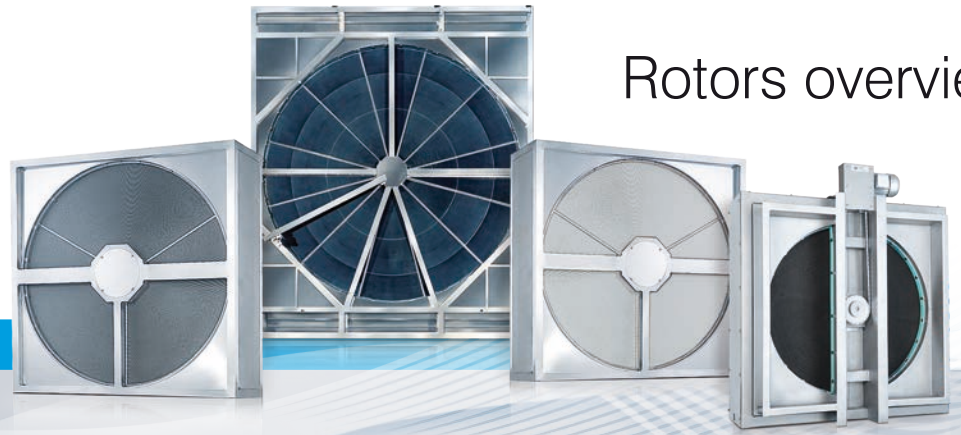
KLINGENBURG
ENERGY RECOVERY

Rotors overview



Quick guide

EUROVENT CERTIFIED PERFORMANCE

AHRI CERTIFIED
www.ahridirectory.org
Air-to-Air ERV
AHRI Standard 1060

ASHRAE

GOST

VDI 6022

Rotors overview

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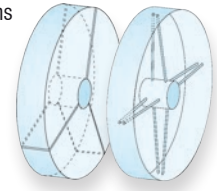
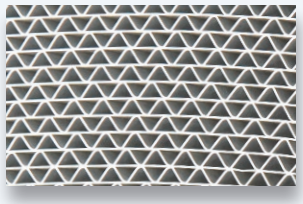
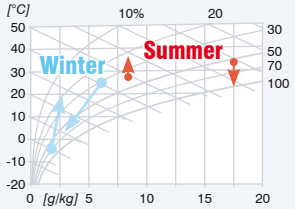
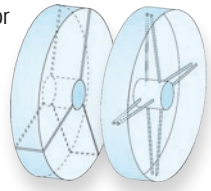
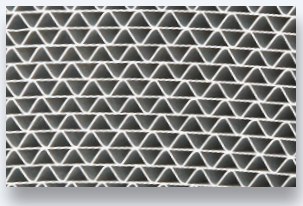
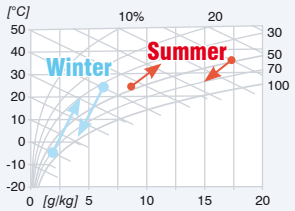
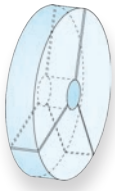
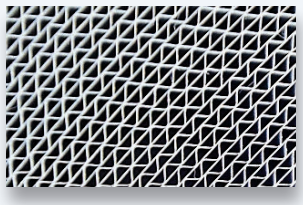
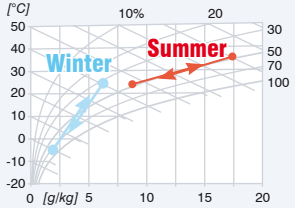
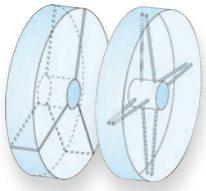
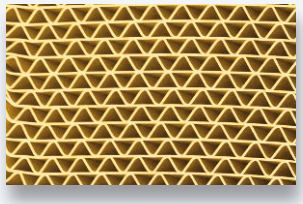
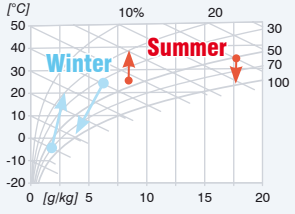
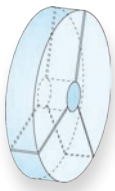
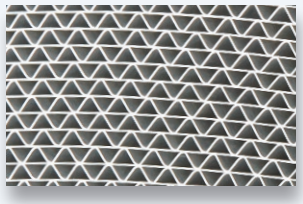
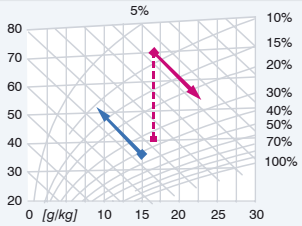
Rotor type		Heat recovery		Preferred application	Wave heigh	Thickness of material
Condensations Rotor P/PT				only sensible, latent only at Condensation	Systems with no humidification and no cooling	1,4 mm 1,5 mm 1,6 mm 1,7 mm 1,9 mm 2,5 mm	0,07 D 0,08 C 0,1 B 0,12 A
Enthalpie Rotor E/ET				sensible, limited latent	Systems with humidification and without cooling	1,4 mm 1,5 mm 1,6 mm 1,7 mm 1,9 mm 2,5 mm	0,07 D 0,08 C 0,1 B 0,12 A
Sorptions Rotor HUgo N				sensibe and latent, (within the whole seasonal cycle)	Systems with humidification and cooling, reduction of cooling capacity by drying and cooling the external air	1,4 mm 1,6 mm 1,7 mm 1,9 mm	0,08 C
Epoxy-Coated Rotor K/KT				only sensible, latent only at Condensation	Systems with high exhaust air requirements such as: - swimming pools - industrial exhaust systems - Adiabatic humidification of exhaust air - Paint booths Adiabatic cooling	1,6 mm 1,7 mm 1,9 mm 2,5 mm	0,08 C 0,12 A
SECO HYSG Silicagel-Rotor				sensible and latent	Active drying with regeneration air DEC Enthalpy recovery	ca 1,6 mm fixed height	Silicagel-Matrix

Rotor range overview

Housing versions

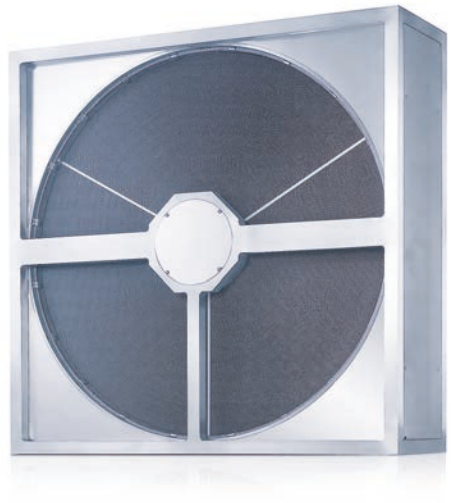
Housing type

RRU

RRC

RRS

RRT



RRU housing:

Undivided, zinc-plated steel frame with a screwed design

for vertical installation positions

Variable housing dimensions up to max 2500 mm HxW

RRC housing:

Plugged undivided aluminium housing (frame profiles with plastic edge connectors)

for vertical installation positions

Variable housing dimensions up to max 3000 mm HxW

Lining plates made from aluminium, aluminium-zinc or zinc-plated steel

Maintenance-friendly ring seal accessible from the narrow side

RRS housing:

welded zinc-plated steel frame; optionally stainless steel (RRV)

for vertical and horizontal installation positions

Variable housing dimensions up to max 4250 mm HxW

From wheel diameter 2380 mm in divided version - optional special division for smaller design sizes

RRT housing:

welded aluminium frame

for vertical and horizontal installation positions

Housing and casing made from saltwater-proof aluminium alloy

Variable housing dimensions up to max 8000 mm HxW

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Cleaning

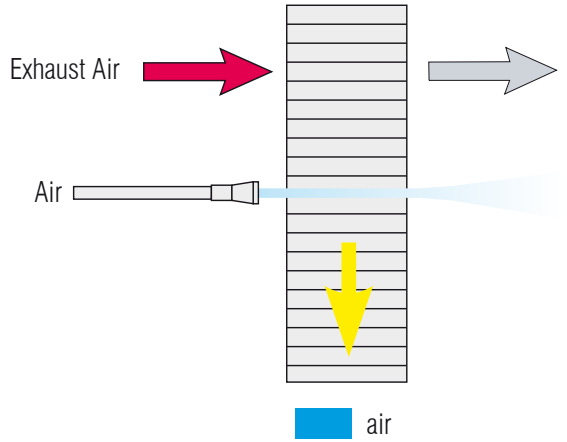
Sensible for ventilation and air conditioning systems with high exhaust air loads.

Cleaning of the storage medium surface with compressed air and/or high-pressure water. Note media provision (compressors and HP modules) and the necessary piping!

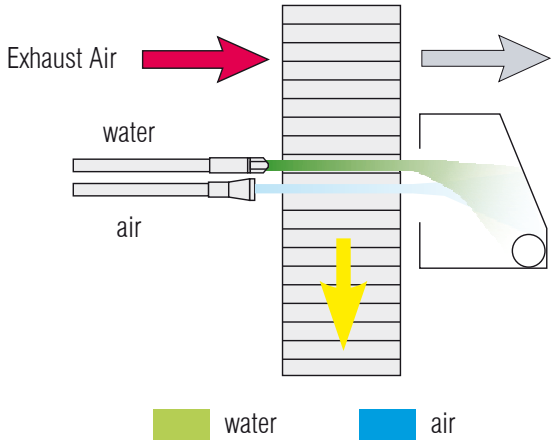
The cleaning equipment also has to be cleaned (particularly for wet cleaning)

Reinforced media of at least 0.1mm foil thickness recommended for high-pressure cleaning.

Compressed air cleaning



Compressed Air and pressure water cleaning



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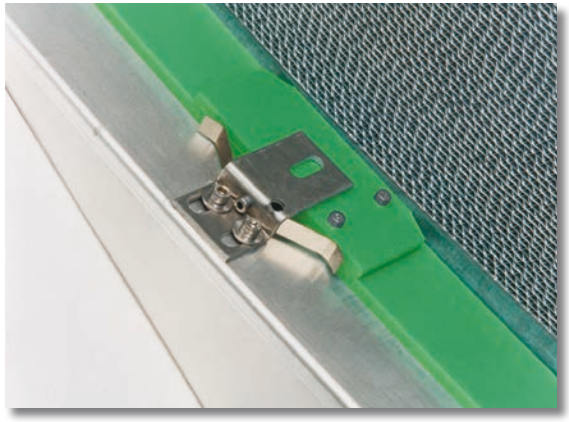
Sealing Systems

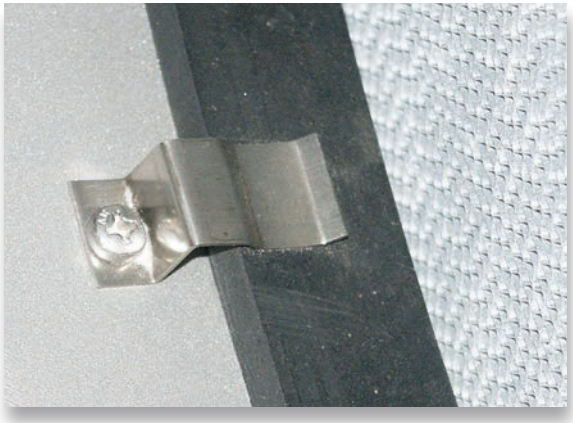
Reduction of leakage at rotor circumference and water line separation.



Special plastic seal (spring-loaded) for paint booths and systems with very high sealing requirements

Brush seal for standard ventilation and air-conditioning

Pressure-stable felt seal for standard ventilation and air-conditioning



Rubber seal, alternative to felt seal

Synthetic leather ring seal - for systems with high seal requirements (RRC only)

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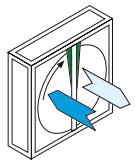
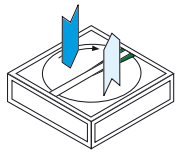
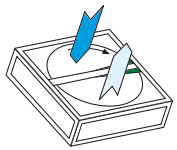
Installation position		- vertical with horizontal or vertical air flow separation	**As a general rule, no transfer of external power in the rotor frame** - No additional construction required
		- horizontal installation	- Framed support of rotor and bearing area required
		- horizontal inclined installation	- Base frame construction and brake motor and/or control system with holding torque and guide plates recommended
Odour transfer		Depending on the direction of leakage (fan arrangements) and water solubility of the odours, odour transfer takes place with condensation.	Kitchen smells; water-soluble, bathroom smells ;non-water-soluble, use of sorption rotors not recommended.
Rotor operation control		Gives error messages for unintentional rotor stoppage (e.g. V- belt blockage, break) designed as proximity switch (magnetic) in the rotor housing.	

Glossary

Rotor controller

Control of the rotation speed and therefore the recovery efficiency.

Controller can be specified in measurement and control specifications, retrofitting possible.

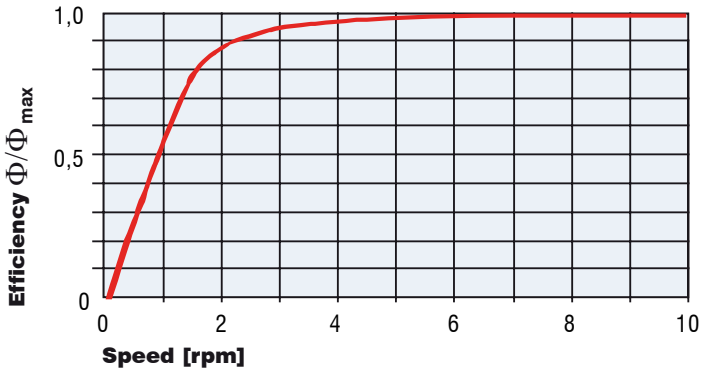
Operation with customer provided signal or self-sufficient with rotors with sensors.

The KR controllers for rotary heat exchangers are available in two sizes:
KR4 = 400 Watt and KR7 = 750 Watt

Basic controller:
Controller signal inputs
Digital speed indicator
Fault indication
Intermittent operation
Motor thermal protection
Rotation control

optional functions:
Sequence switch
Supply air temperature control
Summer mode

	- Basic controller	- Controller output	- Rotation control *)		- additional functions	- Supply air temp. control	- Summer mode
KR	**4** **7**		**R**	**Z**	**A**	**B** - using temp. comparison **C** - using enthalpy comparison **D** - using outside temperature measurement	
	Basic Controller				Additional functions		



The diagram shows the dependence of the efficiency on the rotor speed

Required additional sensors and optional features

Supply air temperature control
1 sensor in the supply air

Summer mode using temperature comparison
2 sensors

Summer mode using enthalpy comparison
2 sensors

Summer mode using outside temperature measurement
1 sensor

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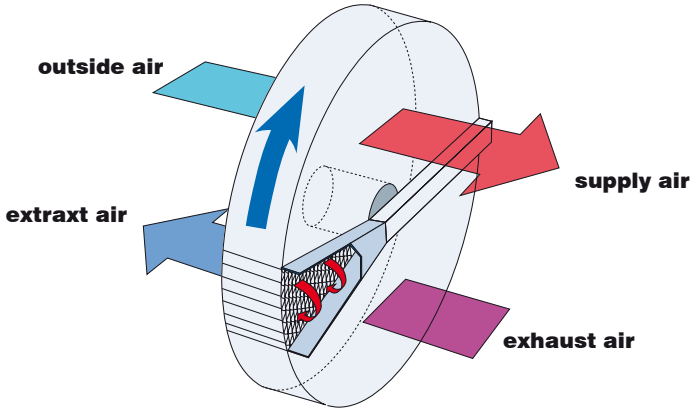
Self-Cleaning	Counter-current air flow cleans dry contamination from storage masses. Requirement: rotating rotor and/or activated intermittent operation.	
Software terminology clarification	Standard volume	Air volume relative to 20°C / 50% relative humidity / 1013 mbar
	Operating volume	Air volume for given temperatures and relative humidities
	Flow rate	Air speed in relation rotor to effective surface, not cross section of duct
	Pressure loss standard density	relates to standard volume
Purge sector	Avoidance of cross contamination between return and supply air due to rotation. Respect purge sector air-volume in fan layout. Rotational direction: from return air across purge sector to supply air. Purge sector always on warm side of wheel.	



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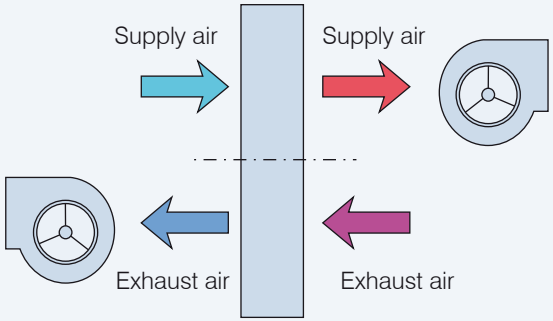
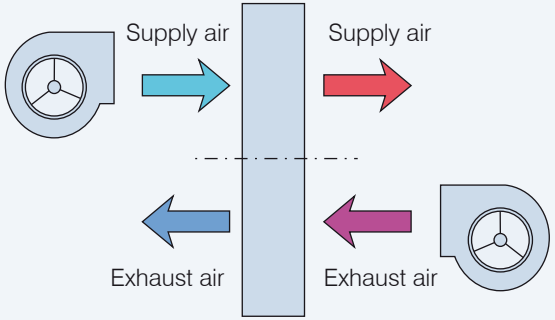
Purge sector dimensions depend on the pressure difference between the through flows



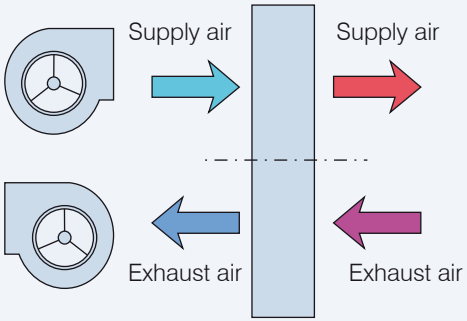
Purge sector: yes

Leakage: ≈ 3-5%



Purge sector: yes

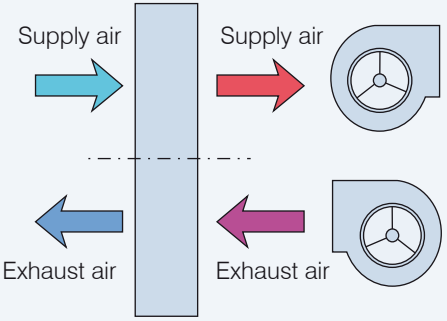
Leakage: ≈ 3-5%



Purge sector: no

Leakage: Leakage higher than 10% in direction of supply air

Sealing: Double center line sealing.



Purge sector: yes / may be reduced in size

Leakage: Leakage higher than 10% in direction of exhaust air

Sealing: then double seals on middle horizontal frame.

Water-tight collection chamber with condensate drain

Inclined aluminium tray in rotor housing with drainage at the lowest position for efficient draining of condensate and cleaning fluid.

Required for rotors with cleaning units and/or high levels of condensate.

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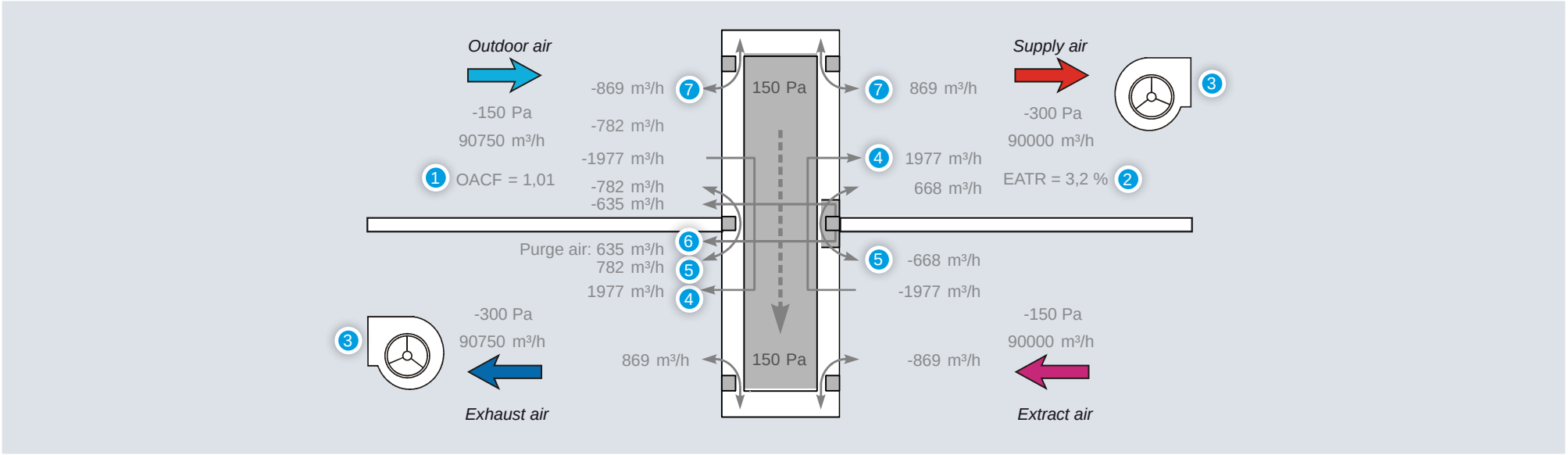
Leakage and Purge Sector Calculation



1 **OACF: (Outdoor Air Correction Factor)**

Outdoor Air Volume/Supply Air Volume (possibly < 1)
Classification number for increased power of ODA/SUP-fan.
Consists of leakage caused by sealing gaps and purge air, if applicable.

2 **EATR: (Exhaust Air Transfer Ratio)**

Extract Air Volume in Supply Air/Supply Air Volume (>0)
Classification number for the amount of extract air transferred into the supply air.
Under ideal circumstances (use of an effective purge sector) this value can be reduced to nearly 0%. Consists of air transferred due to rotation 4 and leakage caused by sealing gaps 5 and 7.

3 **Fan Arrangement:**

Influences the pressure situation over the rotor and therefore direction and amount of leakage, as well as a possible purge sector application. Ideal: draw through arrangement on both sides of the rotor.

4 **Rotation induced transfer:**

Air volume inside the rotor matrix that is cross-transferred to supply and exhaust air by rotation.

5 **Cross-Sealing:**

Leakage in the area of the crossbeam separating supply and extract air.

6 **Purge Air:**

Leakage effective supply air volume that rejects rotation induced transfers from the rotor matrix. Depends on the pressure grade between outdoor and extract air (min. 200 Pa).
To be effective: Purge Air > Rotation induced transfer
Possible purge sector sizes: 2x 2,5° or 2x 5°, depending on the purge pressure

7 **Circumference Sealing:**

Leakage depends on the type of sealing used.
For example: Felt with defined sealing gap or sliding seal with reduced gap.

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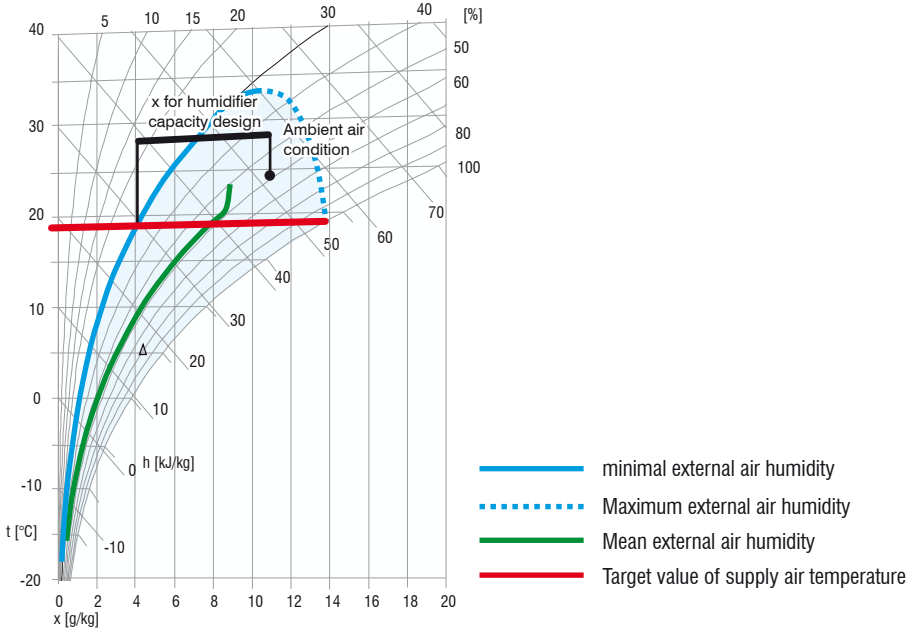
Humidifier design

The required supply air humidity must be achieved over the whole temperature range after reaching the target supply air temperature.

Note the rotor's speed control behaviour!



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Product Desciption

Example: RRC - N - C19 - 2000 / 1800 - 1720

RRC	P	A	14
RRS	E	B	15
RRT	N	C	16
RRU	K	D	17
			19
			25

– XXXX / XXXX – XXXX

Housing

RRC
RRS
RRT
RRU

Type of rotor

P:
Condensations rotor

E:
Enthalpy rotor

N:
Sorption rotor HUgo

K:
Epoxy coated rotor

Thickness of material

A - 0.12
B - 0.10
C - 0.08
D - 0.07

Height of matrix

14
15
16
17
19
25

Housing height [mm]

Housing width [mm]

Wheel diameter [mm]

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Notice

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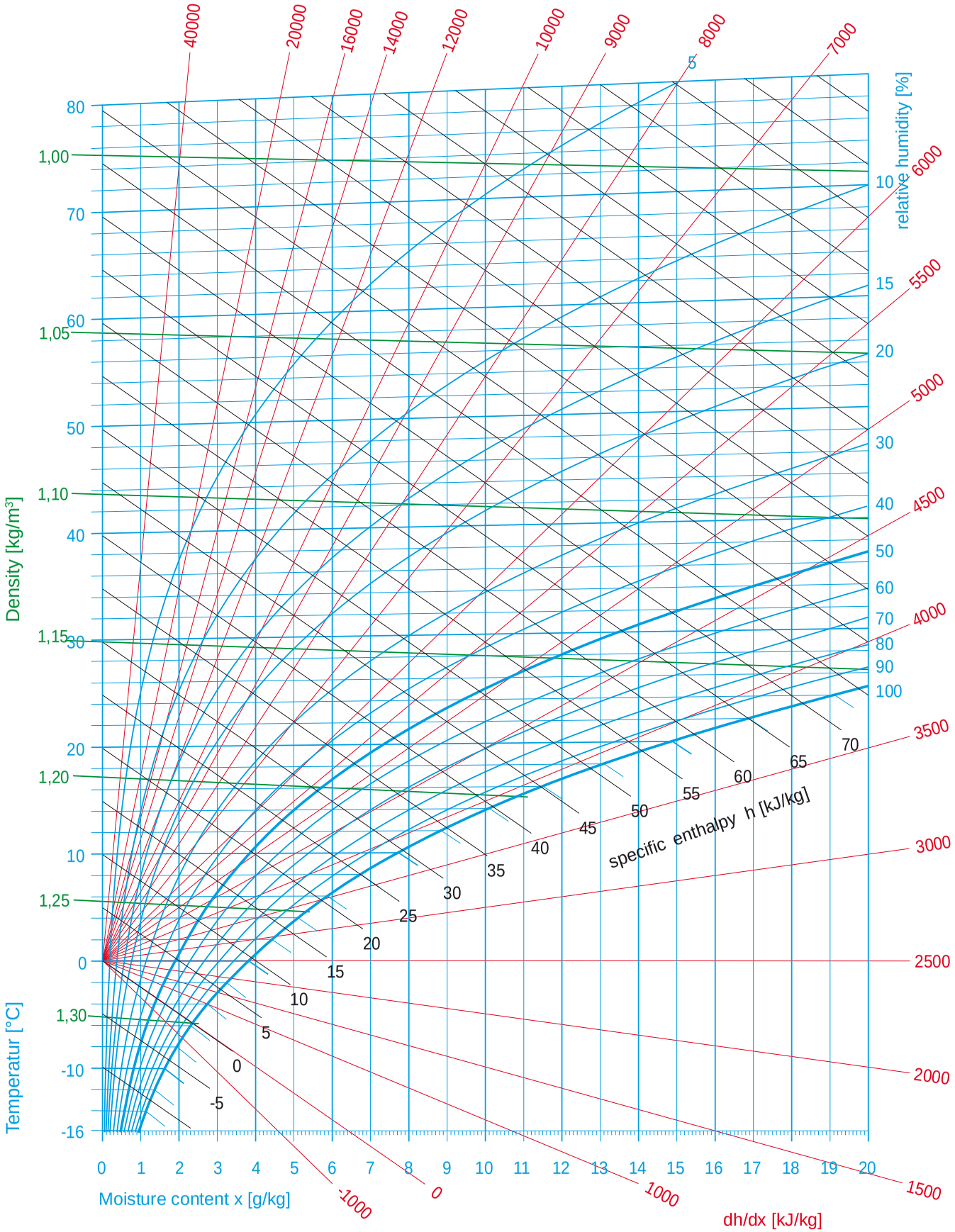
www.klingenburg.de

Mollier-diagram for p=1013 mbar



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