Test Report

Report number:
300-KLAB-YY-XXX

DANISH TECHNOLOGICAL INSTITUTE

Brand & model

Tested according to EN 23953-2:2015

Date

Energy & Climate
Refrigeration & Heat Pump Technology

Test Report

Report number:
300-KLAB-YY-XXX

DANISH TECHNOLOGICAL INSTITUTE

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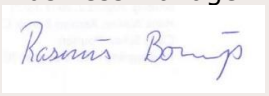
Customer:	Company: Address: City: Tel.: Contact person:
Component:	Brand: Type: Model:
Dates:	Delivered: DD-MM-YY Tested: DD-MM-YY – DD-MM-YY
Procedure:	See Chapter 4
Remarks:	The unit is selected and supplied by the customer.
Terms:	This analysis/test was conducted accredited in accordance with international requirements ISO/IEC 17025:2017 and in accordance with the General Terms and Conditions of Danish Technological Institute. The test results solely apply to the tested item. This analysis report/ test report may be quoted in extract only if Danish Technological Institute has granted its written consent.
Division/Centre:	Danish Technological Institute Energy and Climate Refrigeration Laboratory, Taastrup
Signature:	Hans Walløe Laboratory manager  Rasmus Borup Business Manager 

ilac-MRA DANAK
Test Reg. nr. 300

Table of Contents

1. ABSTRACT

The cabinet model XYZ has been tested according to EN 23953-2:2015. Below, you will find a brief description of the test that has been undertaken. Please, be aware that the description is simplified. Please, refer to the standard for a comprehensive overview.

In total, six tests have been conducted as can be seen in the table below.

The first test is the seal test, which as described in the standard is done by inserting a strip of paper, closing the door, and retracting the paper to see if the seal provides resistance.

After a stable period of 24 hours, the testing period of 24 hours is initiated. The door opening sequence is initiated with each door being opened consecutively for three minutes, and then follows a 12-hour period where each door is opened six times per hour in an evenly staggered interval. In this period, the cabinet lights are switched on and remain on for the 12-hour period. For the remaining part of the testing period, the lights are off and there are no door openings.

During the testing period, the thermal packages placed in the cabinet are monitored to ensure that the highest temperature measured is lower than -15°C and that the highest minimum temperature is below -18°C.

Additionally, the cabinet is monitored throughout the test to determine if water vapor condensation is detectable inside or on the surface during testing.

Lastly, the daily electrical consumption DEC and the refrigerant daily electrical energy consumption REC (a calculated value that converts refrigerant energy consumption into electrical consumption) are both attained through measurements and calculations according to the standard.

A summary of the key results can be seen in the table below.

Key results	**Test Results**	**Declared by manufacturer**	**Deviation %**	**Meets requirements[1]**
Total display area TDA	X.XXX m^2	X.XXX m^2	X.X %	Yes
Temperature test L1	Θ_{ah} = -XX.X°C	Θ_{ah} = -XX.X °C	-	Yes
Annual energy consumption	XX,XXX.X kWh	XX,XXX.X kWh	X.X %	Yes

[1] According to COMMISSION DELEGATED REGULATION (EU) 2019/2018 of 11 March 2019

2. TEST PROGRAM

Test 1: Total display area

Test 2: Temperature test

Test 3: Electrical energy consumption test

Test 4: Heat extraction rate test (refrigerant energy consumption test).

Test 5: Water vapor condensation test

Test 6: Seal test for doors and lids.

3. EQUIPMENT

The following equipment was used to obtain the results during the energy consumption test:

- Air velocity: TSI model 8475-225-1
- Mass flow of refrigerant (transmitter / sensor): Siemens Mass 6000 / Sitrans F C Mass2100
- Suction pressure: Danfoss AKS 2050 060G6408
- Temperatures: Measurement Computing TC-32
- Temperature and humidity in climate chamber: Vaisala HMP130
- Electricity consumption: Yokogawa WT333E.

4. METHOD

The accredited tests were carried out according to EN 23953-2:2015. After a stable period of 24 hours, the test period (24 hours) was initiated with a period of 12 hours with the light on, including door openings. Prior to this, each door was opened consecutively for three minutes. For the remaining time of the test, the doors remain closed and the lights are turned off.

5. RESULTS

5.1. Tables

Test 1: Total display area (TDA)	Test results
TDA = (H_0 * L_{0h}) + (H_g * L_{gh}) + (V_0 * L_{0v}) + (V_g * L_{gv})	
H_0	0 m
L_{0h}	0 m
H_g	X.XXX m
L_{gh}	X.XXX m
V_0	0 m
L_{0v}	0 m
V_g	X.XXX m
L_{gv}	X.XXX m
Total display area (TDA)	X.XXX m^2

Test 2: Temperature test	Test results
Temperature class: Y **Thermostat: cut in X°C, cut out X°C** **Evaporation temperature: X°C**	
Highest temperature of warmest M-package, Θ_{ah} [°C]	-XX.X[2]
Average mean temperature of all M-packages, Θ_m [°C]	-XX.X

[2] M8 (See location of M-packages in cabinet in appendix A)

Test 3: Electrical energy consumption test	**Symbol**	**Value**	**Unit**
Temperature class: Y **Thermostat: cut in X°C, cut out X°C** **Evaporation temperature: X°C**			
Direct electrical consumption	DEC	XX.XXX	kWh/24h

Test 4: Heat extraction rate test at ambient temperature 25°C and relative humidity 60%	**Symbol**	**Value**	**Unit**	**Calculations/ Comments**
Suction pressure	p_8	XX.X	BarA	During run-time
Refrigerant cabinet outlet temperature	Θ_8	XX.X	°C	During run-time
Mean evaporation temperature	Θ_{mrun}	XX.X	°C	During run-time
Mean evaporation temperature during the last 10% of all running periods	Θ_{min}	[3])	°C	
Super heat cabinet outlet	SH	XX.X	K	SH = Θ_8 - Θ_{mrun}
Liquid temperature cabinet inlet	Θ_4	XX.X	°C	During run time
Mass flow rate	q_m	XX.X	kg/s	During run time
Heat extraction rate during running time only	Φ_{run}	XX.X	kW	
Heat extraction rate (incl. running, stopping, and defrosting time)	Φ_{24}	XX.X	kW	
Heat extraction rate, excluding defrosting time	$\Phi_{24\text{-deft}}$	XX.X	kW	
Refrigeration daily energy consumption	REC	XX.X	kWh/24h	
Total daily electrical consumption	TEC	XX.X	kWh/24h	TEC = DEC + REC
Annual energy consumption	AE	XX.X	kWh	AE = TEC * 365
Specific daily energy consumption	SEC	XX.X	kWh/24h*m^2	SEC = TEC/TDA
Percentage of running time (open expansion valve)	t_{rr}	XX.X	%	t_{run} /(24 – t_{deft}) * 100
Energy efficiency index	EEI	XX.X	%	
Energy class[4]	[-]	X		

[3] Not calculated because the condensing unit controls the evaporation pressure continuously
[4] According to EU delegated regulation no. 2019/2018

Test 5: Water vapor condensation test	
Lighting (5.3.2.7.1)	Vapor condensation was observed during the last 12h of test b) (12h lights on, then 12h lights off)
Duration of observation period	12 h
Coded sketch	See figure 9
Meets requirements	No according to a) (5.3.4.2)

Test 6: Seal test for doors and lids	**Meets requirements**
Comment: With the doors normally closed, the strip of paper did not slide freely	Yes

5.2. Figures

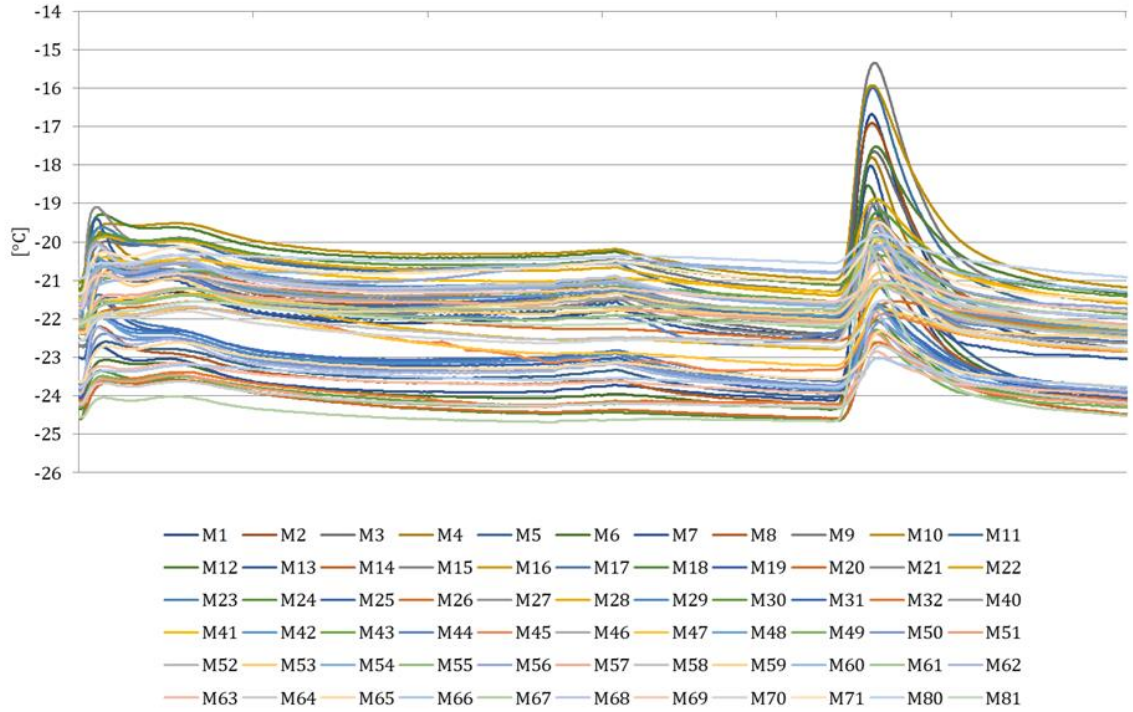


Figure 1 Time/Temperature curves of all M-packages[5]

[5] For information on the location of the different M-packages, see Appendix A

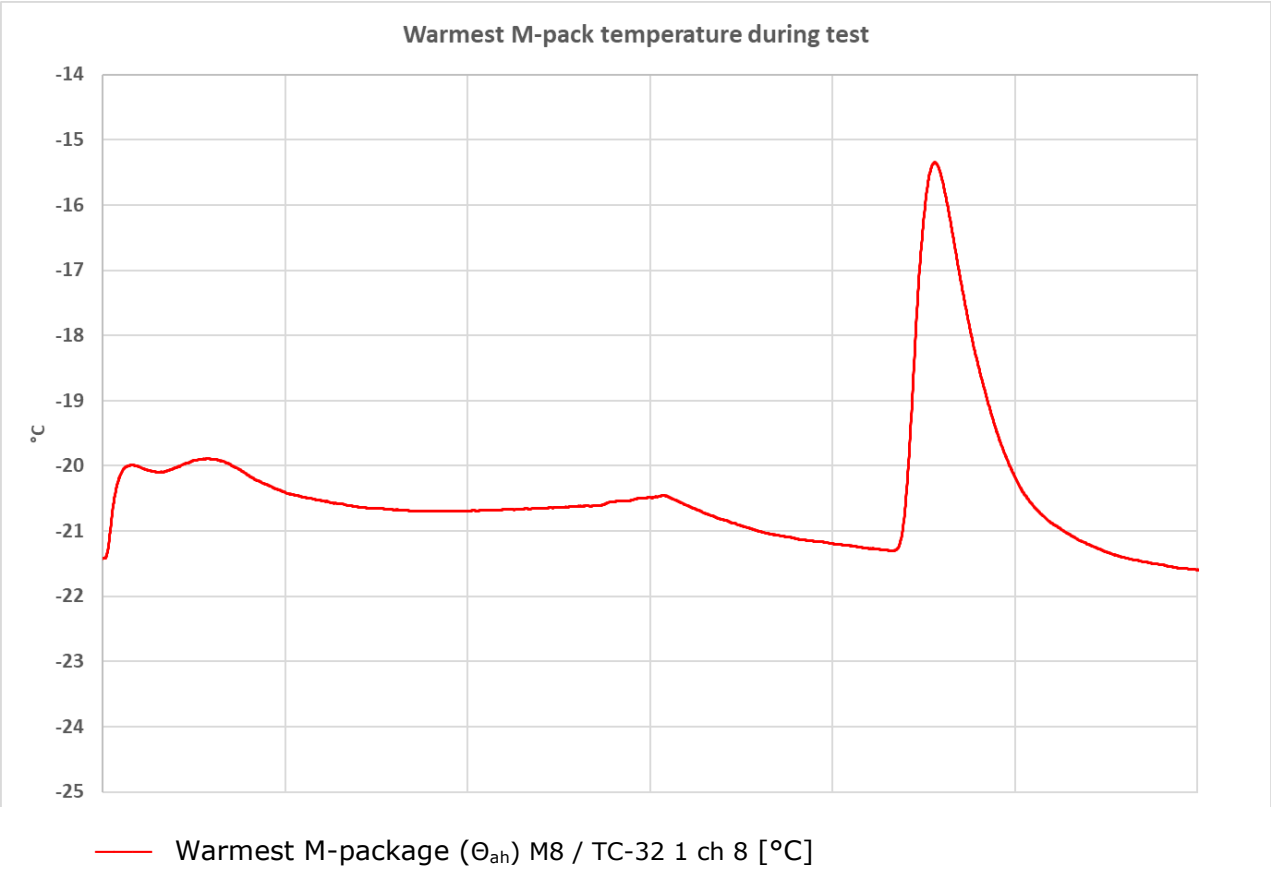


Figure 2 Time/Temperature curves of the warmest M-package

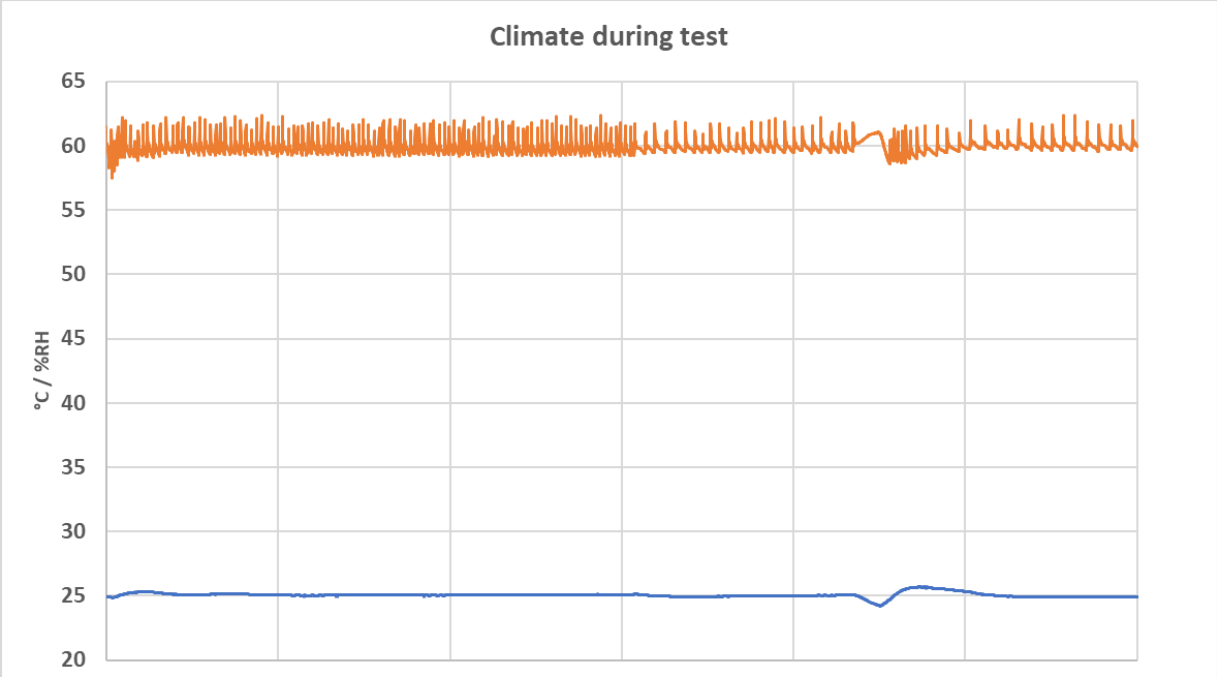


Figure 3 Relative humidity (orange line) & ambient temperature (blue line) in climate chamber during test

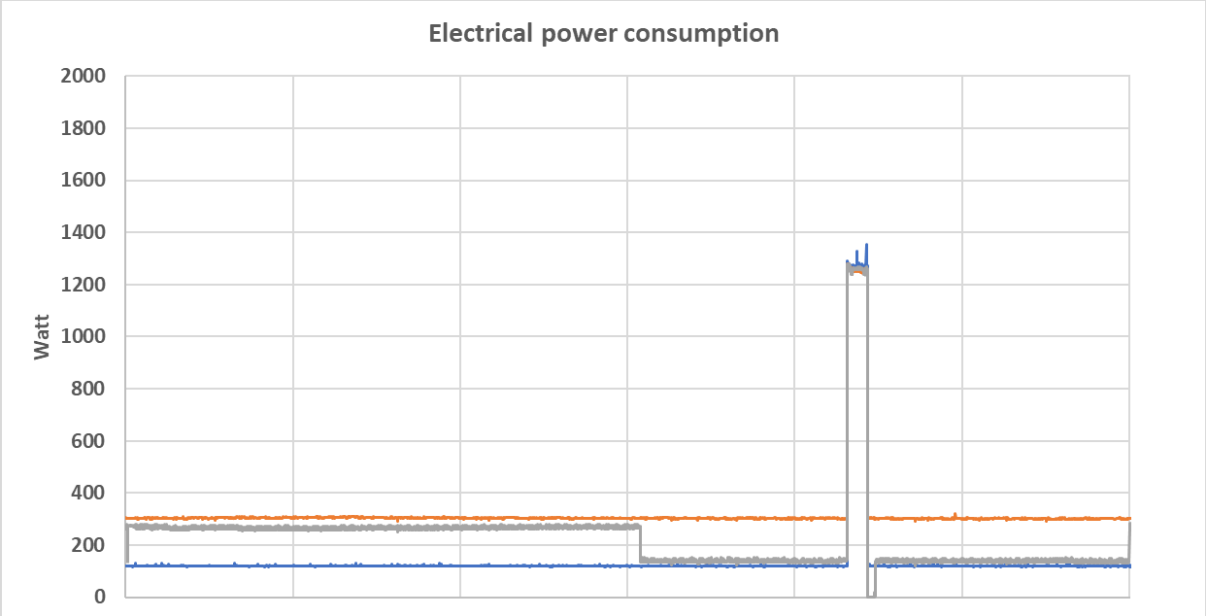


Figure 4 Electrical power consumption

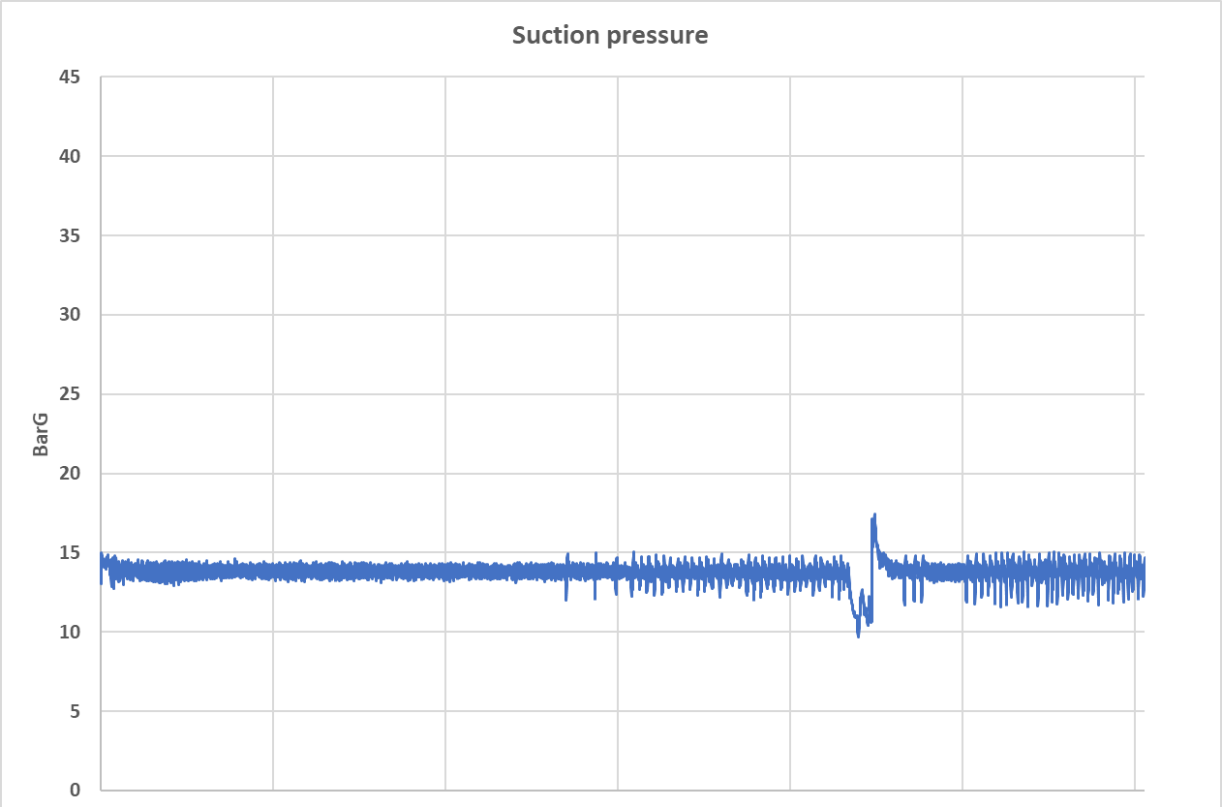


Figure 5 Suction pressure

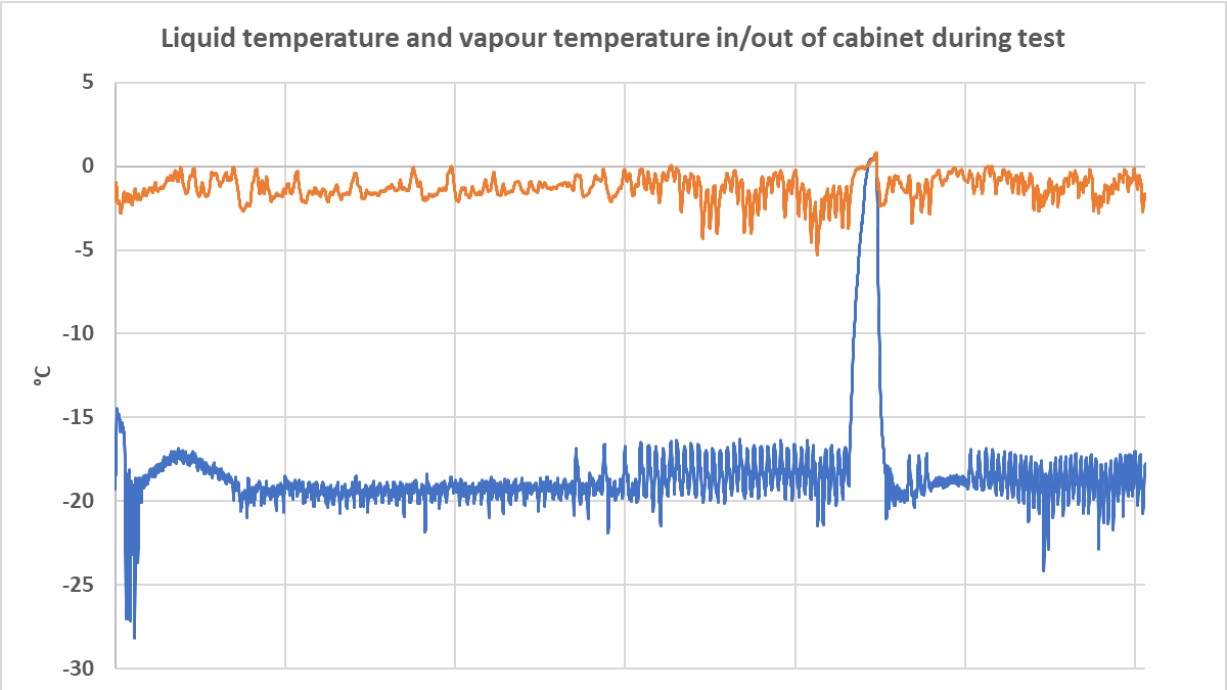


Figure 6 Vapor and liquid temperature during test period

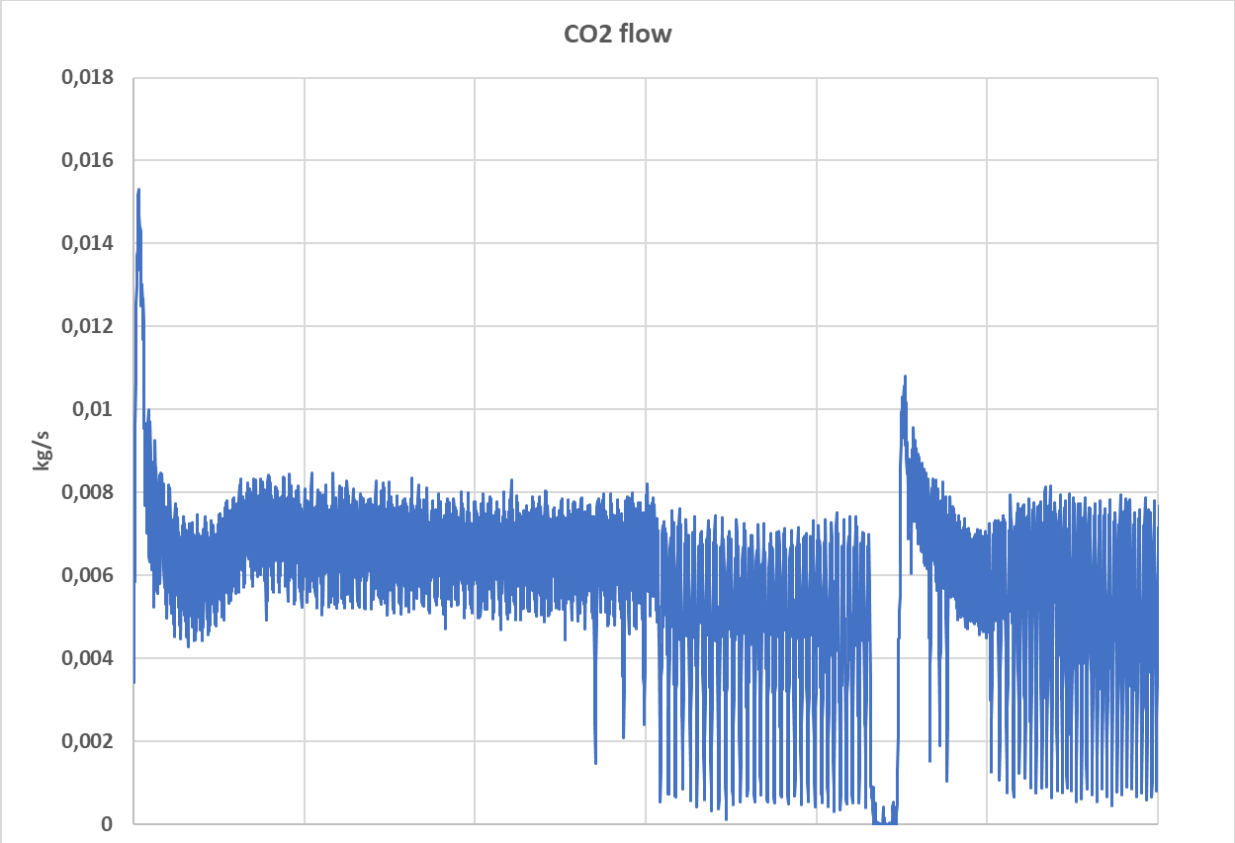


Figure 7 Mass flow of refrigerant

During the energy consumption test, water condensation occurred on the cabinet surface, see coded sketch and pictures below. There have been no additional observations of water vapor condensation.

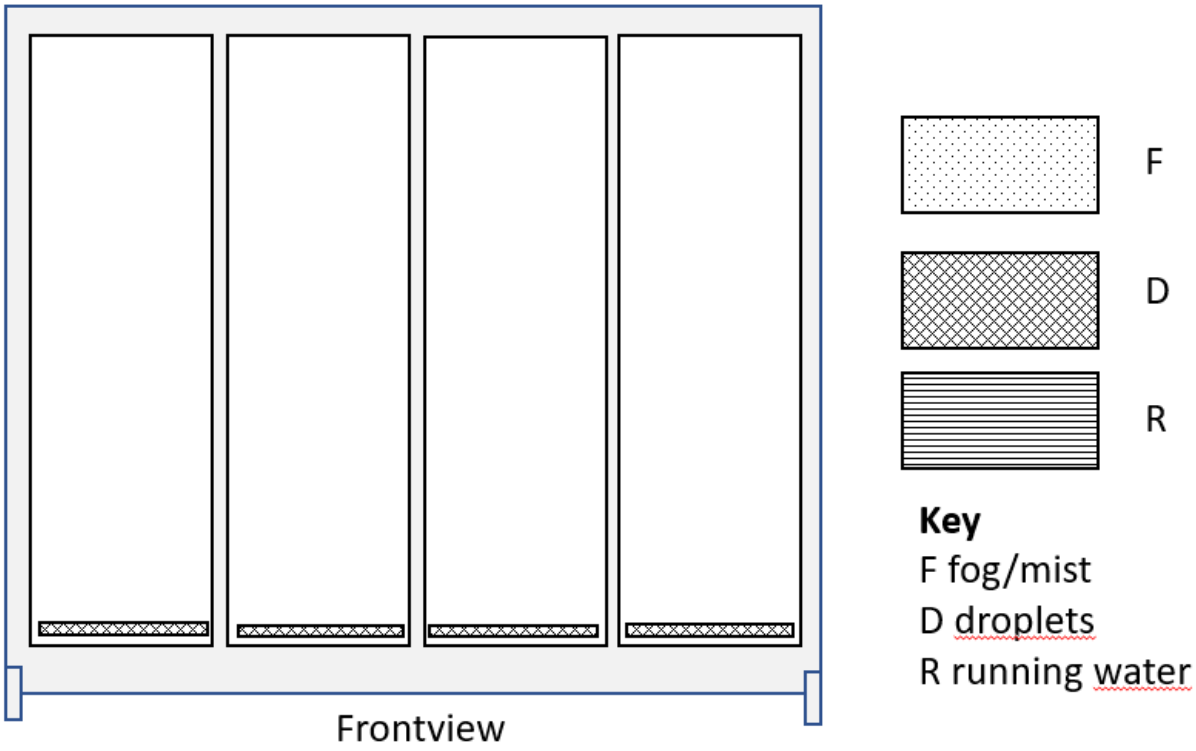


Figure 9 Coded sketch - Water vapor condensation test

Figure 10 Picture of water condensation

6. COMMENTS

No comments.

7. REFERENCES

1. EUROPEAN STANDARD EN 23953-2:2015
   "Refrigerated display cabinets – Part 2: Classification, requirements and test conditions".
2. COMMISSION DELEGATED REGULATION (EU) 2019/2018
   of 11 March 2019 supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of refrigerating appliances with a direct sales function.
3. COMMISSION REGULATION (EU) 2019/2024 of 1 October 2019 laying down ecodesign requirements for refrigerating appliances with a direct sales function pursuant to Directive 2009/125/EC of the European Parliament and of the Council

Picture of rating plate

Picture of cabinet

Energy label

Appendix A (Location of M-packages in cabinet)