D&P	D&P	
Height type		mm	C&P	C&P		C&P	
Top width type		mm	C&P				
Laboratory conditions	Width type	mm	C&P	C&P			
	ISO T class		D&P	D&P	D&P	D&P	
	DEC	kWh/day	D&P	D&P	D&P	D&P	
	REC	kWh/day	D&P	D&P	D&P	D&P	
	TEC	kWh/day	D&P	D&P	D&P	D&P	
	Efficiency (lab)	%	C&P	C&P	C&P	C&P	
	Energy efficiency class		C&P	C&P	C&P	C&P	
	Efficiency reference		D&P	D&P	D&P	D&P	
Bill of material	Energy efficiency Index		D&P	D&P	D&P	D&P	
	DimA	mm	D&P	D&P	D&P	D&P	
	DimB	mm	D&P	D&P	D&P	D&P	
	DimC	mm	D&P	D&P	D&P	D&P	
	DimD	mm		D&P	D&P	D&P	
	DimE	mm	C&P	D&P		D&P	
	DimF	mm		D&P			
	DimG	mm	D&P				
	DimH	mm	D&P			D&P	
	DimI	mm				D&P	
	DimJ	mm				D&P	
	Refrigerant		D&P	D&P	D&P	D&P	
	Lighting type		D&P	D&P	D&P	D&P	
	Glass door type		D&P	D&P	D&P	D&P	
Fan type		D&P	D&P	D&P	D&P		
Length	mm	D&P	D&P	D&P	D&P		
ISO family		D&P	D&P	D&P	D&P		

VII. TOLERANCES

When tested in the independent laboratory, the obtained results shall not differ from the claimed values by more than:

- Warmest product temperature (laboratory conditions) + 0.5 °C
- Coldest (chilled) product temperature (laboratory conditions) - 0.5 °C
- Heat extraction (laboratory conditions) [kWh/24h] + 10 %
- Evaporating temperature (laboratory conditions) - 1 °C
- DEC [kWh/24h] + 5 %
- REC [kWh/24h] + 10 %
- TEC [kWh/24h] + 10 %
- TDA [m²] - 3 %
- Energy Efficiency Index EEI (laboratory condition) *failed if TEC is failed*

The measured M-package temperature class shall equal to or inside the claimed class (see Table 2), with a tolerance of: +/- 0.5 °C

The relevant tolerances on dimensional characteristics for the audit procedure are available in the example of *declaration file* presented in OM-7.