SARS-CoV-2 Heat Exchanger

CAREL

RECUPERATOR

How to use the heat exchanger if the virus can be transmitted via airbone

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Summary

1. COVID-19 Mode of transmission

- 2. How can I use the Plate Heat Exchanger?
- 3. ... and the Thermal Wheel?

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COVID-19 Mode of transmission



I'm hearing more about the possibility of airborne transmission. Is this possible? Airborne transmission is different from droplet transmission as it refers to the presence of microbes within droplet nuclei, particles <5µm in diameter, that can remain in the air for long periods of time and be transmitted to others over distances greater than 1 m.



A specification is needed, in the context of COVID-19, airborne transmission may be possible in **specific circumstances** and **settings** in which procedures or support treatments that generate aerosols are performed. The crowded with poor ventilation could contribute to the spreading of the virus.



In certain very **unlikely** situation , the virus particles could enter in the extract air of the ventilation system and, if there are leak points, could re-enter in the building

Where could be the leak points?

Even if the airborne is very **unlikely** and related to specific situations, it is important to use the air to air heat exchanger in the safe mode, knowing its leakage behavior



Cross Flow



Thermal Wheel



How can I use the Plate Heat Exchanger?

Basic features







Crossflow technology:

- Air flows don't mix: no crosscontamination
- Wide range of sizes
- Square dimensions: 300 2410 mm
- Up to 100.000 m^3/h air flows.
- 50% to 80% efficiency.
- Low pressure drop.







Pressure definitions



The differential pressure can influence the pressure drop because of the plates elastic deformation.

If it is too high (>2500Pa), it could deform plastically the fins!!!





Leakage rate for the plate heat exchangers



The leakage for the plate heat exchanger in the Recuperator catalogue can be **neglected**

If is there a ByPass?



Could the thermal ByPass be used to increase the fresh air?





... and the Thermal Wheel?

Basic feature







To cover the gap between the wheel and the casing sealing brush are installed in the circumferences and on the two crossbeams

OACF

Air leakage in the rotary heat exchanger is defined by two ratios:

- Outdoor air correction factor (OACF) []
- Exhaust air transfer ratio
 (EATR) [%]



$$OACF = \frac{q_{m,21}}{q_{m,22}}$$



With OACF > 1 more air is transferred from the supply to the exhaust air side and with OACF < 1 more air is transferred from exhaust to supply air side (recirculation of exhaust air)



EATR

Air leakage in the rotary heat exchanger is defined by two ratios:

- Outdoor air correction factor (OACF) []
- Exhaust air transfer ratio (EATR) [%]



Exhaust Air Transfer Ratio (EATR) [%]: percentage of the exhaust air inlet going back to the supply air outlet. EATR is measured by gas concentrations of inert gas and represents the exhaust air leakage to the supply airflow, which is in general described as internal exhaust air leakage.



EATR and OACF trend



Leakage in the rotary heat exchanger





Purge sector
$$^{\circ} = f\left(rpm, \frac{1}{v_f}\right)$$

Precondition for a purge sector function is a sufficient overpressure in the supply air.

A sufficient overpressure in the supply air is achieved by appropriate placing of the fans.



Purging sector influence on OACF and EATR





Test with SF6 tracer gas and photoacoustic IR-gas monitor.

measuring point	ν	p _{Baro}	n	q _{m22}	Δp ₂₂₋₁₁	a ₁₁	a ₂₂	a ₂₁	EATR	Purge
	m/s	Pa	rpm	kg/h	Pa	ppm	ppm	ppm	%	Sector
CO 1	2.0	97972	15.2	4072	10	27.41	0.32	0.24	0.29	yes
CO 2	2.0	97958	15.2	4071	250	15.56	0.19	0.19	0.00	yes
Table 2: EATR test results										

Supply in overpressure + purging sector \downarrow EATR close to 0

Fans position

It is important to take care of the fan position inside the ventilation unit to have the supply side in overpressure

The following pictures show the possible installation layout, showing the suggested air flow directions as regard the motor.



Available external pressure drop supply side higher than the extract side



Rotary heat exchanger – **ON** or **OFF**????





In a nutshell...



Plate heat exchanger

- Leakage close to **zero**
- If there is a bypass, it could be useful to evaluate the possibility to open it to **increase** the fresh air
- No recirculation suggested during Covid-19 episodes



Rotary heat exchanger

- **Supply side in overpressure**, if it is in underpressure (most common fault) then adjust the fan or dampers to switch the situation
- **Purging sector to avoid the carry-over**. If it is not present, please ask Recuperator for a plug-in kit
- For properly operating rotary heat exchangers, fitted with purging sectors and correctly set up, leakage rates are about the same as that of plate heat exchangers
- Keep the wheel running, the leakage rate does not depend on the rpm
- **Inspect the rotary heat exchanger** and the sealing component that everything is correctly installed

CAREI

Thanks for your attention



REHVA COVID-19 guidance document, April 3, 2020

WHO https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

Eurovent 17/11 - 2015 Guidelines for Heat Recovery

AICARR Protocol for risk reduction of SARS-CoV2-19 diffusion in healthcare facilities with the aid of air conditioning and ventilation systems.

WHF https://www.world-heart-federation.org/resources/covid-19-transmission/

