



RS 14/C/001-2015

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

RS 14/C/001-2015

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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 23953-2:2005(E) - Informative)

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

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

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 23953-1:2005(E) 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, 3M1, 3L3, 3L2, 3L1 according to Table 1 of EN ISO 23953-2:2005(E) and 3M0 (-1°C; +4°C). For cabinets with night covers and lighting the M-package temperature class is only based on the second test part b) of EN ISO 23953-2:2005(E) chapter 5.3.2.7 with 12 hours day and 12 hours night.

Table 2: Temperature classes

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

Average Heat Extraction Rate ($\Phi_{24\text{-deft}}$ or HER_{avg}) [kW/24h]: According to EN ISO 23953-2:2005(E) chapter 5.3.6.3, with a measurement interval of 20s according to EN ISO 23953-2:2005 (E)

Evaporating temperature (θ_{mrun} or Evap T) [°C]: According EN ISO 23953-2:2005(E) chapter 5.3.6.3.

Refrigeration Electrical energy Consumption (REC) [kWh/24h]: According to EN ISO 23953-2:2005(E) chapter 5.3.6, calculated with the following formula:

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

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

- $t_{deft} = 3.266$; 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 23953-2:2005(E) 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 23953-2:2005(E) 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: 25/02/2011)

Type of cabinet	Application: ISO Temperature class	Reference value for (TEC/TDA)		
	3H	10.1		
		3M2	12.3	
		3M1	13.4	
		3M0	14.5	
	RVC3	3H	13.8	
		3M2	16.0	
RVF1	3L3	29.0		
	3L1	28.5		
	RVC4	3H	6.1	
		3M2	7.4	
		3M1	8.0	
3M0		8.7		
	3H	6.2		
		3M2	6.7	
		3M1	7.2	
	RHF1	3L3	21.0	
	RHC3, RHC4	3H	5.5	
		3M2	5.8	
3M1		6.2		
	3L1	15.0		
		RHF3, RHF4	3L2	14.0
			3L3	13.0
	RHC5, RHC6	3H	4.3	
		3M2	4.7	
		3M1	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)
<55	A
55 ≤ EEI < 75	B
75 ≤ EEI < 90	C
90 ≤ EEI < 100	D
100 ≤ EEI < 110	E
110 ≤ EEI < 125	F
125 ≤ EEI	G

IV. TESTING REQUIREMENTS

Verification of performance characteristics shall be carried out in accordance with the European Standard EN ISO 23953-1/2:2005(E) and its amendments:

Table 5: Testing requirements

EN ISO 23953-1:2005(E)	Terms and definitions
EN ISO 23953-2:2005 (E)	Classification, requirements and test conditions
EN ISO 23953-1:2005/AMD1:2012	Terms and definitions - Amendment 1
EN ISO 23953-2:2005/AMD1:2012	Classification, requirements and test conditions - Amendment 1
CEN TC44/WG1 N.91	
CEN TC44/WG1 N.92 excluding clause 5.3.1.6 “Alternative for filling test packages	

- 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 23953-1/2:2005(E) + *Amd1:2012*:
 - All tests have to be performed according to the general test conditions and procedures defined EN ISO 23953-2:2005(E) chapters 5.3.1 and 5.3.2. The tolerance on power supply shall apply EN ISO 23953-2:2005(E) 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 23953-2:2005(E) chapter 5.3.1.2 must be sent to Eurovent Certita Certification.
 - When necessary (see EN ISO 23953-2:2005(E) chapter 5.3.2.1) a vertical partition wall according EN ISO 23953-2:2005(E) 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 in Annex 2)

could be proposed by the manufacturer and should be followed by the laboratory if it is in accordance with EN ISO 23953-2:2005(E) chapter 5.3.2.3 and if not, shall be submitted to Eurovent Certita Certification for decision.

- For the TDA calculation, the following Tg values for glazed surfaces without coating should be used, even if the glass is coated (Table 6).

Table 6: Values for glazed surfaces

Type of glazed surface	Tg
single anti-reflection glass	98 %
single glass (with and without coating): or methacrylate	90 %
double glass or two single glasses or methacrylates (with and without coating)	81 %
triple glass or methacrylate (with and without coating)	73 %
<i>Each additional glass</i>	<i>X 0.9</i>

- Only the second test concerning lighting and night covers (EN ISO 23953-2:2005(E) 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 ISO 23953-2:2005/AMD 1. 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 ISO 23953-2:2005/AMD 1 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 23953-2:2005(E) chapter 5.3.3, but without defrost check (§ 5.3.3.3).
- Water vapour condensation test according to EN ISO 23953-2:2005(E) 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 23953-2:2005(E) chapter 5.3.5.
- Heat extraction rate measurement according to EN ISO 23953-2:2005(E) chapter 5.3.6. Additionally, HER shall be provided separately for 12h at day and for 12h at night.
- Before applying EN ISO 23953-2:2005(E) chapter 5.3.2.7.b) concerning lighting and night covers, stable conditions have to be reached with night cover ON, as defined in 5.3.2.5 and its amendments (ISO 23953-2:2005/AMD1). 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 High Level Bill of Materials with admitted tolerances and all components fitted in the cabinet as described in BOM (see Appendix of the OM)
- 4) The laboratory will send the test report simultaneously to the manufacturer and 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.

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.

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

Additional 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):

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

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

Alternative lighting outside the cabinet (ex: canopy):

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

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

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:

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

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

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:

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

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

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 7:

$$\text{Evap}T_{\text{storecond}}(T) = \text{Evap}T_{\text{labcond}} + \alpha(T) ; \text{HER}_{\text{storecond}}(T) = \text{HER}_{\text{labcond}} \times \beta(T)$$

Temperature is given on the Eurovent Certita Certification website between Tmin and Tmax with steps of 1°C.

Table 7: Correction coefficients from laboratory to store conditions

23/04/2010

	ISO Temperature Class	Max. Product Temperature	Coefficient to be added to Evaporation temperature			Coefficient to be added to Heat Extraction Rate			
			Evaporation temperature	Heat Extraction Rate	Evaporation temperature	Heat Extraction Rate	Evaporation temperature	Heat Extraction Rate	
		DAY			NIGHT			DAY & NIGHT	
Semi-vertical vertical WITH doors (Category 1)	3M0	4					0	0,950	
	3M1	5					0	0,950	
	3M2	7					0	0,950	
	3H	10					0	0,950	
	3L1	-18					1,0	0,950	
	3L1	-15					2,0	0,925	
	3L2	-18					0,0	0,975	
	3L2	-15					1,0	0,950	
	3L3	-15					0,0	0,975	
Multideckers semi-vertical OPEN (Category 2)	3M0	2	0,0	0,900	0,0	1,000			
	3M0	3	0,5	0,850	0,5	0,988			
	3M0	4	1,0	0,800	1,0	0,975			
	3M1	3	0,5	0,900	0,5	1,000			
	3M1	4	1,0	0,850	1,0	0,975			
	3M1	5	1,5	0,800	1,5	0,950			
	3M2	5	1,5	0,800	1,5	0,950			
	3M2	6	2,0	0,750	2,0	0,925			
	3M2	7	2,5	0,700	2,5	0,900			
	3H	7	1,0	0,850	1,0	0,975			
	3H	8	1,5	0,800	1,5	0,950			
	3H	9	2,0	0,750	2,0	0,925			
3H	10	2,5	0,700	2,5	0,900				
Islands (Category 3) & Service Counters (Category 4)	3M0	2	0,0	1,000	0,0	1,000			
	3M0	3	0,5	0,950	0,5	0,988			
	3M0	4	1,0	0,900	1,0	0,975			
	3M1	3	0,0	1,000	0,0	1,000			
	3M1	4	0,5	0,950	0,5	0,975			
	3M1	5	1,0	0,900	1,0	0,950			
	3M2	5	1,0	0,950	0,5	1,000			
	3M2	6	1,5	0,900	1,0	0,975			
	3M2	7	2,0	0,850	1,5	0,950			
	3H	7	0,5	0,950	0,5	1,000			
	3H	8	1,0	0,900	1,0	0,975			
	3H	9	1,5	0,850	1,5	0,950			
	3H	10	2,0	0,800	2,0	0,925			
	3L1	-18	1,0	0,950	1,0	0,975			
	3L1	-15	2,0	0,900	2,0	0,950			
3L2	-18	0,0	1,000	0,0	1,000				
3L2	-15	1,0	0,950	1,0	0,975				
3L3	-15	0,0	1,000	0,0	1,000				
Combi Freezers (Category 5)	3L1	-18					1,0	0,950	
	3L1	-15					2,0	0,925	
	3L2	-18					0,0	0,975	
	3L2	-15					1,0	0,950	
	3L3	-15					0,0	0,975	

VI. CERTIFIED CHARACTERISTICS AND PERFORMANCE

The dimensional characteristics and performance items (see Table 8) 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 8: Certified ratings (update 30 Dec. 2012)

		R/O	R/WD	R/I	R/CF	R/SC
General	Height	W/m ²	D&P	D&P		
	Width	mm	D&P	D&P		
	Front height	mm				
	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
	Cross-section	Display width type	mm			
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			
Width type		mm	C&P	C&P		
Laboratory conditions	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
	Energy efficiency index		D&P	D&P	D&P	D&P
Bill of material	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 Bill of Material present in OM-7.