CZECH TECHNICAL UNIVERSITY IN PRAGUE
FACULTY OF CIVIL ENGINEERING –
TESTING LABORATORY
testing laboratory No. 1048 accredited by
CIA under ČSN EN ISO/IEC 17025:2018
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Order No.: A24040

TEST REPORT number: 181158/2024

on testing: Air handling unit (trade name CPX8) from manufacturer MANDÍK, a.s. according to standard EN 308.

Client's name and address:

MANDÍK, a.s., Dobříšská 550, 267 24 Hostomice

Czech Republic

Date of test report issue: 24. 4. 2024

place for stamp

Approved by: doc. Ing. Jiří Litoš, Ph.D., OL 181 Technical Manager

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signature

Subject of the test: Heat exchangers for heat recovery in ventilation systems

Testing procedure: Serial No. 181/14 - Measurement of performance parameters

Test regulation: EN 308

Test specimen were manufactured by: Client – results refer to the specimen as it was taken over

Date of taking over test specimen: 17.4.2024

Specimen taken over by: Martin Kny

Manufacturing site of test specimen: Dobříšská 550, Hostomice, Czech Republic

Date of manufacturing test specimen: 2024

Test specimen manufactured by: MANDÍK, a.s

Marking of test specimen: CPX8

Test execution date: 18 - 19. 4. 2024

Test execution place: Czech Technical University In Prague, University Center For Energy Efficient Buildings, Třinecká 1024, 273 43, Bustěhrad, Czech Republic

Potential data on deviations from the test regulation: According to the client's request, only the temperature ratio test for winter conditions (Winter W1) was carried out at a nominal air flow rate of 800 m^3/hr.

Data on uncertainties of quantitative results: The expanded uncertainties of measurement U are the product of standard measurement uncertainties and the expansion coefficient k=2, which provides a confidence interval of ca 95 %

Name of the person who performed the test (measurement): Martin Kny

Name of the person who compiled the test report: Daniel Adamovský

Test results: are shown on page 5.

1) Test Specimen Parameters - Air handling unit

Tab. 1 Parameters of the air handling unit

Dimensions	1910 x 485 x 987 mm (L x V x H)*
Weight	#230 kg#
AHU class according to standard	HRC1a
Supply fan position	downstream of the heat exchanger
Exhaust fan position	downstream of the heat exchanger

** without protruding parts (anchoring handles, throats)*

Detailed photodocumentation of the air handling unit is given in chapter 5

2) Test boundary conditions according to ČSN EN 308

Tab. 2 Boundary condition

Test TYPE B
Precision Class P2
Test condition Winter W1 (without condensation)

According to the client's requirements, only the thermal efficiency $\eta_{t,gro}$ was measured at a nominal flow rate of 800 m^3/hr.

Tab. 3 Boundary condition for test condition Winter W1

Inlet dry bulb temperature exhaust air	25	°C
Inlet wet bulb exhaust air	<14	°C
Inlet dry bulb temperature fresh air	5	°C
Inlet wet bulb temperature fresh air	no requirement	°C

3) Measuring equipment

Tab. 4 Measuring equipment

Sensor/Manufacturer	Serial number	Calibration validity	Calibration range	Number of cal. points
Temp. and humidity Rotronic HC2-S+E2-XX	20043035	15.12.2025	-20 to 60 °C	3
		15.12.2025	10 to 85 % rh	3
Temp. and humidity Rotronic HC2-S+E2-XX	20043036	15.12.2025	-20 to 60 °C	3
		15.12.2025	10 to 85 % rh	3
Temp. and humidity Rotronic HC2-S+E2-XX	20043070	15.12.2025	-20 to 60 °C	3
		15.12.2025	10 to 85 % rh	3
Temp. and humidity Rotronic HC2-S+E2-XX	20043071	15.12.2025	-20 to 60 °C	3
		15.12.2025	10 to 85 % rh	3
Temp. and humidity Rotronic HC2-S+E2-XX	20043072	15.12.2025	-20 to 60 °C	3
		15.12.2025	10 to 85 % rh	3

Anemometer SVH-14SVH	4F151108492	27.01.2026	0.5 to 9.5 m/s	4
Anemometer SVH-14SVH	4F151108493	27.01.2026	0.5 to 9.5 m/s	4
Anemometer SVH-14SVH	4F151108494	27.01.2026	0.5 to 9.5 m/s	4
Anemometer SVH-14SVH	4F151108496	27.01.2026	0.5 to 9.5 m/s	4
Air temperature Sensit TG8-40 10 m	30646/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30647/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30117/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30128/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30650/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30130/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30652/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30653/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30654/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30655/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30656/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30657/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30708/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30714/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30679/1015	09.12.2025	-20 to 60 °C	3
Air temperature Sensit TG8-40 10 m	30680/1015	09.12.2025	-20 to 60 °C	3
Differential pressure SVD 311	2524/15	05.01.2026	0 to 500 Pa	6
Differential pressure SVD 311	2525/15	06.01.2026	0 to 500 Pa	6
Differential pressureBeck 984Q	Z2-11106588/000	08.01.2026	0 to 500 Pa	12
Differential pressure Beck 984A	122816	08.01.2026	0 to 2500 Pa	10
Atmospheric pressure HUBA Control	155782	15.12.2025	0.8 to 1 bar	4
Wattmeter HIOKI PW 3335	160128191	11.12.2025	0 to 700 W	4
Tape measure	160128197	11.12.2025	0 to 5m	5

All electronic equipment was calibrated as a complete chain together with the Datataker DT85 data loggers (sn. 106149 or sn. 106146).

4) Measurement results

Tab. 5 Measurement results

Electrical power		P_E	425 ± 1.4	W
Fan speed adjustment (fresh air/exhaust air)		-	F78/E77	%
Atmospheric air pressure		P_{atm}	97.0 ± 0.3	kPa
Fresh air	Inlet dry bulb temperature	θ_{21}	5.03 ± 0.3	°C
	Inlet relative air humidity	rh_{21}	75.31 ± 2.4	%
	Outlet dry bulb temperature	θ_{22}	20.63 ± 0.3	°C
	Outlet relative air humidity	rh_{22}	24.84 ± 2.3	%
	Inlet total pressure	p_{21}	28 ± 0.8	Pa
	Onlet total pressure	p_{22}	230 ± 1.2	Pa
	Available total pressure	$\Delta p_{s1,ext}$	202 ± 1.2	Pa
	Volumetric air flow	q_{v22}	800 ± 4.2	m^3/hr
	Mass flow rate	q_{m22}	0.254 ± 0.013	kg/s
Exhaust air	Inlet dry bulb temperature	θ_{11}	24.96 ± 0.3	°C
	Inlet relative air humidity	rh_{11}	19.45 ± 2.5	%
	Outlet dry bulb temperature	θ_{12}	9.41 ± 0.3	°C
	Outlet relative air humidity	rh_{12}	48.70 ± 2.4	%
	Inlet total pressure	p_{11}	4 ± 0.8	Pa
	Onlet total pressure	p_{12}	205 ± 1.3	Pa
	Available total pressure	$\Delta p_{s2,ext}$	201 ± 1.4	Pa
	Volumetric air flow	q_{v12}	809.3 ± 4.3	m^3/hr
	Mass flow rate	q_{m12}	0.254 ± 0.014	kg/s
Temperature gross efficiency		$\eta_{t,gro}$	0.783 ± 0.025	-

The expanded uncertainties of measurement U are the product of standard measurement uncertainties and the expansion coefficient k=2, which provides a confidence interval of ca 95 %

5) Photo documentation

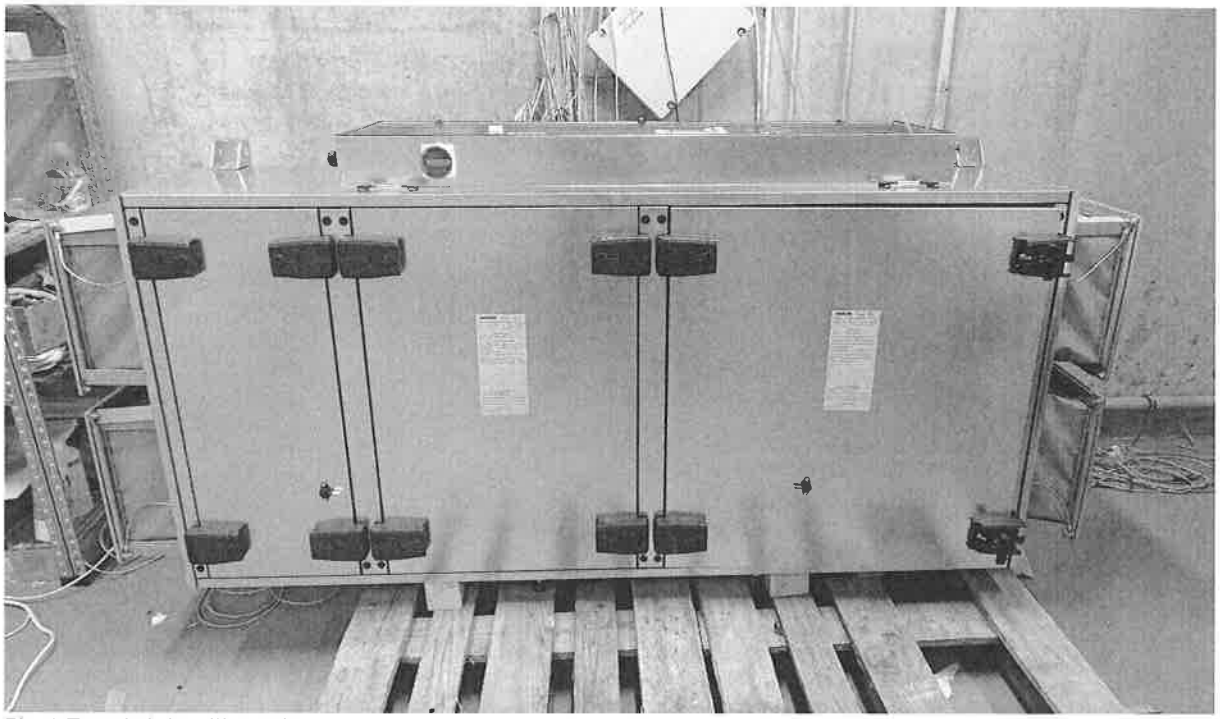

Fig. 1 Tested air handling unit

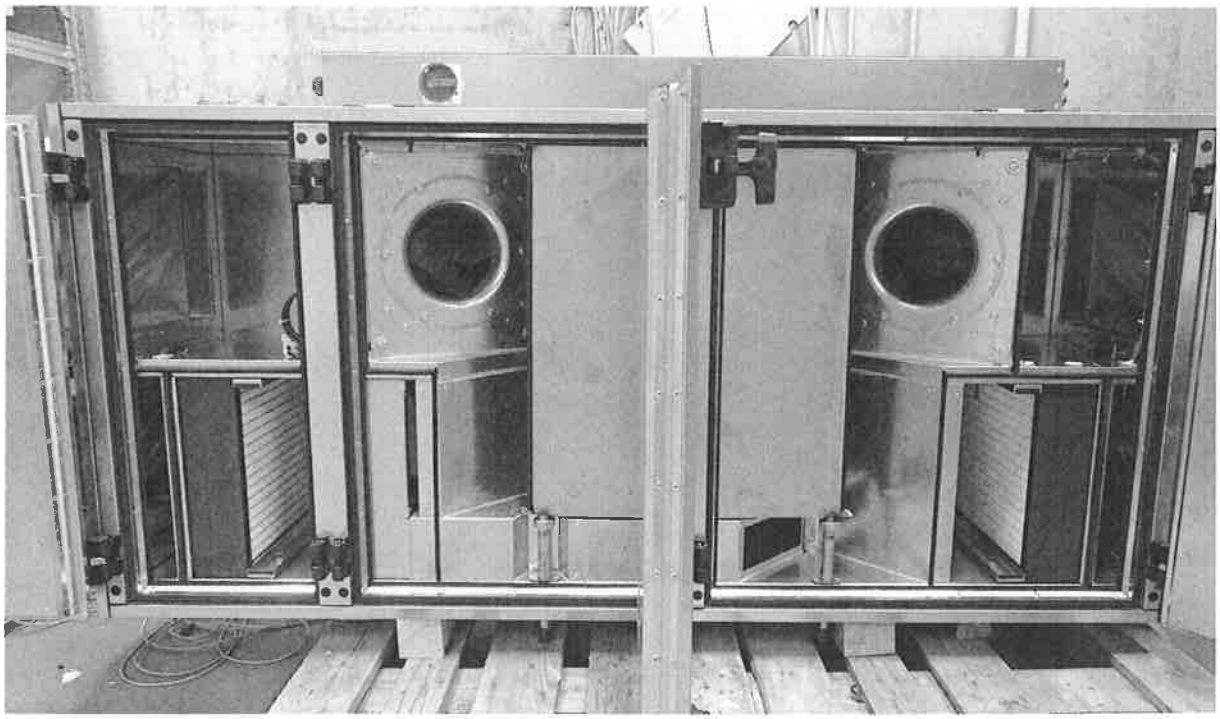

Fig. 2 Internal layout of the air handling unit

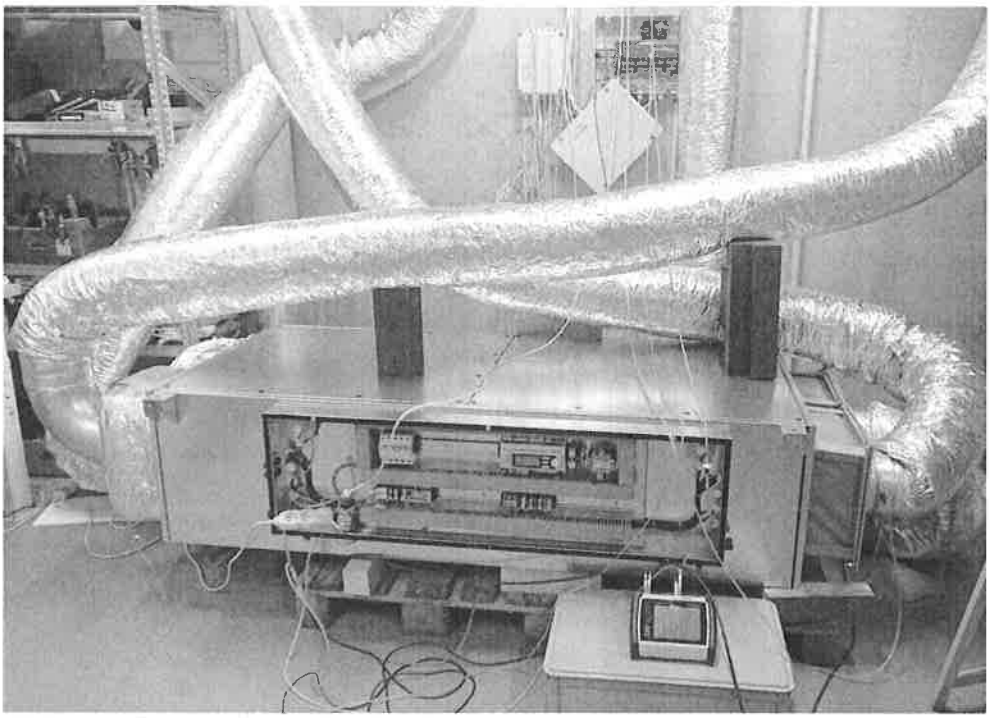

Fig. 3 Air handling unit during measurement

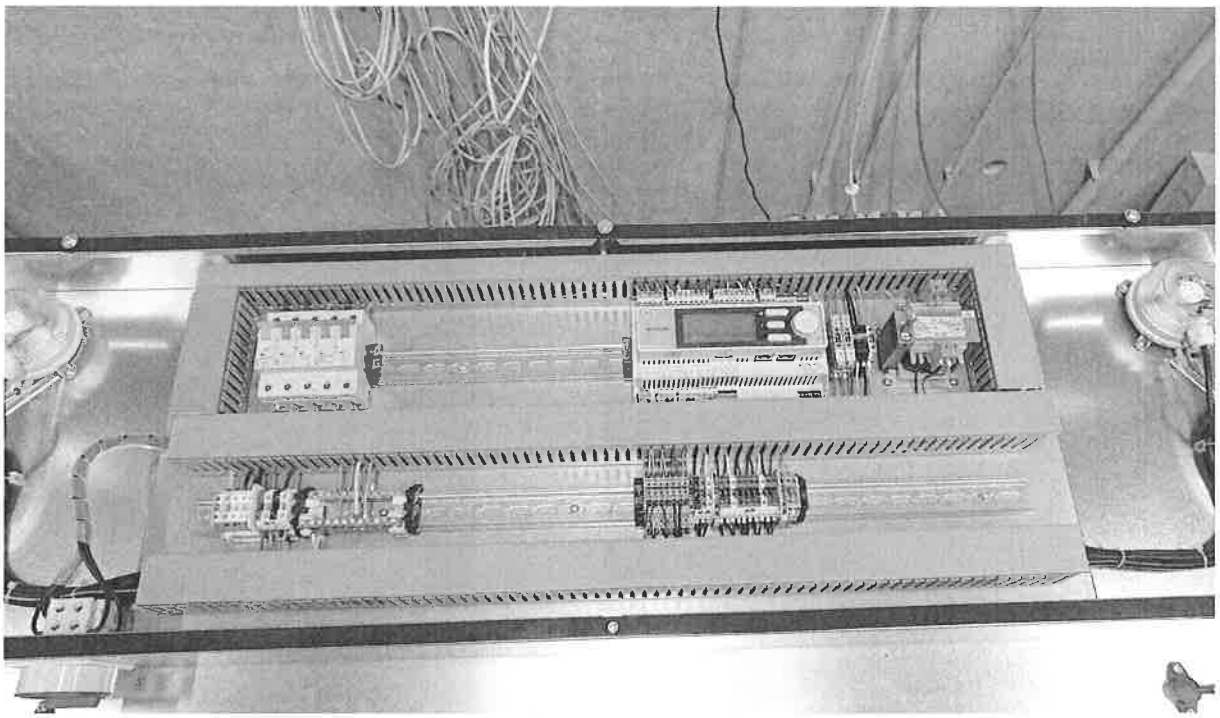

Fig. 4 Electrical switchboard (after removing the cover)

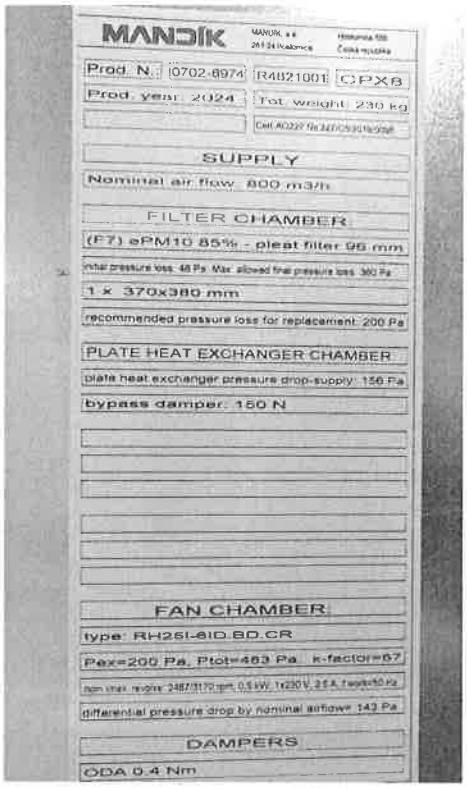

Fig. 5 Air handling unit specifications

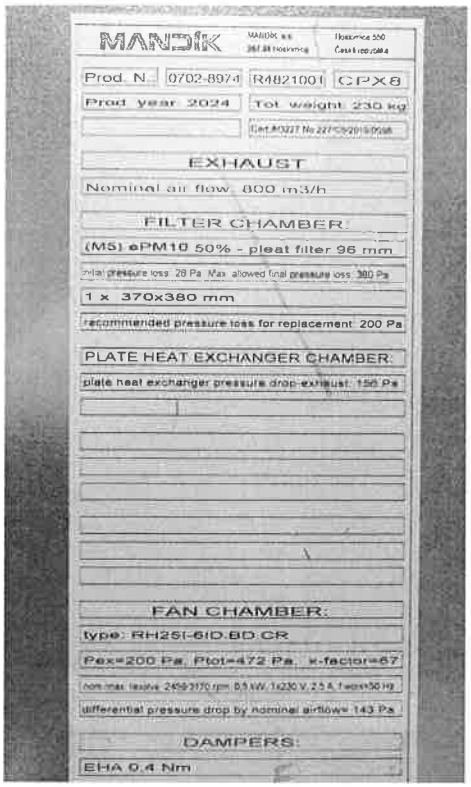

Fig. 6 Air handling unit specifications

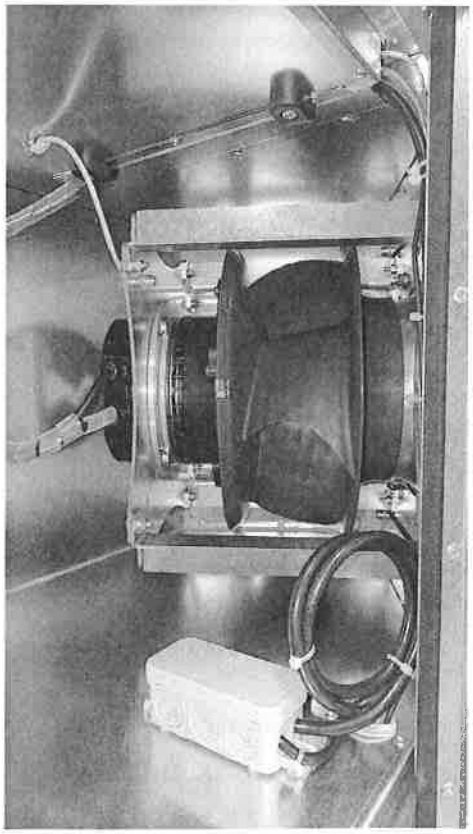

Fig. 7 Exhaust fan

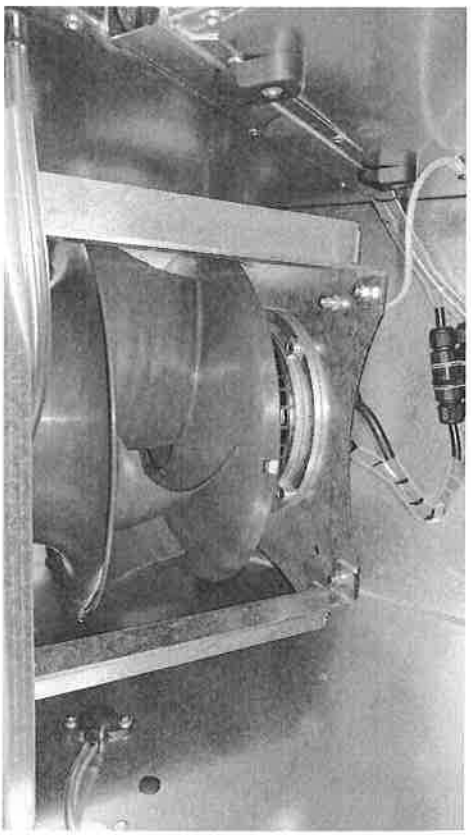

Fig. 8 Supply fan

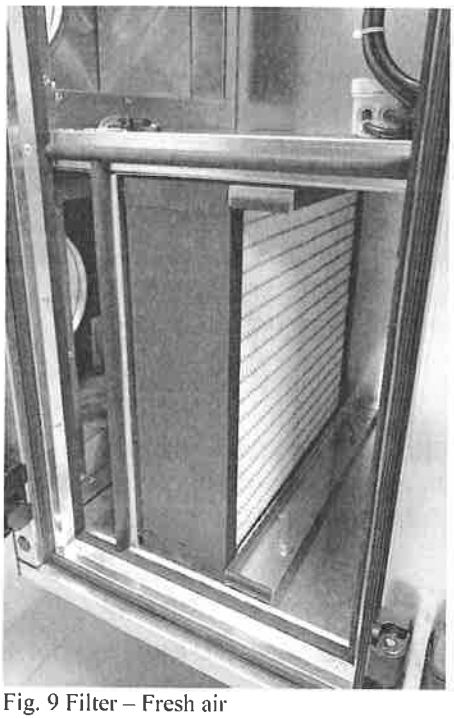

Fig. 9 Filter – Fresh air

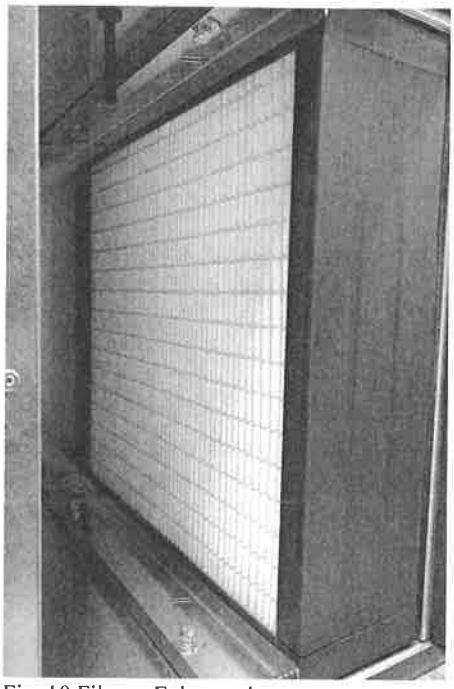

Fig. 10 Filter – Exhaust air

Fig. 11 Exchanger bypass flap (fresh air side)

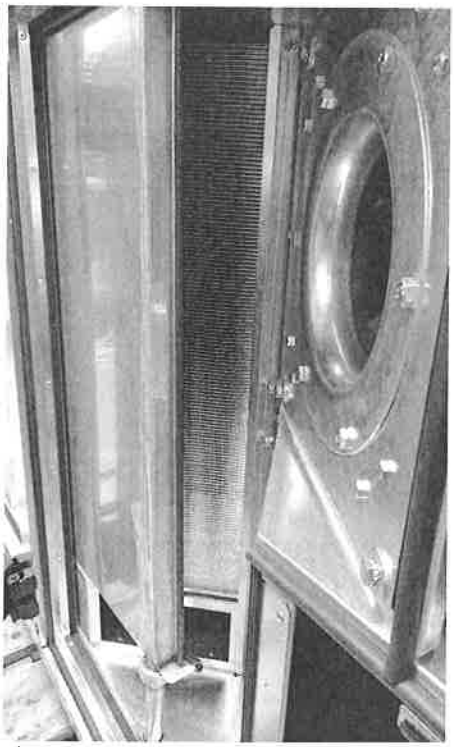

Fig. 12 Exchanger, bypass, condensate drain and fan

 # the data marked as such was supplied by the customer, OL181 is not responsible for it.

---------- end of test report ----------

Annex 1

According to the client's requirements, the results of the measurements according to EN 308 were also expressed according to the test code in paragraph 5.2.1 of the document:

"Doc_4.4_S.a_FR_Ventilateurs_et_Groupes_de_ventilation_v2.0_20211025"

Calculation of the temperature ratio

The test volume flow rate $q_{v,test}$ is defined as the lower of the following two volume flow rates the exhaust air volume flow rate (q_{v11}) and the supply air volume flow rate (q_{v22}) during the test. The thermal efficiency of the heat recovery unit is given by:

$$\eta_{test} = \frac{(\eta_{t,sup} + \eta_{t,eha})}{2}$$

The temperature ratios of the supply air side ($\eta_{t,sup}$) and the extract air side ($\eta_{t,eha}$) are calculated using the temperatures measured during the test and are conventionally corrected to take account of the heat from electrical energy consumed:

$$\eta_{t,sup} = \frac{t_{22} - \Delta t_{22} - t_{21} - \Delta t_{21}}{t_{11} + \Delta t_{11} - t_{21} - \Delta t_{21}} \quad \text{et} \quad \eta_{t,eha} = \frac{t_{11} + \Delta t_{11} - t_{12} + \Delta t_{12}}{t_{11} + \Delta t_{11} - t_{21} - \Delta t_{21}}$$

The temperature differences (Δt_{xx}) corresponding to the position of the fans.

Tab. 6 Measurement results

Fresh air fan position		downstream of the heat exchanger		
Exhaust air fan position		downstream of the heat exchanger		
Fan speed adjustment (fresh air/exhaust air)		-	F 78/E 77	%
Electrical power		$P_{elec.ahu.test}$	425	W
Specific Fan Power (SFP)		P_{SFP}	0.956	kW/m³/s
Atmospheric air pressure		P_{atm}	97.0	kPa
Fresh air	Inlet dry bulb temperature	t_{21}	5.03	°C
	Outlet dry bulb temperature	t_{22}	21.46	°C
	Available total pressure	-	202	Pa
	Volumetric air flow	q_{v22}	800.0	m³/hr
Exhaust air	Inlet dry bulb temperature	t_{11}	24.96	°C
	Inlet dew point temperature	-	0.1	°C
	Inlet wet air temperature	-	12.1	°C
	Outlet dry bulb temperature	t_{12}	10.24	°C
	Available total pressure	-	201	Pa
	Volumetric air flow	q_{v11}	809.3	m³/hr
Δt11		Δt_{11}	0.00	K
Δt12		Δt_{12}	0.83	K
Δt21		Δt_{21}	0.00	K
Δt22		Δt_{22}	0.83	K
ηt,sup		$\eta_{t,sup}$	78.3	%
ηt,eha		$\eta_{t,eha}$	78.0	%
Test air flow		**$q_{v,test}$**	**800.0**	m³/hr
Final thermal efficiency		**$\eta_{t,epb}$**	**78**	%