Hoval

Hoval energy recovery

Rotary heat exchangers

Design handbook

For energy recovery in ventilation systems and in process engineering



Hoval | Responsibility for energy and environment

Rotary heat exchangers

Easy to change brush seal for high tightness

Storage mass in 3 variants: for condensation, enthalpy and sorption wheels



Stepper motor without gear unit

Space-saving, robust casing for high stability and tightness



Hoval energy recovery 3

Economical. Reliable. Competent.



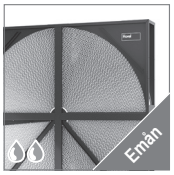
At a glance 5

Model range, type codes



Condensation wheels 13

Rotary heat exchanger for use in ventilation systems without mechanical cooling, with moisture transfer exclusively in winter



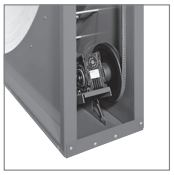
Enthalpy wheels 21

Rotary heat exchanger for use in comfort ventilation systems, with moisture transfer even in the transition period



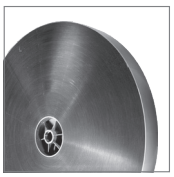
Sorption wheels 29

Rotary heat exchanger for use in ventilation systems with mechanical cooling, with moisture transfer all year round



Drive systems 37

Drive motors and controllers for operation with variable or constant wheel speed



Wheels without casing 45



Options 49



System design 55



Hoval energy recovery

Economical. Reliable. Competent.



Economical. Reliable. Competent.

Hoval develops and produces components for heat, cold and moisture recovery for today and tomorrow. The systems are used in ventilation systems and in process technology. They use energy several times and thus achieve considerable savings.

Hoval offers a wide range of regenerative and recuperative systems for energy recovery:

- Rotary heat exchangers transfer energy through a rotating storage mass, which is alternately heated by one air stream and cooled by the other. They can transfer both temperature and moisture between air streams.
- Plate heat exchangers transfer energy through thin separating plates. The warm and cold air streams pass each other in crossflow. Energy is transferred between the air streams purely by heat conduction as a result of the temperature difference.

Economical
This investment in Hoval energy recovery systems pays off in several ways:

- high thermal efficiency with low pressure drop at the same time
- low installation costs
- low energy consumption
- minimum maintenance requirements

Reliable
Hoval systems for energy recovery are inspected time and time again by independent test institutes (for example at the building technology testing laboratory of the University of Lucerne). All technical data are based on these measurements. This means that they are reliable data for planners, installers and operators.

Competent
Hoval is one of the world's leading suppliers of plate heat exchangers and rotary heat exchangers with decades of industry experience. We support you with our expert know-how. You can rely on detailed technical advice from our engineers as well as on the competent deployment of our service technicians.



At a glance

Model range, type codes

1 Model range 6
2 Type code 10

1 Model range

Hoval rotary heat exchangers are important elements for saving energy in ventilation systems and in process technology. They can transfer both temperature and moisture between air streams. A wide range of models is available for optimum adaptation to the application in question.

1.1 Designs

Condensation wheels
These only transfer moisture in winter when moisture in the extract air condenses in the storage mass. They are best suited for use in ventilation systems without mechanical cooling. Depending on the application, different types of foil are used.

Enthalpy wheels
These are partially coated with a sorption agent. Thus they transfer moisture also in the transition period. Usually enthalpy wheels are used in comfort ventilation systems.

Sorption wheels
These are largely or even completely coated with a sorption agent. This means that the moisture transfer is almost constant throughout the year. Sorption wheels are ideal for use in ventilation systems with mechanical cooling. During the summer months, they dehumidify the supply air and thus reduce the cooling requirement to be covered by refrigeration machines. In winter operation, moisture transfer improves the indoor climate.

Principle	Storage mass
Condensation	
ST1, ST3 (Viskan)	Untreated aluminium
SC1	Aluminium epoxy-coated (for industrial applications)
Enthalpy	
SE3 (Emån)	Corrugated foil: .. Untreated aluminium Smooth foil:..... Aluminium coated with molecular sieve 3 Å
Sorption	
SH1	Corrugated foil: .. Aluminium coated with molecular sieve 3 Å Smooth foil:..... Untreated aluminium
HM1 (Muonio)	Both foils:..... Aluminium coated with molecular sieve 3 Å

Table B1: Designs

1.2 Wave height, wave length

The efficiency of rotary heat exchangers depends on the heat-transferring surface of the storage mass. To adapt the efficiency to the requirements of the respective project, storage masses with different wave heights and wave lengths are therefore available.

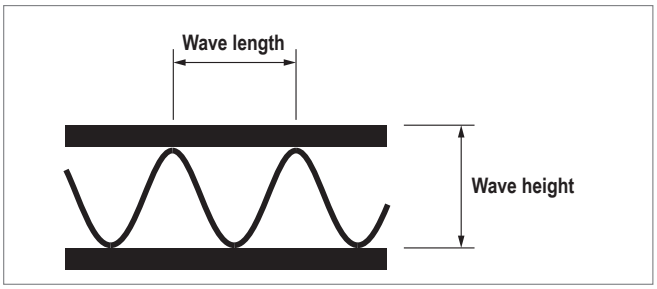


Fig. B1: Wave height and wave length

1.3 Wheel construction

In order to simplify transport and installation, large wheels can be delivered in several parts. The segments are assembled when the wheel is installed.

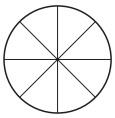
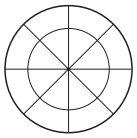
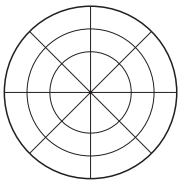
Wheel construction	Segments	Wheel diameter
	1-piece	500 … 2600
	4	950 … 1699
	6	1700 … 2699
	8	2700 … 3549
	16	3550 … 4599
	24	≥ 4600

Table B2: Number of segments (dimensions in mm)

1.4 Wheel orientation

A distinction is made between wheels for vertical and horizontal installation. Horizontally installed wheels are exposed to higher loads. They are therefore equipped with stronger bearings and additional spokes. When installing horizontally, pay attention to the following:

- Support the casing over a wide area.
- Provide additional support for the shaft.

1.5 Wheel diameter

The diameter of the wheels can be freely selected in 1 mm steps:

- Wheels with casing: 500 … 4200 mm
- Loose wheels: 500 … 5030 mm

1.6 Casing

Casing height and width can be freely selected in 1 mm steps. The casing depth depends on the depth of the wheel. Detailed information on minimum and maximum sizes can be found in Table B4 and Table B5.

The casings for Hoval rotary heat exchangers are designed for installation in ventilation units and are characterised by the following special features:

- space-saving design
- sturdy construction
- high tightness
- easily accessible seal
- removable purge sector

1.7 Options

Optional components are precisely matched to the respective Hoval rotary heat exchanger and round it off to form a complete package from a single source.

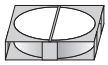
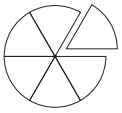
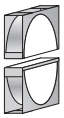
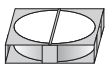
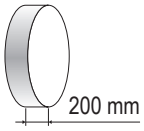
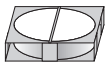
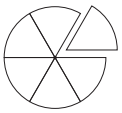
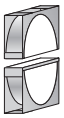
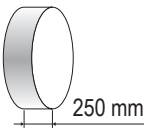
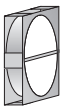
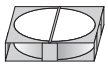
Wheel				Design					
Depth	Construction	Orientation Loose / with casing	Diameter	ST1	ST3	SC1	SE3	SH1	HM1
200 mm			500 … 2600	●	–	●	●	●	●
			500 … 2099	–	●	–	–	–	–
			500 … 2000	●	–	●	●	●	●
			500 … 2600	●	–	●	●	●	●
			500 … 2099	–	●	–	–	–	–
			500 … 2000	●	–	●	●	●	●
			950 … 5030	●	–	●	●	●	●
			950 … 4200	●	–	●	●	●	●
250 mm			500 … 2600	●	–	–	●	●	●
			500 … 1800	●	–	–	●	●	●
			500 … 2000	●	–	–	●	●	●
			500 … 1800	●	–	–	●	●	●

Table B3: Available wheel models (dimensions in mm)

Wheel				Casing			
Depth	Construction	Orientation	Diameter	Type [1]	Depth	Min. height / min. width depending on drive system [1]	
						V0, V1, K1, K3, K5, W0	V6, V7
 200 mm			500 … 2600	SM	290	for Ø < 600 mm: Ø + 130 for Ø ≥ 600 mm: Ø + 100	for Ø < 750 mm: Ø + 130 for Ø ≥ 750 mm: Ø + 50
			500 … 2000				
			950 … 2600	SP	290	Ø + 140	Ø + 140
			2000 … 4200	PR	430	Ø + 200	Ø + 200
 250 mm			500 … 2000	SM	340	for Ø < 600 mm: Ø + 130 for Ø ≥ 600 mm: Ø + 100	for Ø < 750 mm: Ø + 130 for Ø ≥ 750 mm: Ø + 50
			500 … 1800				

[1] See unit type codes

Table B4: Available casing models (dimensions in mm)

Casing type	Dimension x depending on drive system		Maximum dimensions [1]
	V0, V1, K1, K3, K5, W0	V6, V7	
SM	100	50	H_{max} = Ø + 1000 → W_{max} = Ø + x W_{max} = Ø + 1000 → H_{max} = Ø + x
SP	140	140	
PR	200	200	

[1] For permitted intermediate sizes, see Hoval CASER design program

Table B5: Maximum dimensions for casing height and width (dimensions in mm)

Notice
The maximum casing height for 1-piece delivery is 2700 mm.

2 Type code

ST1 - X L - W V - 0500 - SM - V7 - A1 - 0 , W0550 , H0550 - ... - C001

Design

ST1	Condensation wheel
ST3	Condensation wheel Viskan
SC1	Condensation wheel (corrosion-protected)
SE3	Enthalpy wheel Emån
SH1	Sorption wheel (hybrid)
HM1	Sorption wheel Muonio

Wave height / wave length

P	1.35 mm / 3.1 mm (only for ST3 design)
X	1.50 mm / 3.0 mm
E	1.50 mm / 3.9 mm (only for ST3 design)
S	1.65 mm / 3.0 mm
L	1.70 mm / 4.0 mm
O	1.75 mm / 3.9 mm (only for ST3 design)
N	2.00 mm / 3.9 mm (only for ST3 design)
N	2.00 mm / 4.0 mm
C	2.60 mm / 4.2 mm (only for ST3 design)
B	2.60 mm / 5.5 mm (only for ST3 design)
H	2.70 mm / 5.5 mm

Wheel depth

L	200 mm
N	250 mm

Wheel construction

W	1-piece
S	Segmented

Wheel orientation

V	Vertical
H	Horizontal

Wheel diameter

0500	500 - 4200 mm (wheels with casing) 500 - 5030 mm (loose wheels)

Casing type

SM	Sheet-metal casing for 1-piece wheels
SP	Sheet-metal casing for segmented wheels
PR	Profile casing for segmented wheels
NC	without casing

B

ST1 - X L - W V - 0500 - SM - V7 - A1 - 0 , W0550 , H0550 - ... - C001

Drive system

V0	Variable drive for external controller
V1	Variable drive MicroMax
V6	Variable drive VariMax
V7	Variable drive DRHX
K1	Constant drive 1~ 230 V, 50 Hz
K3	Constant drive Δ/Y 230/400 V, 50 Hz (SPG40-3K: 3~ 400 V, 50 Hz)
K5	Constant drive Δ/Y 230/400 V, 60 Hz (SPG40-3K: 3~ 400 V, 60 Hz)
WO	without drive system

Air flow and motor position

A1-P4	Code for air flow and motor position

Purge sector

0	without
5	Purge sector 5°

Casing width

W0550	Width in mm

Casing height

H0550	Height in mm

Options

see Table B7

Customer code

C001	Code for customer-specific attributes

Table B6: Type code

2.1 Options

Code	Option	Availability
IB	Inspection port	All casing types from wheel Ø 1000 mm (motor change from wheel Ø 1350 mm possible)
C4	Corrosion protection	Standard for design SC1 All casing types
CRLL	Controller loose	Drive system V1 Drive system V6: with CL3 or CL6 Drive system V7: with CL3
EDG	Corrosion protection air inlet	Standard for design SC1 Option for designs ST1, ST3
CCP	Closed side walls	All casing types
CB	Cable bushing	All drive systems
SHM	Half mounted	Casing types SP, PR
CL3	Cable length 3 m	Drive systems V0, K1, K3, K5 | V1, V6, V7 (with CRLL)
CL6	Cable length 6 m	Drive systems V0, K1, K3, K5 | V1, V6 (with CRLL)
RG2	Rotation guard RG2	Standard for the drive system V1 Option for the drive systems V0, V6, K1, K3, K5
RG3	Rotation guard RG3	Drive systems V0, V7, K1, K3, K5
P75	Belt pulley 75 Hz	Drive system V0
ECH1111	Eccentricity	All casing types
Q1	Stronger packaging	All designs (for loose wheels only up to wheel Ø 2300 mm)

Table B7: Available options



Condensation wheels

Rotary heat exchanger for use in ventilation systems without mechanical cooling, with moisture transfer exclusively in winter

1 Use 14
2 Construction. 14
3 Specification text. 16
4 Technical data 17

1 Use

Hoval rotary heat exchangers are energy recovery units for installation in ventilation and air-conditioning units and for process engineering applications. They are available in different sizes, suitable for air flow rates from approx. 200 to 150 000 m³/h.

The heat exchangers in the design as condensation wheel are built for use in ventilation systems without mechanical cooling. Their storage mass does not have any hydrophilic coating. Therefore, they transfer moisture between the air flows exclusively in winter when moisture from the extract air condenses in the exchanger.

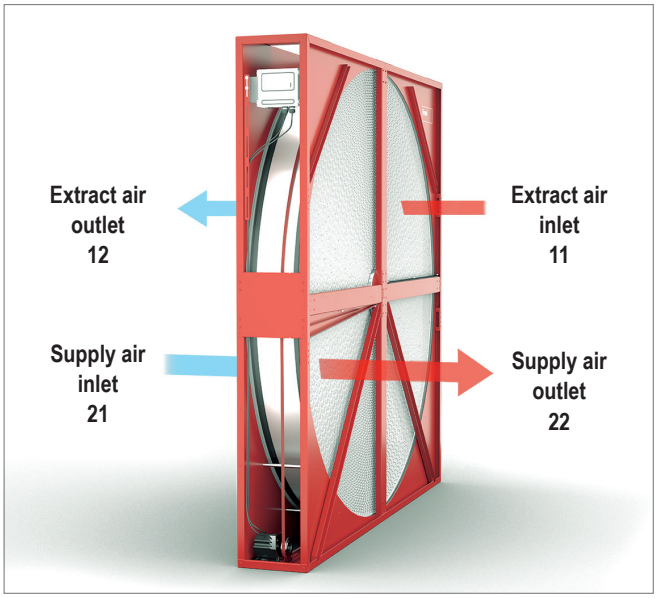


Fig. C1: Air ducting through rotary heat exchangers

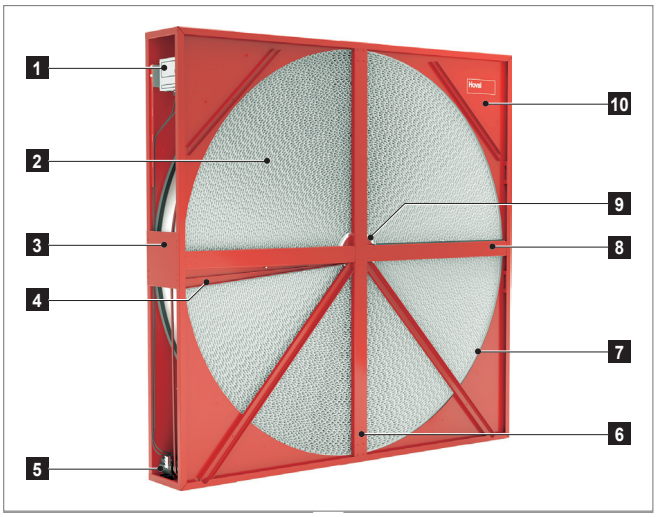
Definition of the heat recovery efficiency
$\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$

Definition of the moisture recovery efficiency
$\eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$

2 Construction

Rotary heat exchangers consist of the following components:

- Wheel:
  consisting of storage mass, shaft, bearing and hub
- Casing:
  with seals and purge sector
- Drive system:
  consisting of belt, drive motor, controller and rotation guard; see Part F “Drive systems”



1	Controller	6	Support foot
2	Storage mass	7	Radial seal
3	Side wall	8	Middle beam
4	Purge sector	9	Hub
5	Drive motor	10	End wall

Fig. C2: Structure of rotary heat exchanger

2.1 Wheel

The storage mass consists of aluminium foil. A smooth and a corrugated foil are wound on top of each other to form a wheel of sinusoidal channels. Warm air and cold air flow through these alternately and thus transfer the heat between the 2 air flows.

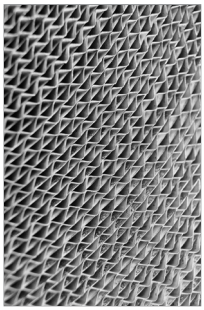


Fig. C3:
Structure of the storage mass

The wheel is fixed at the circumference by a jacket plate. Spokes between the jacket plate and hub provide high stability.
The installed exchanger area is decisive for the efficiency of the wheel. Hoval therefore offers storage masses with different wave heights, wave lengths and wheel depths so that an optimum solution can be used for each project according to the boundary conditions.

Condensation wheels are available in different designs for use in various application areas:

Design ST1
The storage mass consists of untreated aluminium with internal spokes between the jacket plate and hub. The exchangers are ideally suited for use in ventilation units for residential buildings, offices, hotels, etc.

Design ST3 (Viskan)
The storage mass consists of untreated aluminium with external spokes between the jacket plate and hub. The exchangers are ideally suited for use in ventilation units for residential buildings, offices, hotels, etc.

Notice
Exchangers of design ST1 and ST3 consist of the same materials, but exchangers of design ST3 are optimised in terms of efficiency and pressure drop.

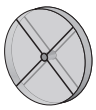
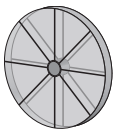
External spokes	Wheel diameter
	500 … 750
	751 … 1449
	1450 … 2099

Table C1: Arrangement of external spokes in the inflow surface of the storage mass (design ST3, dimensions in mm)

Design SC1
The storage mass consists of an epoxy coated aluminium foil with internal spokes between the jacket plate and hub. The coating provides better protection against corrosion. In addition, a paint finish protects the inflow surface from corrosion. The exchangers are mainly used in industrial applications.

2.2 Casing

The casings are designed for installation in ventilation units. The casing size can be selected as required in steps of 1 mm for optimum adjustment to the installation situation.

- The design is very space saving. The minimum dimension is only slightly larger than the wheel diameter in each case.
- The robust construction gives the exchanger high stability and tightness.
- Brush seals are used for the radial seal and the seal between the air flows along the middle beams. They are easy to replace if necessary.
- The purge sector prevents the supply air flow from being contaminated by extract air. It is easy to remove and can also be reinstalled in another position.
- The drive motor is installed at a selectable position in the casing. The controller is mounted on rails. Its position can be adjusted in height in the upper or lower half of the casing.
- The position of the wheel in the casing is adjustable by means of adjusting screws (SM casing from wheel Ø 1800 mm, all SP and PR casings).

Different casing types are available depending on whether the wheel is supplied in 1-piece or segmented form, and depending on the wheel diameter:

SM casing
- Sheet-metal casing for 1-piece wheels
- The exchangers are delivered fully assembled.

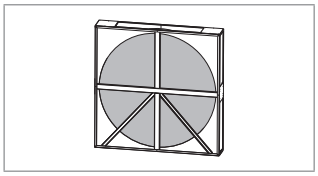


Fig. C4:
Delivery SM casing

SP casing
- Sheet-metal casing for segmented wheels
- The casings are delivered in 2 parts; the wheel segments are delivered in separate packaging.

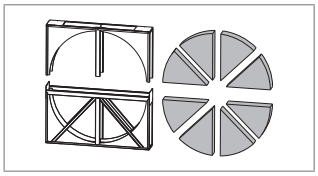


Fig. C5:
Delivery SP casing

PR casing
- Profile casing for segmented wheels
- The casings are delivered in 2 parts; the wheel segments are delivered in separate packaging.

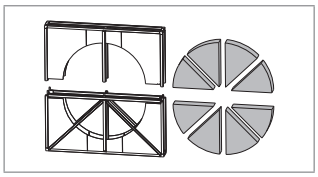


Fig. C6:
Delivery PR casing

Notice
SP casings or PR casings are available for many segmented wheels. SP casings are the less expensive variant. PR casings have the advantage that the frame profiles offer space for insulation panels provided by the customer. They can also be used as connection casings and directly mounted on air handling units or ducts.

3 Specification text

Condensation wheel

Rotary heat exchanger for heat and moisture transmission; suitable for optimum dimensioning in accordance with VDI guideline 3803 sheet 5.

Wheel
The storage mass consists of corrugated and smooth aluminium foil wrapped in layers. The result is small sinusoidal ducts for laminar flow of air. The outside of the storage mass is supported by the wheel mantle; the hub is inside with the permanently lubricated, maintenance-free ball bearings and the shaft. The wheel is permanently stabilised by spokes between the wheel mantle and hub.

Design
- ST1, ST3 (Viskan): Storage mass consisting of untreated aluminium
- SC1: Storage mass consisting of epoxy-coated aluminium foil (corrosion-protected)

Wheel orientation
- V: Rotary heat exchanger for vertical installation
- H: Rotary heat exchanger for horizontal installation (not available for design ST3)

Casing
- SM sheet metal casing for 1-piece wheels: self-supporting construction made of magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.
- SP sheet metal casing for segmented wheels: self-supporting construction made of magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.
- PR profile casing for segmented wheels, constructed from extruded aluminium sections clad with magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.

Drive system
- Variable drive system with performance control; consisting of motor and associated controller for infinitely variable adjustment of the speed depending on the input signal. The controllers, motors, gear units, pulleys and V-belts used are optimally matched to one another; transmission ratios are set so that the wheel reaches the optimum speed.

- Constant drive without performance control. The motors, gear units, pulleys and V-belts used each are optimally matched to one another; transmission ratios are set so that the wheel reaches the optimum speed.

Application limits

- Temperature resistance without controller: −20 … 50 °C
- Temperature resistance with controller: −20 … 45 °C
- Pressure difference between the air flows max. 1000 Pa
- Pressure difference to outside max. 1000 Pa
- Pressure drop 1-piece wheels depends on the wheel diameter and changes linearly between:
  Ø 500 mm → max. 400 Pa
  Ø 2600 mm → max. 300 Pa
- Pressure drop segmented wheels max. 400 Pa

Options

- Inspection port: Access to the drive system through the end walls of the casing, from wheel Ø 1000 mm for visual inspection, from wheel Ø 1350 mm also motor replacement possible
- Corrosion protection: casing powder-coated in RAL 9006 colour white aluminium
- Controller loose: controller is supplied loose for customer installation outside the rotary heat exchanger
- Corrosion protection air inlet: inflow surface of storage mass painted, colour RAL 7032 pebble grey (standard for SC1 design)
- Closed side walls: casing with side walls on all sides; surface of the panels according to the selected surface quality of the casing
- Cable bushing: 2 cable glands each mounted in the 2 end walls of the casing
- Half mounted: lower half of the segmented wheel pre-mounted at the factory; upper half of casing, drive system, seals and remaining wheel segments supplied separately for customer mounting
- Cable length 3 m: connection cable for motor
- Cable length 6 m: connection cable for motor
- Rotation guard RG2: with 2-core cable (standard for the drive system V1)
- Rotation guard RG3: with 3-core cable
- Pulley 75 Hz: transmission ratio configured for motor input frequency 75 Hz for an optimum speed
- Eccentricity: wheel shaft offset in height
- Stronger packaging for sea freight or airfreight

4 Technical data

4.1 Application limits

Condensation wheels				
Temperature				
without controller			−20 … 50	°C
with controller			−20 … 45	°C
Pressure difference between the air flows		max.	1000	Pa
Pressure difference to outside		max.	1000	Pa
Pressure drop				
1-piece wheels [1]	Ø 500 mm	max.	400	Pa
	Ø 2600 mm	max.	300	Pa
Segmented wheels		max.	400	Pa

[1] The maximum permissible pressure drop depends on the wheel diameter and changes linearly between the values given here (calculation with Hoval CASER).

Table C2: Application limits

4.2 Sound attenuation

Frequency [Hz]	63	125	250	500	1000	2000	4000	8000
Condensation wheel	3	3	4	3	4	5	6	10

Table C3: Insertion attenuation L_W (values in dB)

4.3 Specification of material for components

Storage mass	
Design ST1, ST3	Aluminium
Design SC1	Aluminium epoxy-coated
Shaft	Steel
Bearing	Permanently lubricated ball bearings (FAG, SKF)
Hub	
1-piece wheels	Aluminium
Segmented wheels	Steel
Cover	Steel magnesium-zinc-coated
Red V-belt	PE, covering fabric
Green V-belt	PET, covering fabric
Screws	Galvanised steel
Bolts	Aluminium / steel
Brush seal	PP

Table C4: Specification of material

4.4 Specification of material for casing

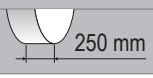
SM casing			
 200 mm	**Ø 500 … 1099**	**Ø 1100 … 1799**	**Ø 1800 … 2600**
 250 mm	**Ø 500 … 1099**	**Ø 1100 … 1499**	**Ø 1500 … 2000**
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)
Support foot 90°	–	Canted galvanised sheet steel (U-section)	Canted galvanised sheet steel (U-section)
Support foot 45°	–	–	Canted galvanised sheet steel (U-section)

Table C5: Specification of material for SM casing

SP casing		
 200 mm	**Ø 950 … 1799**	**Ø 1800 … 2600**
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)
Support foot 90°	Canted galvanised sheet steel (U-section)	Canted galvanised sheet steel (U-section)
Support foot 45°	–	Canted galvanised sheet steel (U-section)

Table C6: Specification of material for SP casing

PR casing		
 200 mm	**Ø 2000 … 2599**	**Ø 2600 … 4200**
Frame	Connected aluminium sections	Connected aluminium sections
Frame corners	Aluminium	Aluminium
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Aluminium section	Aluminium section
Support foot 90°	Aluminium section	Aluminium section
Support foot 45°	–	Canted galvanised sheet steel (U-section)

Table C7: Specification of material for PR casing

4.5 Exchanger dimensions

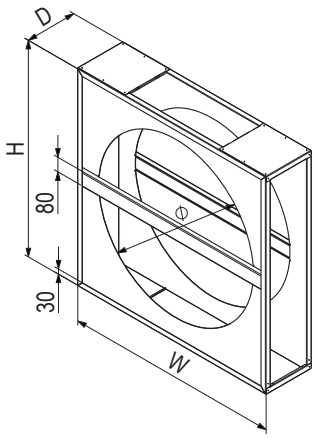
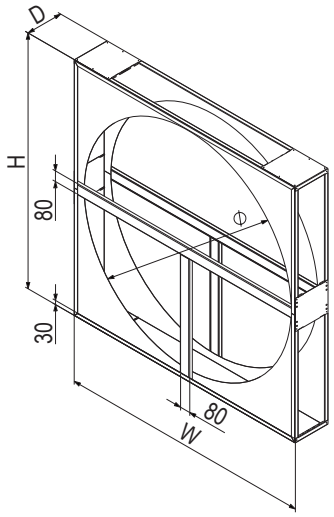
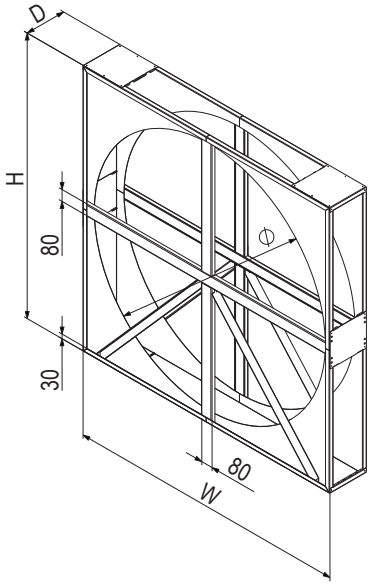
200	**Ø 500 ... 1099**	D = 290	**Ø 1100 ... 1799**	D = 290	**Ø 1800 ... 2600**	D = 290
250	**Ø 500 ... 1099**	D = 340	**Ø 1100 ... 1499**	D = 340	**Ø 1500 ... 2000**	D = 340
SM	 Installation position E1-P4		 Installation position E1-P4			

Fig. C7: Dimensional drawing for SM casing (dimensions in mm)

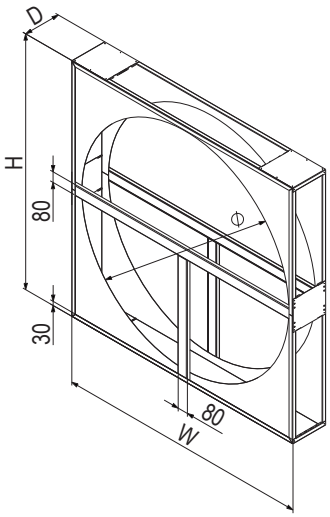
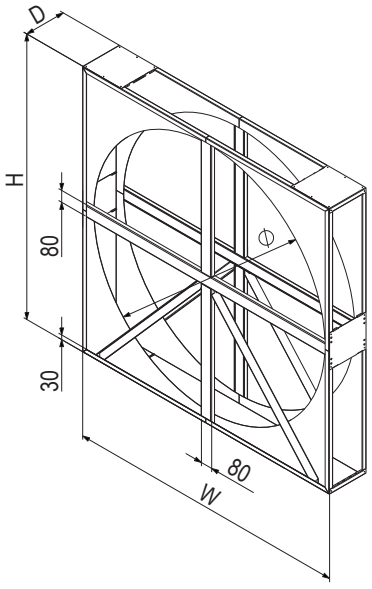
200	**Ø 950 ... 1799**	D = 290	**Ø 1800 ... 2600**	D = 290
SP	 Installation position E1-H4			

Fig. C8: Dimensional drawing for SP casing (dimensions in mm)

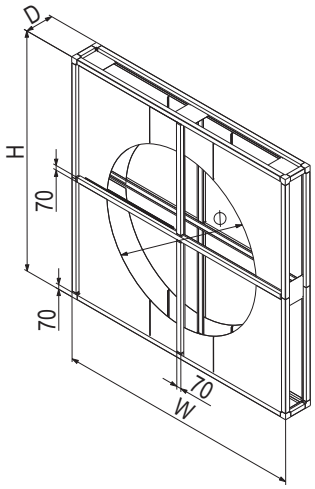
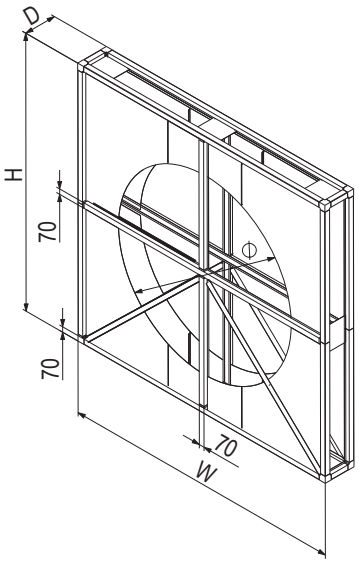
200	Ø 2000 ... 2599	D = 430	Ø 2600 ... 4200	D = 430
PR				

Fig. C9: Dimensional drawing for PR casing (dimensions in mm)

4.6 Casing adaptation

Casing height and width can be selected as required. If the selected casing size is substantially larger than the minimum size, the following applies to sheet metal casings:

- Boxes are attached to the wheel casing.
- Drive motor and controller are installed in the actual wheel casing, not in the box.
- The boxes are open and allow easy access from the side.

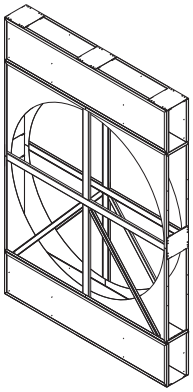
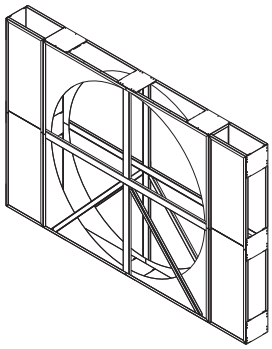
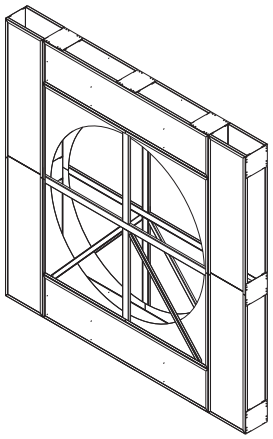
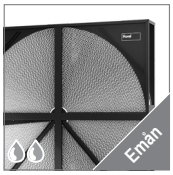
SM SP			

Fig. C10: Adaptation of the casing size with boxes



Enthalpy wheels

Rotary heat exchanger for use in comfort ventilation systems, with moisture transfer even in the transition period

1 Use 22
2 Construction. 22
3 Specification text. 24
4 Technical data 25

1 Use

Hoval rotary heat exchangers are energy recovery units for installation in ventilation and air-conditioning units and for process engineering applications. They are available in different sizes, suitable for air flow rates from approx. 200 to 150 000 m³/h.

The heat exchangers in the design as enthalpy wheel (Emån) are built for use in comfort ventilation systems. Their storage mass is partially coated with a hydrophilic material. Therefore, they transfer moisture between the air flows both in winter and in the transition period.

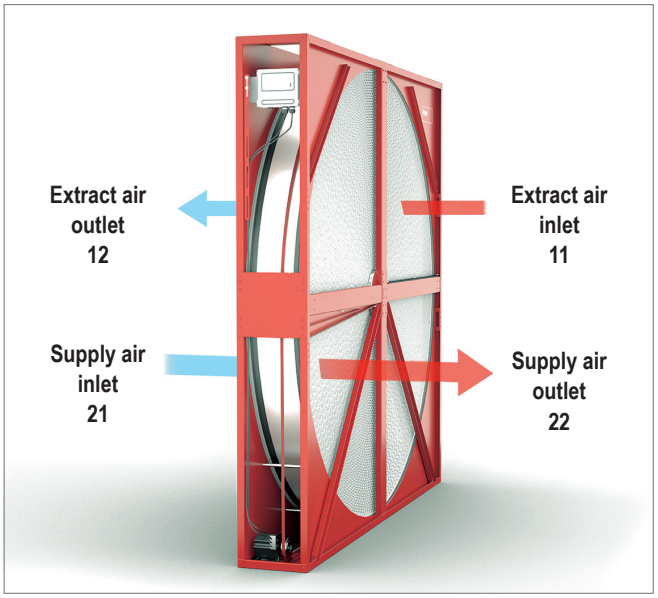


Fig. D1: Air ducting through rotary heat exchangers

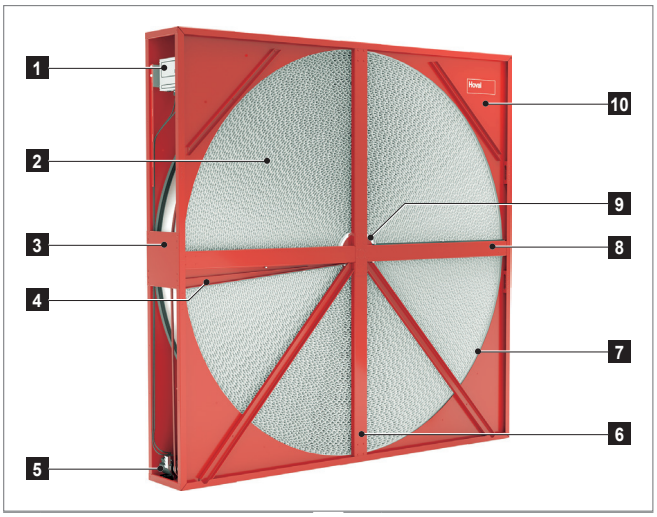
Definition of temperature efficiency
$\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$

Definition of the moisture recovery efficiency
$\eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$

2 Construction

Rotary heat exchangers consist of the following components:

- Wheel:
  consisting of storage mass, shaft, bearing and hub
- Casing:
  with seals and purge sector
- Drive system:
  consisting of belt, drive motor, controller and rotation guard; see Part F “Drive systems”



1	Controller	6	Support foot
2	Storage mass	7	Radial seal
3	Side wall	8	Middle beam
4	Purge sector	9	Hub
5	Drive motor	10	End wall

Fig. D2: Structure of rotary heat exchanger

2.1 Wheel

The storage mass consists of aluminium foil. A smooth and a corrugated foil are wound on top of each other to form a wheel of sinusoidal channels. Warm air and cold air flow through these alternately and thus transfer the heat between the 2 air flows.

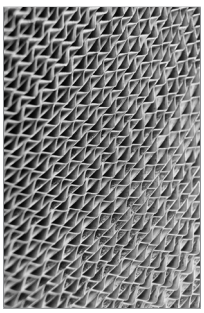


Fig. D3:
Structure of the storage mass

The wheel is fixed at the circumference by a jacket plate. Internal spokes between the jacket plate and hub provide high stability.
The installed exchanger area is decisive for the efficiency of the wheel. Hoval therefore offers storage masses with different wave heights, wave lengths and wheel depths so that an optimum solution can be used for each project according to the boundary conditions.

Design SE3 (Emån)
2 different aluminium foils are used for the production of the storage mass. The corrugated foil is untreated, the smooth foil is coated with molecular sieve 3 Å. The exchangers are ideally suited for use in comfort ventilation units for homes, offices, hotels, etc. The higher air humidity thanks to improved moisture transfer improves the room climate.

2.2 Casing

The casings are designed for installation in ventilation units. The casing size can be selected as required in steps of 1 mm for optimum adjustment to the installation situation.

- The design is very space saving. The minimum dimension is only slightly larger than the wheel diameter in each case.
- The robust construction gives the exchanger high stability and tightness.
- Brush seals are used for the radial seal and the seal between the air flows along the middle beams. They are easy to replace if necessary.
- The purge sector prevents the supply air flow from being contaminated by extract air. It is easy to remove and can also be reinstalled in another position.
- The drive motor is installed at a selectable position in the casing. The controller is mounted on rails. Its position can be adjusted in height in the upper or lower half of the casing.
- The position of the wheel in the casing is adjustable by means of adjusting screws (SM casing from wheel Ø 1800 mm, all SP and PR casings).

Different casing types are available depending on whether the wheel is supplied in 1-piece or segmented form, and depending on the wheel diameter:

SM casing
- Sheet-metal casing for 1-piece wheels
- The exchangers are delivered fully assembled.

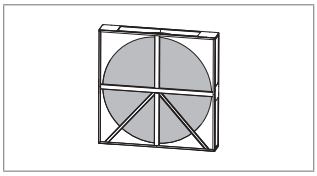


Fig. D4:
Delivery SM casing

SP casing
- Sheet-metal casing for segmented wheels
- The casings are delivered in 2 parts; the wheel segments are delivered in separate packaging.

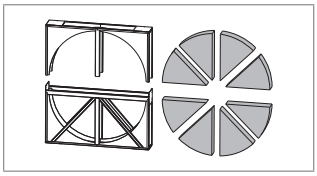


Fig. D5:
Delivery SP casing

PR casing
- Profile casing for segmented wheels
- The casings are delivered in 2 parts; the wheel segments are delivered in separate packaging.

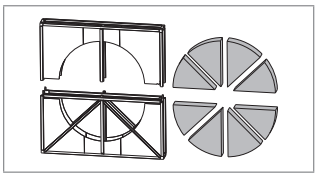


Fig. D6:
Delivery PR casing

Notice
SP casings or PR casings are available for many segmented wheels. SP casings are the less expensive variant. PR casings have the advantage that the frame profiles offer space for insulation panels provided by the customer. They can also be used as connection casings and directly mounted on air handling units or ducts.

3 Specification text

Enthalpy wheel

Rotary heat exchanger for heat and moisture transmission; suitable for optimum dimensioning in accordance with VDI guideline 3803 sheet 5.

Wheel
The storage mass consists of corrugated and smooth aluminium foil wrapped in layers. The result is small sinusoidal ducts for laminar flow of air. The outside of the storage mass is supported by the wheel mantle; the hub is inside with the permanently lubricated, maintenance-free ball bearings and the shaft. The wheel is permanently stabilised by internal spokes between the wheel mantle and hub.

Design
- SE3 (Emån): storage mass consisting of 2 aluminium foils: corrugated foil untreated, smooth foil coated with molecular sieve 3 Å

Wheel orientation
- V: Rotary heat exchanger for vertical installation
- H: Rotary heat exchanger for horizontal installation

Casing
- SM sheet metal casing for 1-piece wheels: self-supporting construction made of magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.
- SP sheet metal casing for segmented wheels: self-supporting construction made of magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.
- PR profile casing for segmented wheels, constructed from extruded aluminium sections clad with magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.

Drive system
- Variable drive system with performance control; consisting of motor and associated controller for infinitely variable adjustment of the speed depending on the input signal. The controllers, motors, gear units, pulleys and V-belts used are optimally matched to one another; transmission ratios are set so that the wheel reaches the optimum speed.
- Constant drive without performance control. The motors, gear units, pulleys and V-belts used each are optimally matched to one another; transmission ratios are set so that the wheel reaches the optimum speed.

Application limits
- Temperature resistance without controller: −20 … 50 °C
- Temperature resistance with controller: −20 … 45 °C
- Pressure difference between the air flows max. 1000 Pa
- Pressure difference to outside max. 1000 Pa
- Pressure drop 1-piece wheels depends on the wheel diameter and changes linearly between:
  Ø 500 mm → max. 400 Pa
  Ø 2600 mm → max. 300 Pa
- Pressure drop segmented wheels max. 400 Pa

Options
- Inspection port: Access to the drive system through the end walls of the casing, from wheel Ø 1000 mm for visual inspection, from wheel Ø 1350 mm also motor replacement possible
- Corrosion protection: casing powder-coated in RAL 9006 colour white aluminium
- Controller loose: controller is supplied loose for customer installation outside the rotary heat exchanger
- Corrosion protection air inlet: inflow surface of storage mass painted, colour RAL 7032 pebble grey
- Closed side walls: casing with side walls on all sides; surface of the panels according to the selected surface quality of the casing
- Cable bushing: 2 cable glands each mounted in the 2 end walls of the casing
- Half mounted: lower half of the segmented wheel pre-mounted at the factory; upper half of casing, drive system, seals and remaining wheel segments supplied separately for customer mounting
- Cable length 3 m: connection cable for motor
- Cable length 6 m: connection cable for motor
- Rotation guard RG2: with 2-core cable (standard for the drive system V1)
- Rotation guard RG3: with 3-core cable
- Pulley 75 Hz: transmission ratio configured for motor input frequency 75 Hz for an optimum speed
- Eccentricity: wheel shaft offset in height
- Stronger packaging for sea freight or airfreight

4 Technical data

4.1 Application limits

Enthalpy wheels				
Temperature				
without controller			−20 … 50	°C
with controller			−20 … 45	°C
Pressure difference between the air flows		max.	1000	Pa
Pressure difference to outside		max.	1000	Pa
Pressure drop				
1-piece wheels [1]	Ø 500 mm	max.	400	Pa
	Ø 2600 mm	max.	300	Pa
Segmented wheels		max.	400	Pa

[1] The maximum permissible pressure drop depends on the wheel diameter and changes linearly between the values given here (calculation with Hoval CASER).

Table D1: Application limits

4.2 Sound attenuation

Frequency [Hz]	63	125	250	500	1000	2000	4000	8000
Enthalpy wheel	3	3	4	3	4	5	6	10

Table D2: Insertion attenuation L_W (values in dB)

4.3 Specification of material for components

Storage mass	
Design SE3	Aluminium, untreated and coated with molecular sieve 3 Å
Shaft	Steel
Bearing	Permanently lubricated ball bearings (FAG, SKF)
Hub	
1-piece wheels	Aluminium
Segmented wheels	Steel
Cover	Steel magnesium-zinc-coated
Red V-belt	PE, covering fabric
Green V-belt	PET, covering fabric
Screws	Galvanised steel
Bolts	Aluminium / steel
Brush seal	PP

Table D3: Specification of material

4.4 Specification of material for casing

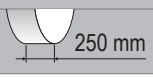
SM casing			
 200 mm	**Ø 500 … 1099**	**Ø 1100 … 1799**	**Ø 1800 … 2600**
 250 mm	**Ø 500 … 1099**	**Ø 1100 … 1499**	**Ø 1500 … 2000**
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)
Support foot 90°	–	Canted galvanised sheet steel (U-section)	Canted galvanised sheet steel (U-section)
Support foot 45°	–	–	Canted galvanised sheet steel (U-section)

Table D4: Specification of material for SM casing

SP casing		
 200 mm	**Ø 950 … 1799**	**Ø 1800 … 2600**
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)
Support foot 90°	Canted galvanised sheet steel (U-section)	Canted galvanised sheet steel (U-section)
Support foot 45°	–	Canted galvanised sheet steel (U-section)

Table D5: Specification of material for SP casing

PR casing		
 200 mm	**Ø 2000 … 2599**	**Ø 2600 … 4200**
Frame	Connected aluminium sections	Connected aluminium sections
Frame corners	Aluminium	Aluminium
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Aluminium section	Aluminium section
Support foot 90°	Aluminium section	Aluminium section
Support foot 45°	–	Canted galvanised sheet steel (U-section)

Table D6: Specification of material for PR casing

4.5 Exchanger dimensions

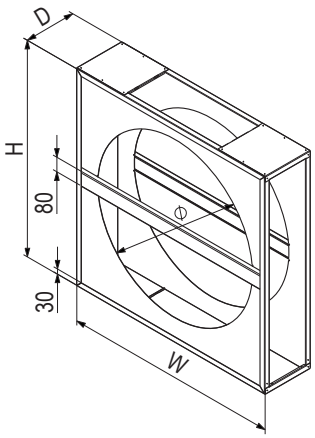
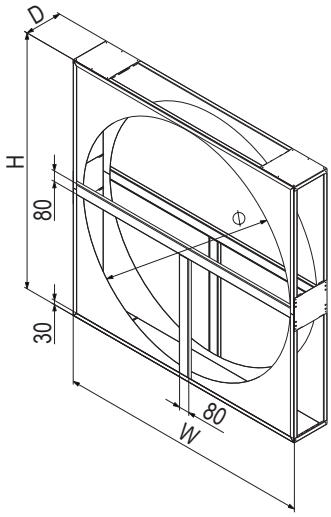
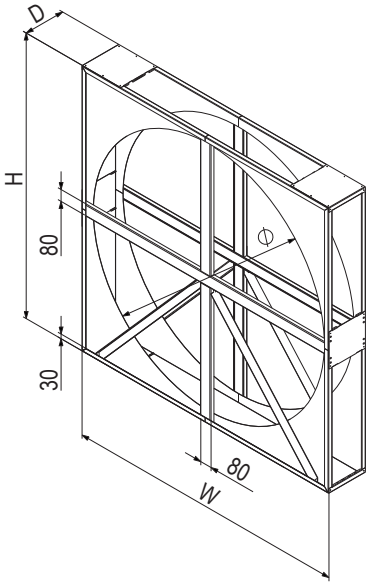
200	**Ø 500 ... 1099**	D = 290	**Ø 1100 ... 1799**	D = 290	**Ø 1800 ... 2600**	D = 290
250	**Ø 500 ... 1099**	D = 340	**Ø 1100 ... 1499**	D = 340	**Ø 1500 ... 2000**	D = 340
SM	 Installation position E1-P4		 Installation position E1-P4			

Fig. D7: Dimensional drawing for SM casing (dimensions in mm)

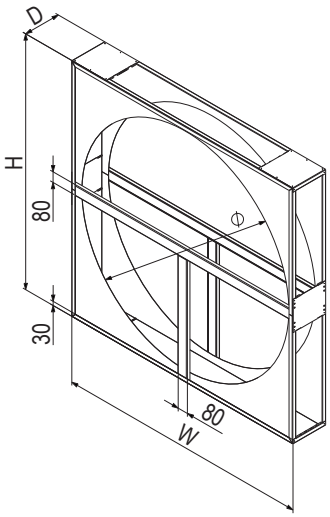
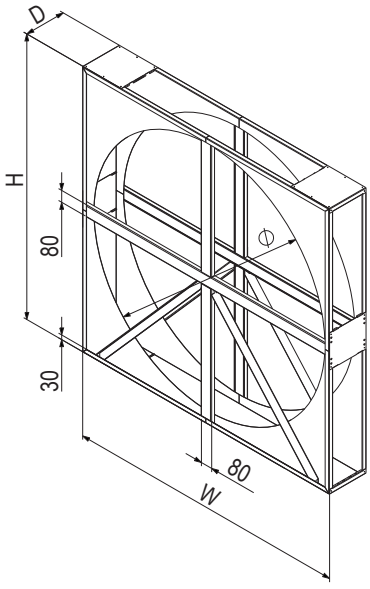
200	**Ø 950 ... 1799**	D = 290	**Ø 1800 ... 2600**	D = 290
SP	 Installation position E1-H4			

Fig. D8: Dimensional drawing for SP casing (dimensions in mm)

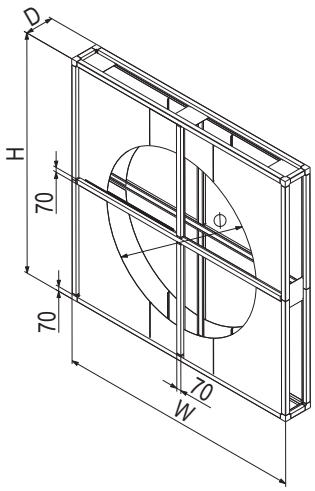
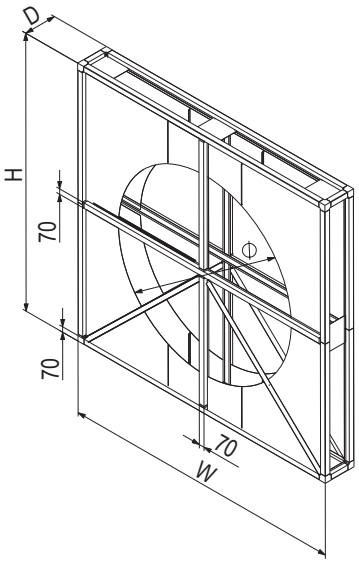
200	Ø 2000 ... 2599	D = 430	Ø 2600 ... 4200	D = 430
PR				

Fig. D9: Dimensional drawing for PR casing (dimensions in mm)

4.6 Casing adaptation

Casing height and width can be selected as required. If the selected casing size is substantially larger than the minimum size, the following applies to sheet metal casings:

- Boxes are attached to the wheel casing.
- Drive motor and controller are installed in the actual wheel casing, not in the box.
- The boxes are open and allow easy access from the side.

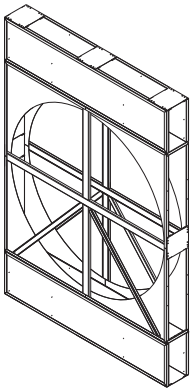
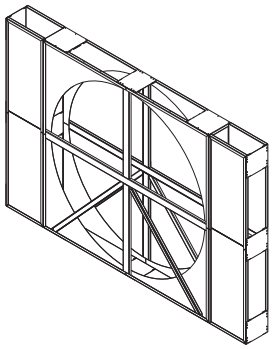
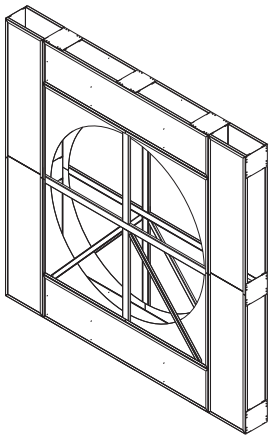
SM SP			

Fig. D10: Adaptation of the casing size with boxes



Sorption wheels

Rotary heat exchanger for use in ventilation systems with mechanical cooling, with moisture transfer all year round

1 Use 30
2 Construction. 30
3 Specification text. 32
4 Technical data 33

1 Use

Hoval rotary heat exchangers are energy recovery units for installation in ventilation and air-conditioning units and for process engineering applications. They are available in different sizes, suitable for air flow rates from approx. 200 to 150 000 m³/h.

The heat exchangers in the design as sorption wheel are built for use in ventilation systems with mechanical cooling. Their storage mass is largely or even completely coated with a hydrophilic material. Therefore, they transfer moisture between the air flows all year round.

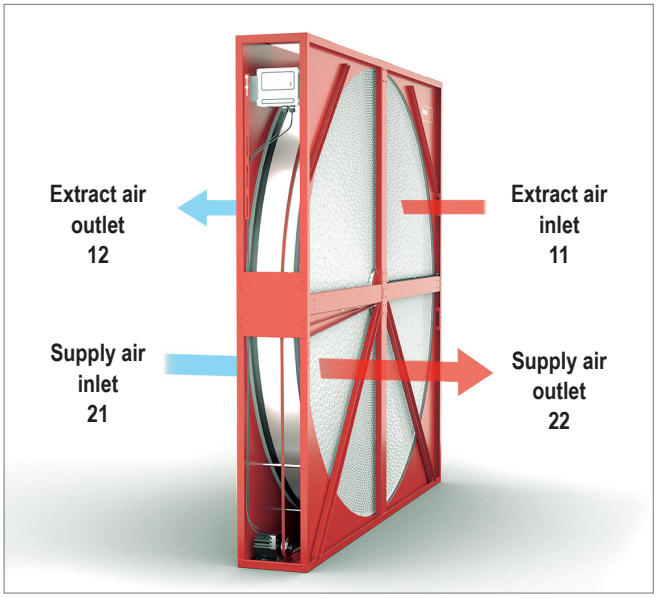


Fig. E1: Air ducting through rotary heat exchangers

Definition of temperature efficiency

$$\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$$

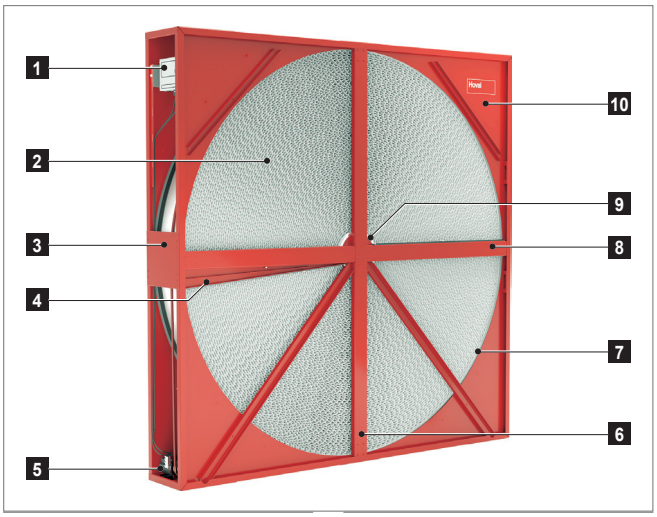
Definition of the moisture recovery efficiency

$$\eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$$

2 Construction

Rotary heat exchangers consist of the following components:

- Wheel:
  consisting of storage mass, shaft, bearing and hub
- Casing:
  with seals and purge sector
- Drive system:
  consisting of belt, drive motor, controller and rotation guard; see Part F “Drive systems”



1	Controller	6	Support foot
2	Storage mass	7	Radial seal
3	Side wall	8	Middle beam
4	Purge sector	9	Hub
5	Drive motor	10	End wall

Fig. E2: Structure of rotary heat exchanger

2.1 Wheel

The storage mass consists of aluminium foil. A smooth and a corrugated foil are wound on top of each other to form a wheel of sinusoidal channels. Warm air and cold air flow through these alternately and thus transfer the heat between the 2 air flows.

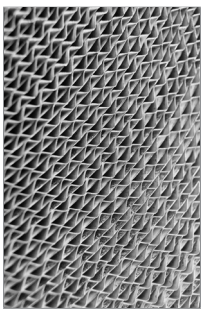


Fig. E3:
Structure of the storage mass

The wheel is fixed at the circumference by a jacket plate. Internal spokes between the jacket plate and hub provide high stability.
The installed exchanger area is decisive for the efficiency of the wheel. Hoval therefore offers storage masses with different wave heights, wave lengths and wheel depths so that an optimum solution can be used for each project according to the boundary conditions.

Sorption wheels are available in 2 material variants for use in various application areas:

Design SH1
2 different aluminium foils are used for the production of the storage mass. The corrugated foil is coated with molecular sieve 3 Å, the smooth foil is untreated. The exchangers achieve very high moisture efficiencies (> 55%) and are mainly used in ventilation systems with mechanical cooling.

Design HM1 (Muonio)
The aluminium foil used for the storage mass is completely coated with molecular sieve 3 Å. This makes Muonio exchangers a high-performance model. They are ideally suited for use in ventilation systems with mechanical cooling. The sorption coating guarantees maximum moisture efficiency throughout the year (> 70%). In summer operation the supply air is dried. The cooling requirement to be covered by a chiller is considerably reduced. This saves both investment costs and energy costs for cooling. In winter operation, moisture transfer improves the indoor climate.

2.2 Casing

The casings are designed for installation in ventilation units. The casing size can be selected as required in steps of 1 mm for optimum adjustment to the installation situation.

- The design is very space saving. The minimum dimension is only slightly larger than the wheel diameter in each case.
- The robust construction gives the exchanger high stability and tightness.
- Brush seals are used for the radial seal and the seal between the air flows along the middle beams. They are easy to replace if necessary.
- The purge sector prevents the supply air flow from being contaminated by extract air. It is easy to remove and can also be reinstalled in another position.
- The drive motor is installed at a selectable position in the casing. The controller is mounted on rails. Its position can be adjusted in height in the upper or lower half of the casing.
- The position of the wheel in the casing is adjustable by means of adjusting screws (SM casing from wheel Ø 1800 mm, all SP and PR casings).

Different casing types are available depending on whether the wheel is supplied in 1-piece or segmented form, and depending on the wheel diameter:

SM casing
- Sheet-metal casing for 1-piece wheels
- The exchangers are delivered fully assembled.

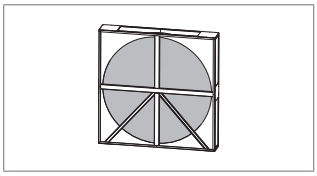


Fig. E4:
Delivery SM casing

SP casing
- Sheet-metal casing for segmented wheels
- The casings are delivered in 2 parts; the wheel segments are delivered in separate packaging.

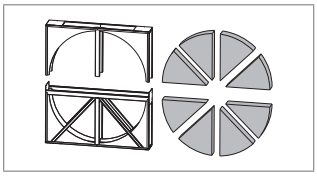


Fig. E5:
Delivery SP casing

PR casing
- Profile casing for segmented wheels
- The casings are delivered in 2 parts; the wheel segments are delivered in separate packaging.

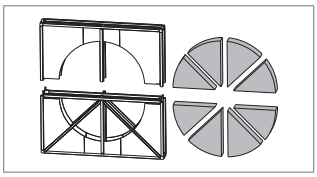


Fig. E6:
Delivery PR casing

Notice
SP casings or PR casings are available for many segmented wheels. SP casings are the less expensive variant. PR casings have the advantage that the frame profiles offer space for insulation panels provided by the customer. They can also be used as connection casings and directly mounted on air handling units or ducts.

3 Specification text

Sorption wheel

Rotary heat exchanger for heat and moisture transmission; suitable for optimum dimensioning in accordance with VDI guideline 3803 sheet 5.

Wheel
The storage mass consists of corrugated and smooth aluminium foil wrapped in layers. The result is small sinusoidal ducts for laminar flow of air. The outside of the storage mass is supported by the wheel mantle; the hub is inside with the permanently lubricated, maintenance-free ball bearings and the shaft. The wheel is permanently stabilised by internal spokes between the wheel mantle and hub.

Design
- SH1: storage mass consisting of 2 aluminium foils: smooth foil untreated, corrugated foil coated with molecular sieve 3 Å
- HM1 (Muonio): storage mass consisting of aluminium foil coated with molecular sieve 3 Å

Wheel orientation
- V: Rotary heat exchanger for vertical installation
- H: Rotary heat exchanger for horizontal installation

Casing
- SM sheet metal casing for 1-piece wheels: self-supporting construction made of magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.
- SP sheet metal casing for segmented wheels: self-supporting construction made of magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.
- PR profile casing for segmented wheels, constructed from extruded aluminium sections clad with magnesium-zinc-coated sheet steel, suitable for installation in air handling units, with easily exchangeable brush seals as radial seal and between the air flows, with purge sector to prevent carryover of the extract air into the supply air flow, silicone-free.

Drive system
- Variable drive system with performance control; consisting of motor and associated controller for infinitely variable adjustment of the speed depending on the input signal. The controllers, motors, gear units, pulleys and V-belts used are optimally matched to one another; transmission ratios are set so that the wheel reaches the optimum speed.
- Constant drive without performance control. The motors, gear units, pulleys and V-belts used each are optimally matched to one another; transmission ratios are set so that the wheel reaches the optimum speed.

Application limits
- Temperature resistance without controller: −20 … 50 °C
- Temperature resistance with controller: −20 … 45 °C
- Pressure difference between the air flows max. 1000 Pa
- Pressure difference to outside max. 1000 Pa
- Pressure drop 1-piece wheels depends on the wheel diameter and changes linearly between:
  Ø 500 mm → max. 400 Pa
  Ø 2600 mm → max. 300 Pa
- Pressure drop segmented wheels max. 400 Pa

Options
- Inspection port: Access to the drive system through the end walls of the casing, from wheel Ø 1000 mm for visual inspection, from wheel Ø 1350 mm also motor replacement possible
- Corrosion protection: casing powder-coated in RAL 9006 colour white aluminium
- Controller loose: controller is supplied loose for customer installation outside the rotary heat exchanger
- Corrosion protection air inlet: inflow surface of storage mass painted, colour RAL 7032 pebble grey
- Closed side walls: casing with side walls on all sides; surface of the panels according to the selected surface quality of the casing
- Cable bushing: 2 cable glands each mounted in the 2 end walls of the casing
- Half mounted: lower half of the segmented wheel pre-mounted at the factory; upper half of casing, drive system, seals and remaining wheel segments supplied separately for customer mounting
- Cable length 3 m: connection cable for motor
- Cable length 6 m: connection cable for motor
- Rotation guard RG2: with 2-core cable (standard for the drive system V1)
- Rotation guard RG3: with 3-core cable
- Pulley 75 Hz: transmission ratio configured for motor input frequency 75 Hz for an optimum speed
- Eccentricity: wheel shaft offset in height
- Stronger packaging for sea freight or airfreight

4 Technical data

4.1 Application limits

Sorption wheels				
Temperature				
without controller			−20 … 50	°C
with controller			−20 … 45	°C
Pressure difference between the air flows		max.	1000	Pa
Pressure difference to outside		max.	1000	Pa
Pressure drop				
1-piece wheels [1]	Ø 500 mm	max.	400	Pa
	Ø 2600 mm	max.	300	Pa
Segmented wheels		max.	400	Pa

[1] The maximum permissible pressure drop depends on the wheel diameter and changes linearly between the values given here (calculation with Hoval CASER).

Table E1: Application limits

4.2 Sound attenuation

Frequency [Hz]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Sorption wheel	3	3	4	4	5	6	7	11

Table E2: Insertion attenuation L_W (values in dB)

4.3 Specification of material for components

Storage mass	
Design SH1	Aluminium, untreated and coated with molecular sieve 3 Å
Design HM1	Aluminium coated with molecular sieve 3 Å
Shaft	Steel
Bearing	Permanently lubricated ball bearings (FAG, SKF)
Hub	
1-piece wheels	Aluminium
Segmented wheels	Steel
Cover	Steel magnesium-zinc-coated
Red V-belt	PE, covering fabric
Green V-belt	PET, covering fabric
Screws	Galvanised steel
Bolts	Aluminium / steel
Brush seal	PP

Table E3: Specification of material

4.4 Specification of material for casing

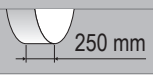
SM casing			
 200 mm	**Ø 500 … 1099**	**Ø 1100 … 1799**	**Ø 1800 … 2600**
 250 mm	**Ø 500 … 1099**	**Ø 1100 … 1499**	**Ø 1500 … 2000**
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)
Support foot 90°	–	Canted galvanised sheet steel (U-section)	Canted galvanised sheet steel (U-section)
Support foot 45°	–	–	Canted galvanised sheet steel (U-section)

Table E4: Specification of material for SM casing

SP casing		
 200 mm	**Ø 950 … 1799**	**Ø 1800 … 2600**
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Canted galvanised sheet steel (closed, double U-section)	Canted galvanised sheet steel (closed, double U-section)
Support foot 90°	Canted galvanised sheet steel (U-section)	Canted galvanised sheet steel (U-section)
Support foot 45°	–	Canted galvanised sheet steel (U-section)

Table E5: Specification of material for SP casing

PR casing		
 200 mm	**Ø 2000 … 2599**	**Ø 2600 … 4200**
Frame	Connected aluminium sections	Connected aluminium sections
Frame corners	Aluminium	Aluminium
Casing	Magnesium-zinc-coated sheet steel	Magnesium-zinc-coated sheet steel
Middle beam	Aluminium section	Aluminium section
Support foot 90°	Aluminium section	Aluminium section
Support foot 45°	–	Canted galvanised sheet steel (U-section)

Table E6: Specification of material for PR casing

4.5 Exchanger dimensions

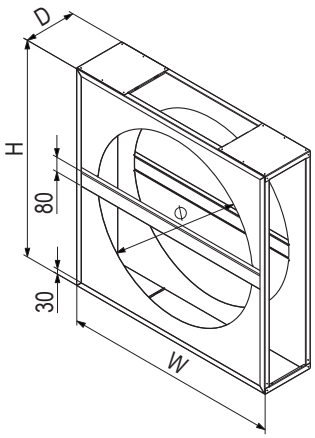
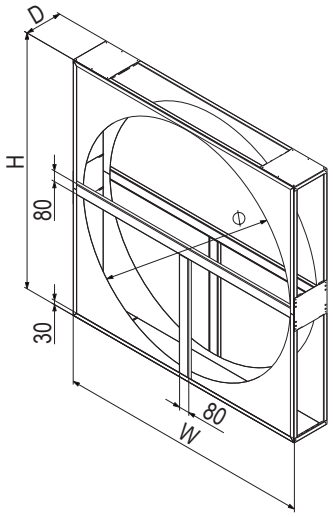
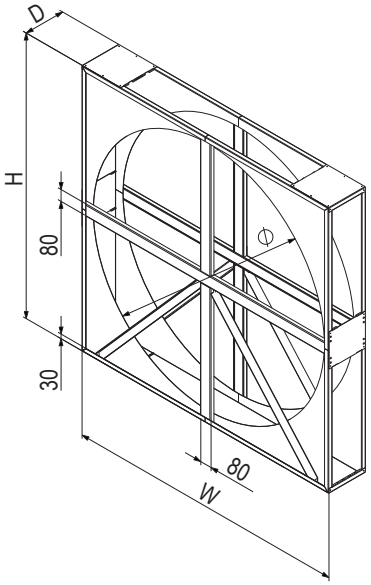
200	**Ø 500 ... 1099**	D = 290	**Ø 1100 ... 1799**	D = 290	**Ø 1800 ... 2600**	D = 290
250	**Ø 500 ... 1099**	D = 340	**Ø 1100 ... 1499**	D = 340	**Ø 1500 ... 2000**	D = 340
SM	 Installation position E1-P4		 Installation position E1-P4			

Fig. E7: Dimensional drawing for SM casing (dimensions in mm)

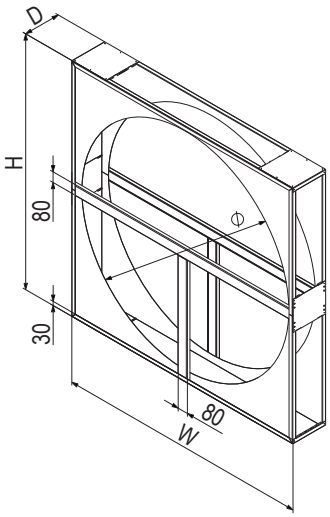
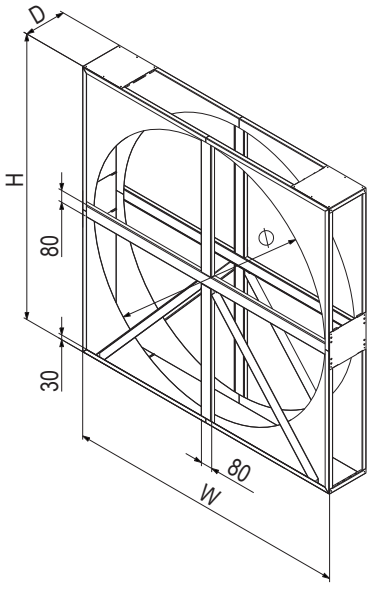
200	**Ø 950 ... 1799**	D = 290	**Ø 1800 ... 2600**	D = 290
SP	 Installation position E1-H4			

Fig. E8: Dimensional drawing for SP casing (dimensions in mm)

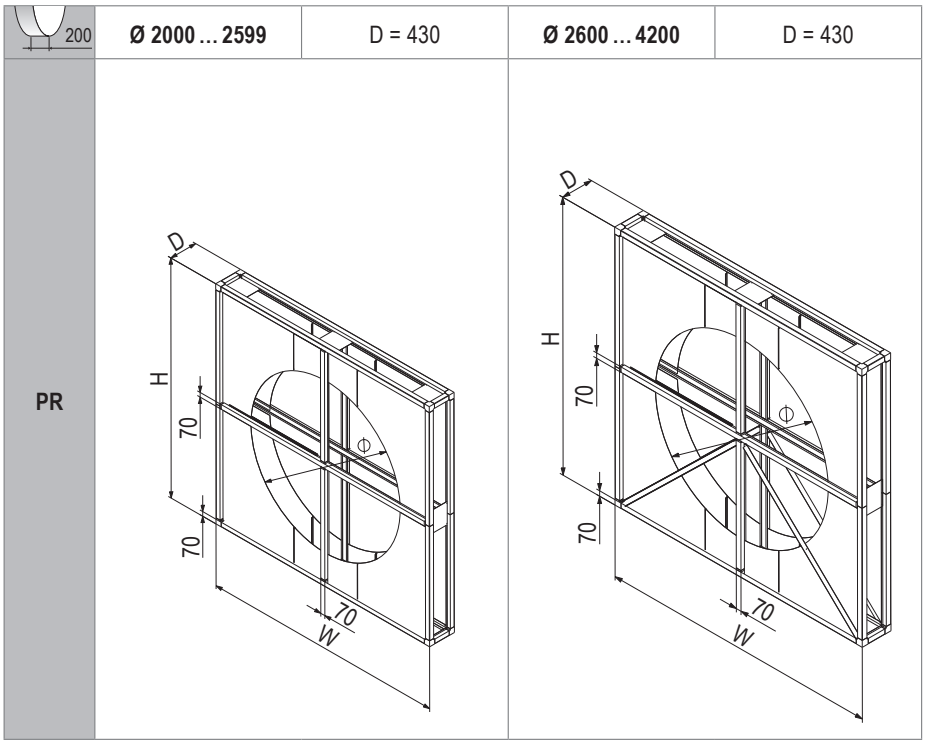


Fig. E9: Dimensional drawing for PR casing (dimensions in mm)

4.6 Casing adaptation

Casing height and width can be selected as required. If the selected casing size is substantially larger than the minimum size, the following applies to sheet metal casings:

- Boxes are attached to the wheel casing.
- Drive motor and controller are installed in the actual wheel casing, not in the box.
- The boxes are open and allow easy access from the side.

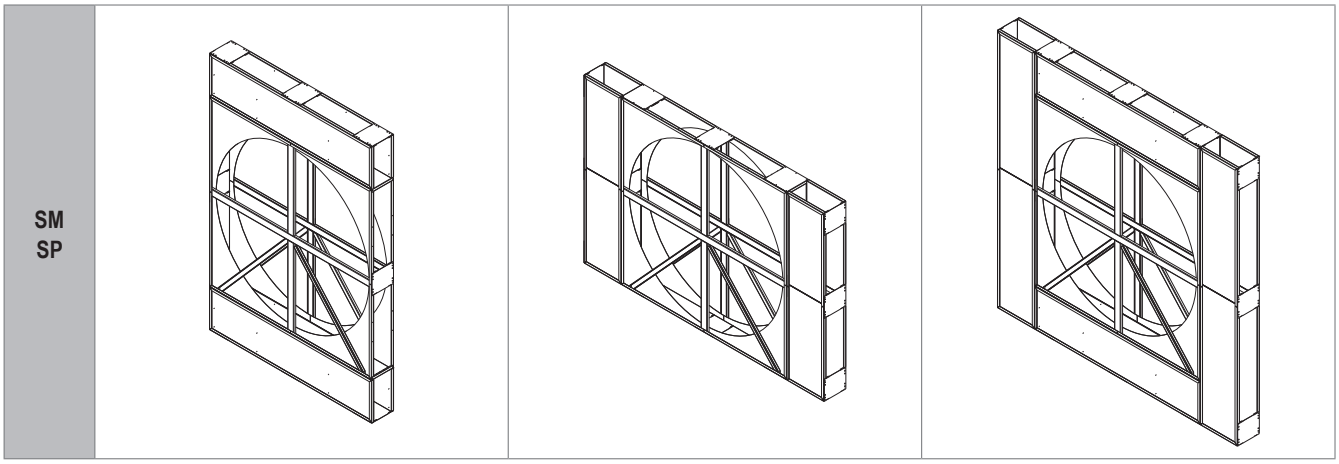


Fig. E10: Adaptation of the casing size with boxes



Drive systems

Drive motors and controllers for operation with variable or constant wheel speed

1 Variable drives 38
2 Constant drives 41
3 Air flow and motor position 43

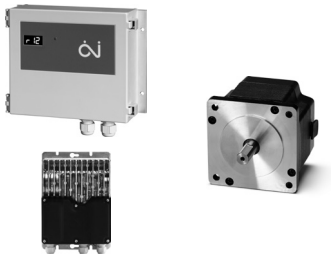
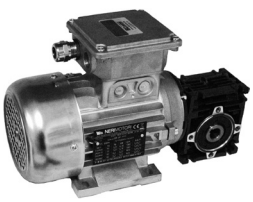
1 Variable drives

Variable drives permit continuous adjustment of the wheel speed, i.e. the performance of the energy recovery can be regulated.
A drive system consists of a controller, motor, gear unit, belt pulley and V-belt. The individual components are optimally matched to each other. The transmission ratio is dimensioned so that the wheel reaches the optimum speed.

Optimum speed	Design
approx. 12 rpm	ST1 ST3 SC1 SE3
approx. 20 rpm	SH1 HM1

Table F1: Optimum speed

1.1 Availability

System	Motor	Controller	Wiring [1]	Run monitoring	Figure
V1	3-phase motor with gear unit	MicroMax	yes	Rotation guard RG2 (Standard)	
	⚠ For the rotation guard to function correctly, the input signal to the controller must be at least 2 V.				
V6	Stepper motor without gear unit	VariMax 25 NG VariMax 50 NG VariMax 100 NG	yes	Internal electronic run monitoring	
V7	Stepper motor without gear unit	DRHX	yes	Internal electronic run monitoring	
V0	3-phase motor with gear unit	external	Connection cable optional	Rotation guard optional	
	■ Control via customer's frequency converter ■ Transmission ratio configured for 50 Hz ■ with thermal contact (BNC / Klixon) ⚠ The circuitry provided by the customer for the thermal contact must ensure that no automatic restart takes place after cooling down. ⚠ For the rotation guard to function correctly, the input signal to the controller must be at least 2 V.				

[1] The motor and rotation guard are prewired to the controller at the factory if the controller is mounted in the rotary heat exchanger.

Table F2: Available variable drives

Notice
According to the Ecodesign Regulation ErP 1253/2014, it is mandatory in the EU to equip rotary heat exchangers with speed control.

1.2 Technical data of drive motors for external controller

System	Type	Voltage	Frequency	Motor power	Current	Weight [1]
			Hz	W	A	kg
V0	SPG40-3V	3~ 220 V	50	40	0.39	3.4
	N56-3 [2]	Δ/Y 230/400 V	50	90	0.70 / 0.40	4.5
	N63-3 [2]	Δ/Y 230/400 V	50	180	1.00 / 0.57	5.4
	N71-3 [2]	Δ/Y 230/400 V	50	370	1.60 / 0.95	8.6
	N80-3 [2]	Δ/Y 230/400 V	50	750	3.30 / 1.90	14.3

[1] incl. gear unit
[2] Wired for Δ 3 × 230 V at delivery

Table F3: Technical data of drive motors for external controller

1.3 Technical data of controllers

Controller	V1 MicroMax	V6 VariMax		V7 DRHX	
Wheel Ø	Ø 500 … 4200 mm	for 12 rpm	for 20 rpm	for 12 rpm	for 20 rpm
		Ø 500 … 3899 mm	Ø 500 … 3000 mm	Ø 500 … 4200 mm	Ø 500 … 3600 mm
Operation indicator	LEDs (On, Alarm, Operation, Rotation)	LEDs (On, Alarm, Operation, Rotation)		Display [1] (Speed, Torque, Operation, Alarm, Text, Cleaning function)	
Cleaning function	10 s (every 30 min)	10 s (every 30 min)		10 s (every 10 min)	
Run monitoring	RG2	internal		internal	
Degree of protection	IP54	IP54		IP54	
Connection voltage	1 × 230 V, 50/60 Hz	1 × 230 V, 50/60 Hz		1 × 230 V, 50/60 Hz	
Output voltage	3 × 230 V	3 × 230 V		3 × 230 V	
Input signal	0-10 V	0-10 V		0-10 V	
Communication protocol	–	Modbus RTU RS485		Modbus RTU RS485	

[1] Except for model DRHX 690 W

Table F4: Technical data of controllers

F

1.4 Controller position

The drive motor is installed at a selectable position in the casing. Depending on the wheel design and diameter, the standard position of the controller is in the opposite or the same half of the casing.

The controller is mounted on rails. Its position can be adjusted in height in the upper or lower half of the casing.

Notice
For very small exchangers (Ø < 1100 mm) the rail is not required due to space reasons.

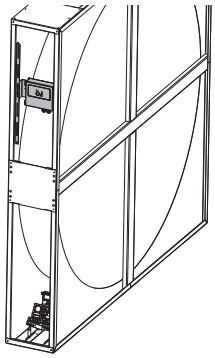
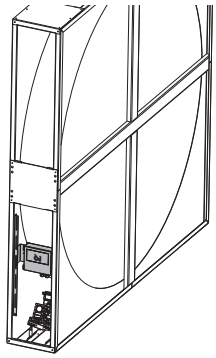
Wheel construction	1-piece	Segmented	Segmented
Wheel Ø	500 … 2600	950 … 1599	1600 … 4200
Controller position	opposite the motor		near the motor
Figure			

Table F5: Controller position

2 Constant drives

Constant drives operate with constant speed, i.e. the performance of the energy recovery cannot be regulated. A drive system consists of a motor, gear unit, belt pulley and V-belt. The individual components are optimally matched to each other. The transmission ratio is dimensioned so that the wheel reaches the optimum speed.

Optimum speed	Design
approx. 12 rpm	ST1 ST3 SC1 SE3
approx. 20 rpm	SH1 HM1

Table F6: Optimum speed

2.1 Availability

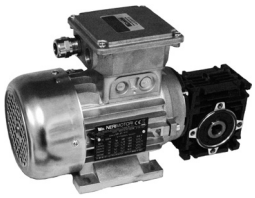
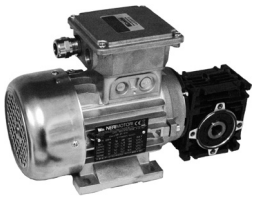
System	Motor	Connection	Cabling	Run monitoring	Figure
K1	1-phase motor with gear unit	1~ 230 V, 50 Hz	Connection cable optional	Rotation guard optional	
	■ Available for wheels up to max. Ø 1000 mm ■ Transmission ratio configured for motor input frequency 50 Hz				
K3	3-phase motor with gear unit	Δ/Y 230/400 V [1] 50 Hz	Connection cable optional	Rotation guard optional	
	■ Transmission ratio configured for motor input frequency 50 Hz ■ with thermal contact (BNC / Klixon) [1]				
K5	3-phase motor with gear unit	Δ/Y 230/400 V [1] 60 Hz	Connection cable optional	Rotation guard optional	
	■ Transmission ratio configured for motor input frequency 60 Hz ■ with thermal contact (BNC / Klixon) [1]				
⚠ The circuitry provided by the customer for the thermal contact must ensure that no automatic restart takes place after cooling down.					
[1] Except for SPG40-3K					

Table F7: Available constant drives

Notice
Rotary heat exchangers marked “WO” in the type code are supplied without drive components and without motor bracket, for customer installation of their own system.

F

2.2 Technical data of drive motors for constant drive

System	Type	Voltage	Frequency	Motor power	Current	Weight [1]
			Hz	W	A	kg
K1	SPG40-1K	1~ 230 V	50	40	0.37	3.1
K3	SPG40-3K	3~ 400 V	50	40	0.21	3.4
	N56-3 [2]	Δ/Y 230/400 V	50	90	0.70 / 0.40	4.5
	N63-3 [2]	Δ/Y 230/400 V	50	180	1.00 / 0.57	5.4
	N71-3 [2]	Δ/Y 230/400 V	50	370	1.60 / 0.95	8.6
	N80-3 [2]	Δ/Y 230/400 V	50	750	3.30 / 1.90	14.3
K5	SPG40-3K	3~ 400 V	60	40	0.21	3.4
	N56-3 [2]	Δ/Y 230/400 V	60	90	0.70 / 0.40	4.5
	N63-3 [2]	Δ/Y 230/400 V	60	180	1.20 / 0.66	5.4
	N71-3 [2]	Δ/Y 230/400 V	60	370	1.70 / 1.00	8.6
	N80-3 [2]	Δ/Y 230/400 V	60	750	3.30 / 2.00	14.3

[1] incl. gear unit
[2] Wired for Y 3 × 400 V at delivery

Table F8: Technical data of drive motors for constant drive

3 Air flow and motor position

The drive motor is installed at a selectable position in the casing. In order to locate the purge sector correctly, it is important to define the installation position of the exchanger precisely with regard to air flow and motor position.

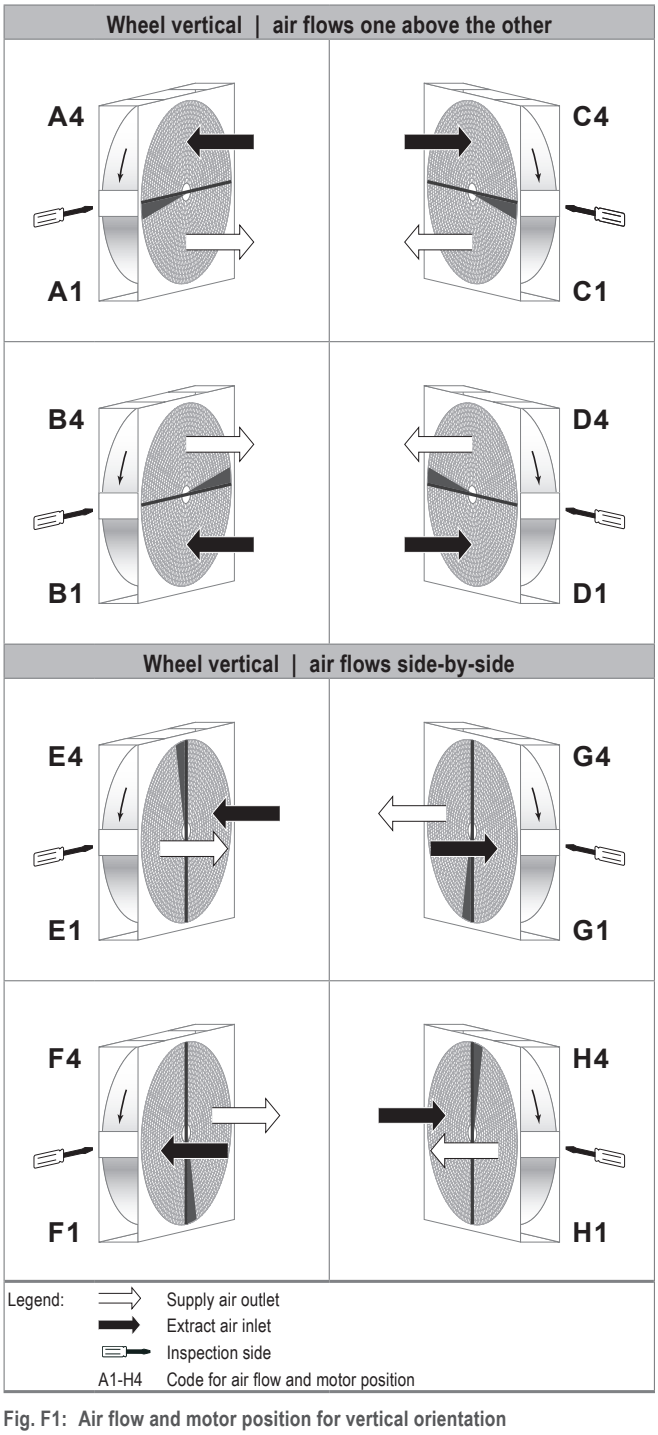


Fig. F1: Air flow and motor position for vertical orientation

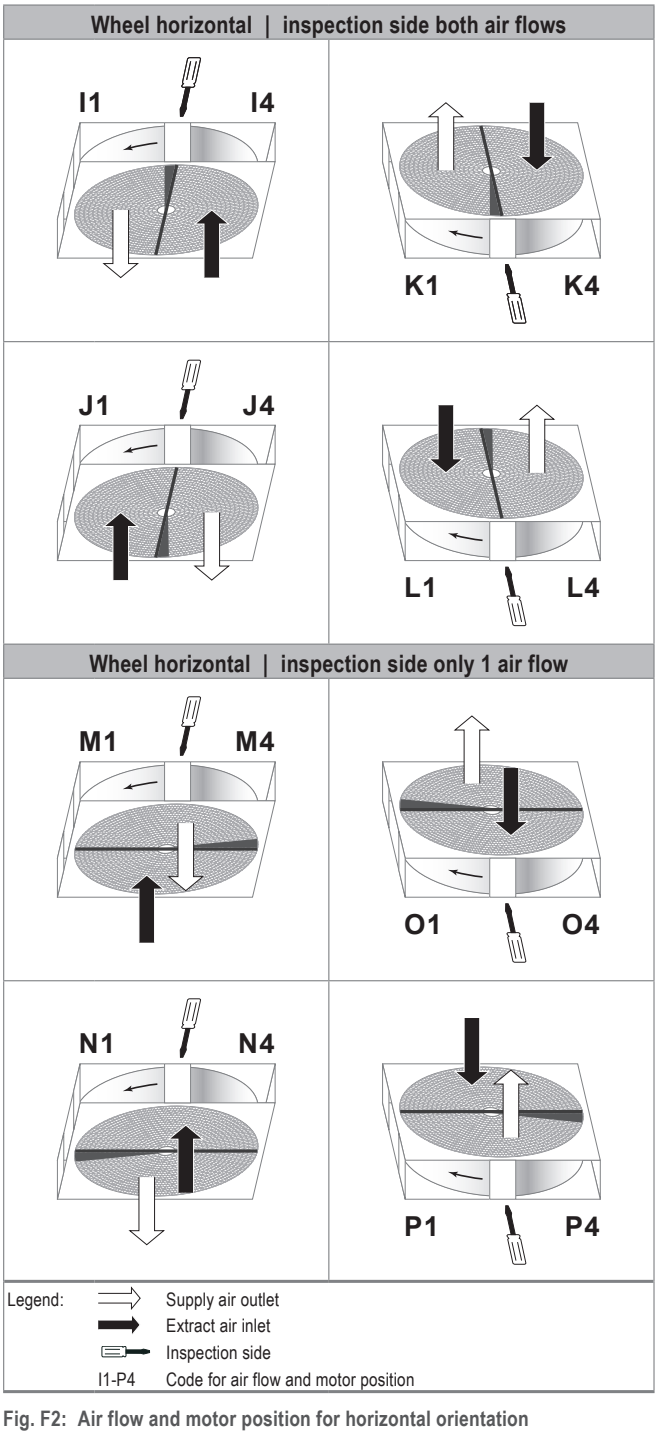
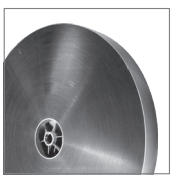


Fig. F2: Air flow and motor position for horizontal orientation



Wheels without casing

1 Use 46
2 Construction. 46
3 Technical data 47

1 Use

Hoval wheels without casing are energy recovery components for installation in ventilation and air-conditioning units and for applications in process engineering. They are available in different sizes, suitable for air flow rates from approx. 200 to 200 000 m³/h.

The wheels are supplied loose ex works and completed by the customer with casing and drive system for energy recovery.

Loose wheels supplied by Hoval are also used as replacement wheels for many other makes. They are easy to install thanks to their bearing mounted in the hub and in many cases the existing casing can still be used. If space is limited, a 1-part wheel can also be replaced by a segmented wheel. Contact Hoval Application Consulting for further information.

2 Construction

Wheels consist of storage mass, shaft, bearing and hub. The storage mass consists of aluminium foil. A smooth and a corrugated foil are wound on top of each other to form a wheel of sinusoidal channels. Warm air and cold air flow through these alternately and thus transfer the heat between the 2 air flows.

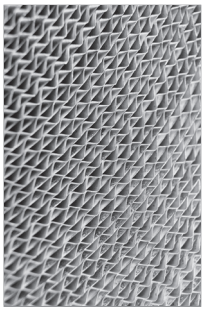


Fig. G1:
Structure of the storage mass

The wheel is fixed at the circumference by a jacket plate. Spokes between the jacket plate and hub provide high stability.
The installed exchanger area is decisive for the efficiency of the wheel. Hoval therefore offers storage masses with different wave heights and wheel depths so that an optimum solution can be used for each project according to the boundary conditions.

2.1 Condensation wheels

Condensation wheels are available in different designs:

Design ST1
The storage mass consists of untreated aluminium with internal spokes between the jacket plate and hub. The exchangers are ideally suited for use in ventilation units for residential buildings, offices, hotels, etc.

Design ST3 (Viskan)
The storage mass consists of untreated aluminium with external spokes between the jacket plate and hub. The exchangers are ideally suited for use in ventilation units for residential buildings, offices, hotels, etc.

Notice
Exchangers of design ST1 and ST3 consist of the same materials, but exchangers of design ST3 are optimised in terms of efficiency and pressure drop.

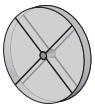
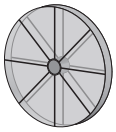
External spokes	Wheel diameter
	500 … 750
	751 … 1449
	1450 … 2099

Table G1: Arrangement of external spokes in the inflow surface of the storage mass (design ST3, dimensions in mm)

Design SC1
The storage mass consists of an epoxy coated aluminium foil with internal spokes between the jacket plate and hub. The coating provides better protection against corrosion. In addition, a paint finish protects the inflow surface from corrosion. The exchangers are mainly used in industrial applications.

2.2 Enthalpy wheels

Design SE3 (Emån)
2 different aluminium foils are used for the production of the storage mass. The corrugated foil is untreated, the smooth foil is coated with molecular sieve 3 Å. The wheels are ideally suited for use in comfort ventilation units for homes, offices, hotels, etc. The higher air humidity thanks to improved moisture transfer improves the room climate.

2.3 Sorption wheels

Sorption wheels are available in 2 material variants:

Design SH1
2 different aluminium foils are used for the production of the storage mass. The corrugated foil is coated with molecular sieve 3 Å, the smooth foil is untreated. The wheels achieve very high humidity efficiencies (> 55%) and are mainly used in ventilation systems with mechanical cooling.

Design HM1 (Muonio)
The aluminium foil used for the storage mass is completely coated with molecular sieve 3 Å. This makes Muonio wheels a high-performance model. They are ideally suited for use in ventilation systems with mechanical cooling.
The sorption coating guarantees maximum moisture efficiency throughout the year (> 70%). In summer operation the supply air is dried. The cooling requirement to be covered by a chiller is considerably reduced. This saves both investment costs and energy costs for cooling. In winter operation, moisture transfer improves the indoor climate.

3 Technical data

3.1 Application limits

Wheels without casing				
Temperature			−40 … 70	°C
Pressure drop				
1-piece wheels [1]	Ø 500 mm	max.	400	Pa
	Ø 2600 mm	max.	300	Pa
Segmented wheels		max.	400	Pa

[1] The maximum permissible pressure drop depends on the wheel diameter and changes linearly between the values given here (calculation with Hoval CASER).

Fig. G2: Application limits

3.2 Specification of material

Storage mass	
Design ST1, ST3	Aluminium
Design SC1	Aluminium epoxy-coated
Design SE3	Aluminium, untreated and coated with molecular sieve 3 Å
Design SH1	Aluminium, untreated and coated with molecular sieve 3 Å
Design HM1	Aluminium coated with molecular sieve 3 Å
Shaft	Steel
Bearing	Permanently lubricated ball bearings (FAG, SKF)
Hub	
1-piece wheels	Aluminium
Segmented wheels	Steel
Cover	Steel magnesium-zinc-coated

Table G2: Specification of material

3.3 Sound attenuation

Frequency [Hz]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Condensation wheel	3	3	4	3	4	5	6	10
Enthalpy wheel	3	3	4	3	4	5	6	10
Sorption wheel	3	3	4	4	5	6	7	11

Table G3: Insertion attenuation L_W (values in dB)

1 Inspection port 50
2 Corrosion protection 50
3 Controller loose 50
4 Corrosion protection air inlet 50
5 Closed side walls 51
6 Cable bushing 51
7 Half mounted 51
8 Cable length 52
9 Rotation guard 52
10 Belt pulley 75 Hz 52
11 Eccentricity 52
12 Stronger packaging 53



Options

1 Inspection port

Inspection openings in the casing allow access to the drive system for maintenance work. The openings are closed with a screwable lid. They are installed in both end walls and are made as large as is possible for the respective casing model.

Wheel Ø	Inspection port
< 1000 mm	not available
≥ 1000 mm	for visual check
≥ 1350 mm	for visual check and motor replacement

Table H1: Availability of inspection ports

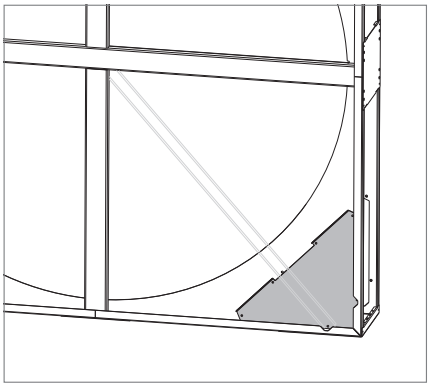


Fig. H1: Inspection port

Notice
The 45° support feet above the inspection openings in some casing models can be unscrewed.

2 Corrosion protection

Corrosion-protected casings are available for industrial and coastal applications with moderate salt loads. They are powder-coated in RAL 9006 colour (white aluminium).

Notice
The aluminium sections of PR casings are not additionally coated. Aluminium is largely corrosion-resistant due to its natural oxide layer.

3 Controller loose

The controller is supplied loose for customer installation outside the rotary heat exchanger. Please note:

- The controller is not wired. To connect the motor and controller, order a connection cable of the required length (see chapter 8).
- The signal cable of the rotation guard is 2 m long. It must be extended by the customer as required.
- The mounting plate in the casing is not required.

4 Corrosion protection air inlet

Paint protects the inflow surface of the storage mass against corrosion (RAL 7032 pebble grey).
This protective coating is standard for SC1 wheels and optionally available for ST1 and ST3 wheels.

5 Closed side walls

All casings are available with side panels mounted on all sides. The surface of the panels corresponds to the selected casing surface.

Please note:
- Install the controller outside the rotary heat exchanger.
- The drive system is not accessible from the side.
- Order the following options as needed:
  - Controller loose
  - Cable bushing
  - Inspection port

Notice
In PR casings, the closed side walls are offset inwards.

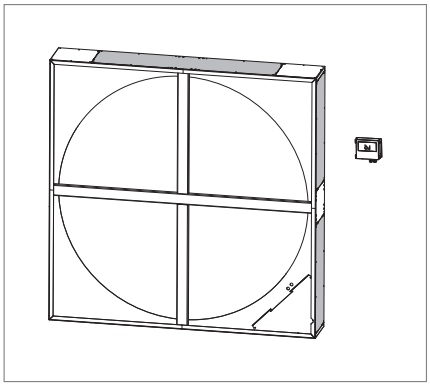


Fig. H2: Closed side walls, SM and SP casings

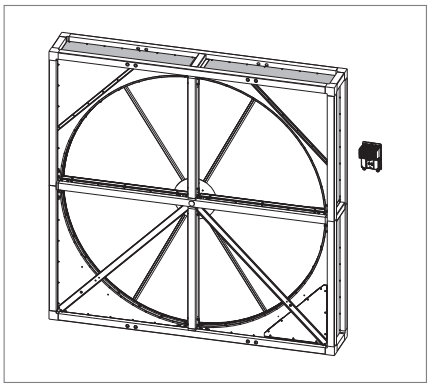


Fig. H3: Closed side walls, PR casings

6 Cable bushing

Cable glands connect power and signal cables firmly and tightly to the casing and provide strain relief. 2 plastic cable glands are mounted in each of the two end walls of the casing at a predefined location near the drive. These are sealed on both sides with blanking plugs, which can be removed during installation as required.

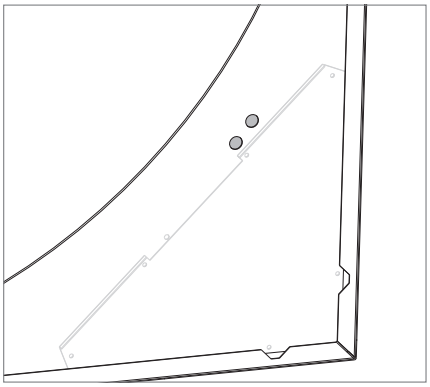


Fig. H4: Cable bushing

7 Half mounted

On request, segmented wheels can be delivered half mounted:
- Half of the storage mass and, if necessary, the drive motor are pre-assembled in the lower half of the casing.
- The upper half of the casing, the remaining segments of the storage mass as well as belt, seals and, if applicable, the controller are delivered separately for assembly by the customer.

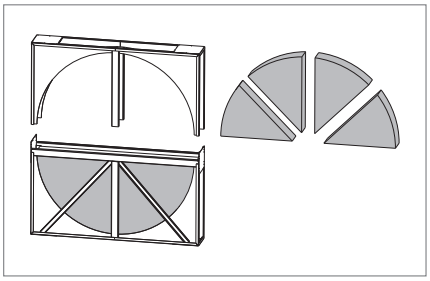


Fig. H5: Delivery half mounted

8 Cable length

Suitable cables in various lengths are available for the electrical connection of the motor:
- for constant drives
- for variable drive systems, if the controller is mounted outside the exchanger

Cable length 3 / 6 m
A suitable cable of the appropriate length is connected to the motor.

Notice
The signal cable of the rotation guard is 2 m long. It must be extended by the customer as required.

9 Rotation guard

Rotation guard RG2 / RG3
A rotation guard with 2-wire or 3-wire cable is installed ready for operation in the rotary heat exchanger for monitoring the running.

Notice
The rotation guard RG 2 is standard for the drive system V1 and therefore not selectable as an option in the design programme Hoval CASER.

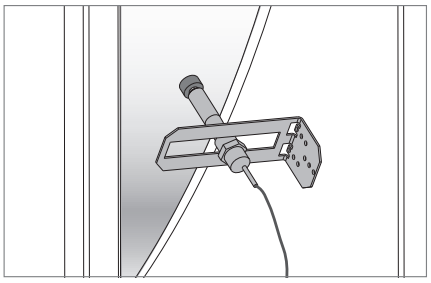


Fig. H6: Rotation guard

10 Belt pulley 75 Hz

For the use of a controller provided by the customer which controls the drive motor at 75 Hz, the belt pulley is dimensioned accordingly. The transmission ratio is designed in such a way that the optimum speed is achieved:
- approx. 12 rpm for the designs ST1, ST3, SC1, SE3
- approx. 20 rpm for the designs SH1, HM1

11 Eccentricity

In order to adapt to the respective installation situation, the wheel can be offset in height. When ordering, define the distance of the wheel axis from the casing edge (dimension ECH).

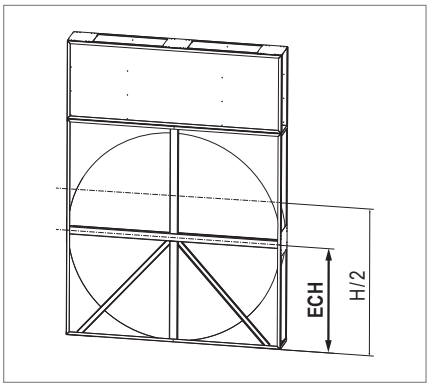


Fig. H7: Wheel axis shifted downwards

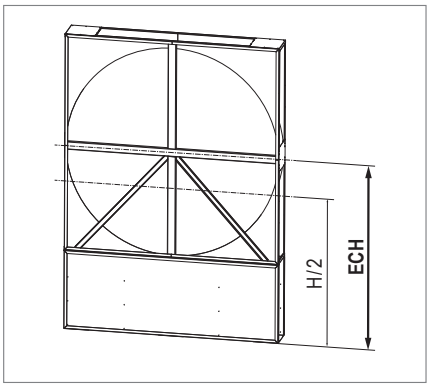


Fig. H8: Wheel axis shifted upwards

12 Stronger packaging

Hoval rotary heat exchangers are delivered on wooden pallets and are protected against contamination and moisture by foil. Stronger packaging is required for sea freight or airfreight, consisting of:

- Additional wooden crate on the side and on top
- Covering of the storage mass with wood fibre boards
- Machine wrapping foil

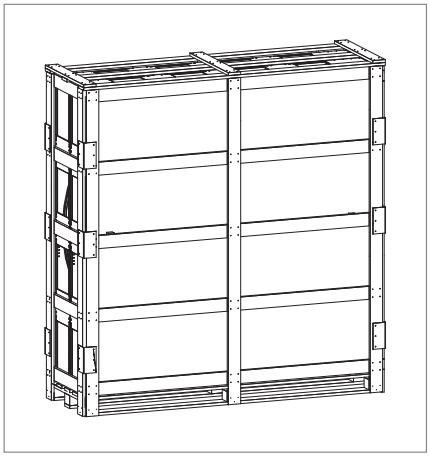


Fig. H9: Stronger packaging

1 Design programme 56
2 Purge sector 57
3 Internal pressure difference 57
4 Leakage 58
5 Condensation 58
6 Frost limit 58
7 Moisture transmission. 59
8 Molecular sieve 3Å 59
9 Pressure drop 60
10 Adjustment 60
11 Performance control 60
12 Counterflow / parallel flow 61
13 Maintenance 61
14 Vibration isolation 62
15 Sound attenuation 62
16 Double wheel concept 63



System design

1 Design programme

For quick and accurate design of Hoval energy recovery systems, you should use the Hoval CASER design program (**C**omputer **A**ided **S**election of **E**nergy **R**ecovery).



Hoval
CASER

1.1 Availability

You can download the Hoval CASER design program free of charge from our website. It is available in English, German, Italian, Turkish, Swedish, Slovak, French and Chinese. Alternatively, it is also available as a Windows DLL package and can therefore be integrated into other spreadsheet programs (available on request).

1.2 Performance features

The design program offers the following performance features:

- Secure planning thanks to reliable data (Eurovent and TÜV-certified)
- Calculation of a specific Hoval plate heat exchanger or rotary heat exchanger
- Calculation of all appropriate Hoval plate heat exchangers or rotary heat exchangers for a specific project
- Efficiency class in accordance with EN 13053
- Calculation mode “73 air” according to the Ecodesign Directive ErP 1253/2014 (only for plate heat exchangers)
- Frost limit (only for plate heat exchangers)
- Dynamic calculation of the pressure drop increase due to pressure difference (only for plate heat exchangers)
- Dynamic calculation of the leakage figures EATR (Exhaust Air Transfer Ratio) and OACF (Outdoor Air Correction Factor) (only for rotary heat exchangers; for explanation see chapters 1.3 and 1.4)
- Linear calculation of the maximum permissible pressure drop for 1-piece wheels
- Simplified ordering process due to optimised type code
- Price calculation

1.3 EATR

(**E**xhaust **A**ir **T**ransfer **R**atio)

The EATR value specifies how much extract air enters the supply air due to carryover. Hoval CASER calculates the value depending on the pressure differential between the supply air outlet and extract air inlet (Δp_{22-11}). It is defined as follows based on EN 16798-3:2017:

$$EATR = \frac{q_{EATR}}{q_{m,22}} \cdot 100\ \%$$

q_{EATR} ..... Air mass flow Carryover of extract air to the supply air
$q_{m,22}$ ..... Air mass flow Supply air

Notice
A correctly set purge sector reduces the exhaust air transfer ratio EATR to a minimum.

1.4 OACF

(**O**utdoor **A**ir **C**orrection **F**actor)

The OACF value states the ratio between the quantity of the fresh air and supply air. Hoval CASER calculates the value depending on the pressure differential between the supply air outlet and extract air inlet (Δp_{22-11}). It is defined as follows according to EN 16798-3:2017:

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

$q_{m,21}$ ..... Air mass flow Fresh air
$q_{m,22}$ ..... Air mass flow Supply air

- An OACF value > 1 means that fresh air gets to the exhaust air (predominantly due to seal leakage at the middle beam).
- An OACF value < 1 means that extract air gets to the supply air (predominantly due to seal leakage at the middle beam).

2 Purge sector

By default, Hoval rotary heat exchangers are equipped with a purge sector to avoid carryover.

Carryover
In rotary heat exchangers, carryover is a feature of the function: The air in the ducts of the storage mass is carried over from the supply air side to the extract air side (and vice versa) during the rotation of the wheel. The supply air is polluted by the extract air.

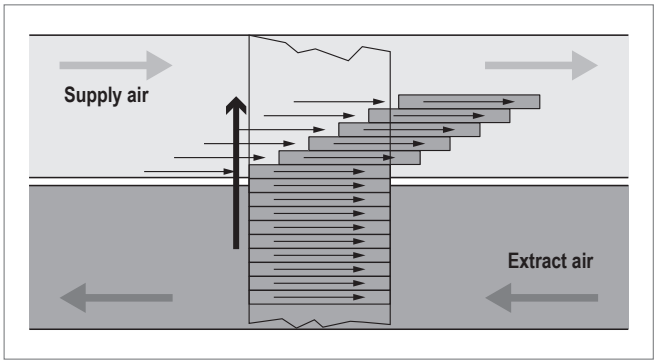
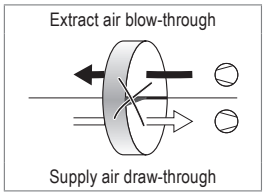


Fig. I1: Carryover

Purge sector
The purge sector is installed where extract air is conveyed into the supply air flow by the rotation of the wheel. It uses the differential pressure between the air flows to purge the storage mass with clean fresh air. The arrangement of the fans and correct dimensioning are therefore important for the function:

- The purge sector cannot be used with the following layout:



- The purge sector must be large enough to prevent extract air carryover.
- The purge sector must not be too large, otherwise the efficiency of the exchanger will be unnecessarily reduced.

On request, Hoval supplies the rotors with a purge sector angle of 5°.

Notice
The purge sector has an influence on the thermal efficiency, pressure drop, EATR value and OACF value of rotary heat exchangers.

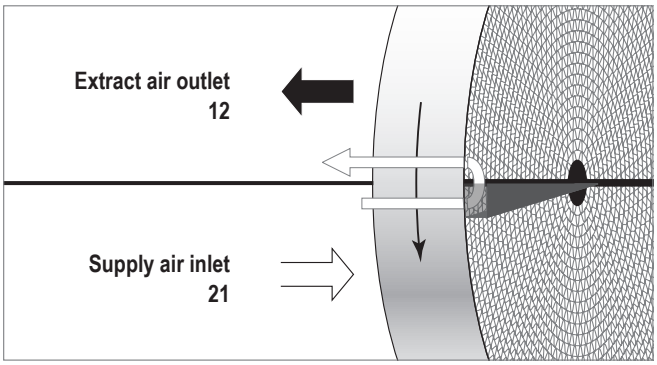


Fig. I2: Purge sector

3 Internal pressure difference

The internal pressure difference, i.e. the pressure difference between supply air flow and extract air flow, is an important criterion for the quality of air conditioning systems and deserves special attention during planning:

- The internal pressure difference is decisive for the internal leakage and thus has an effect on the supply air quality (see chapter 4).
- The internal differential pressure presses against the wheel casing and can cause deformations in extreme cases. Note the application limits.

4 Leakage

The planning and design of air handling systems must take account of the effects of leakage in the heat recovery unit. In addition to the seal quality, the internal pressure differential is the determining factor for leakage. Note the following when planning:

- Arrange the fans in the ventilation unit so that the pressure difference in the rotary heat exchanger is as low as possible.

> **Notice**
> The differential pressure depends on the arrangement of fans. Overpressure on one side and underpressure on the other side add up.

- Correct the volume flows for supply air and extract air by the leakage (calculation possible with CASER). Select the sizes of the fans according to the exhaust air transfer ratio EATR and the outdoor air correction factor OACF.
- Leakage changes the design conditions of the rotary heat exchanger and thus its technical data.

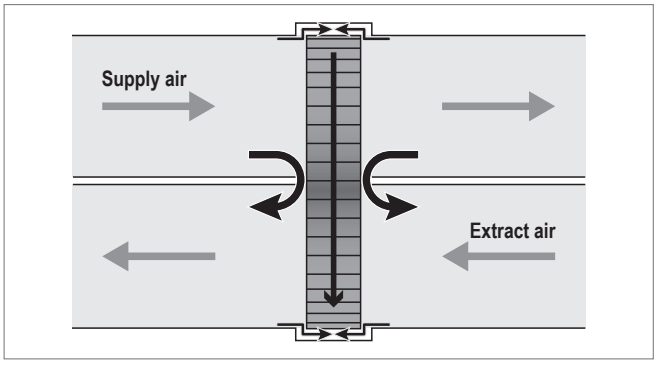


Fig. I3: Leakage

5 Condensation

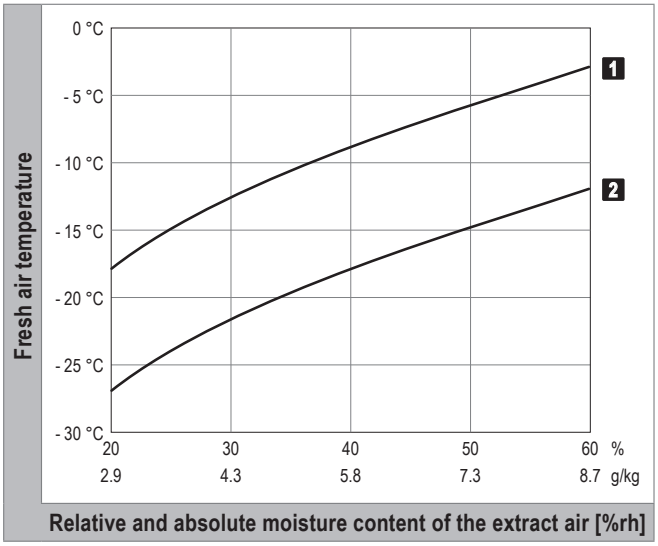
If more water condenses from the warm air than the (heated) cold air can absorb, condensate is formed. This occurs mainly in the first third of the warm wheel side. Consider for the downstream component that condensate is partly carried along by the warm air flow.

6 Frost limit

If the warm extract air is very strongly cooled, extract air humidity can condense and the condensate may even freeze. The fresh air temperature at which freezing starts is called the “frost limit”.
The following circumstances lead to the heat exchanger icing up:

- Very low temperature of the cold air
- High efficiency of the exchanger
- Wheel design
- More cold air than warm air (the larger the mass flow ratio m_2/m_1, the greater the risk of freezing)

Sorption wheels transfer moisture through the sorption coating. The moisture content of the extract air is continuously reduced as it flows through the storage mass and less condensate precipitates. The freezing limit is therefore significantly lower than with condensation wheels.



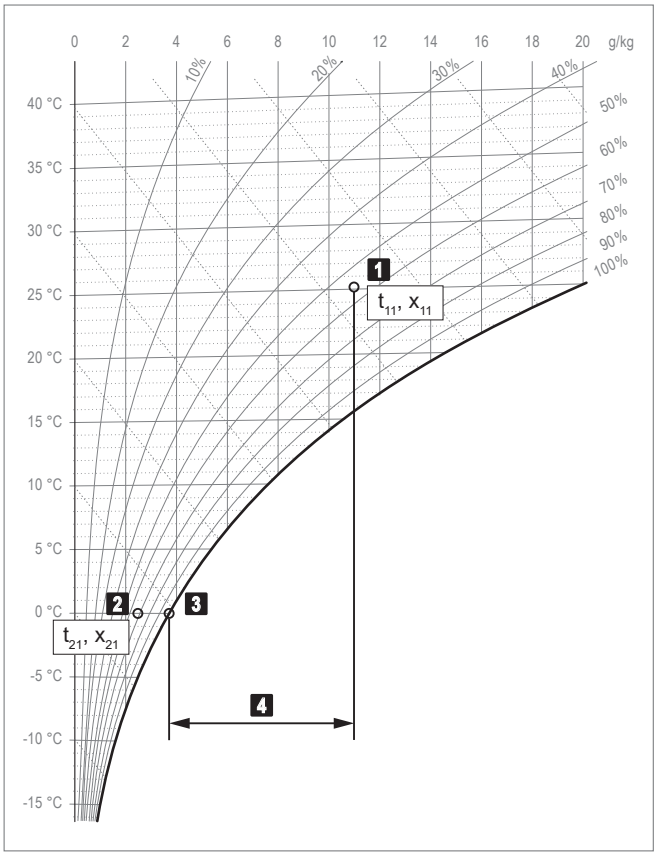
1 Condensation wheel
2 Sorption wheel

Fig. I4: Comparison between frost limits for condensation wheels and sorption wheels

7 Moisture transmission

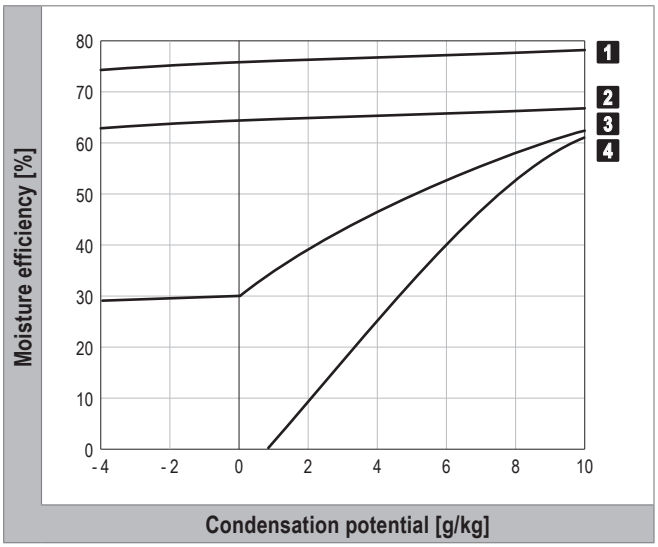
Moisture transfer principles
There are 2 moisture transfer principles:
- Moisture transfer via condensation and evaporation (condensation wheels)
- Moisture transfer via physical adsorption and desorption (sorption wheel, enthalpy wheel in some cases)

Condensation potential
The reference value for the moisture transfer between the 2 air streams is the condensation potential. This is the difference between the extract air humidity and the saturation humidity of the incoming supply air. It is independent of temperature and a direct measure of moisture carryover by condensation. The greater the condensation potential, the larger the expected amount of condensate on the extract air side and consequently the moisture efficiency.



1	Extract air inlet
2	Supply air inlet
3	Saturation humidity of the incoming supply air
4	Condensation potential

Fig. I5: Condensation potential



1	Sorption wheel HM1
2	Sorption wheel SH1
3	Enthalpy wheel SE3
4	Condensation wheel ST1, ST3

Fig. I6: Moisture efficiency depending on condensation potential

8 Molecular sieve 3Å

Sorption wheels can transfer volatile organic compounds (VOC) between air streams. The degree of transfer depends on the type of sorption coating. The molecular sieve 3 Å used in Hoval wheels is optimized for the transfer of moisture. It has a selective adsorption capacity for molecules with a diameter ≤ 3 Å, i.e. for water molecules (Ø = 2.7 Å). The transfer of other substances is minimised.

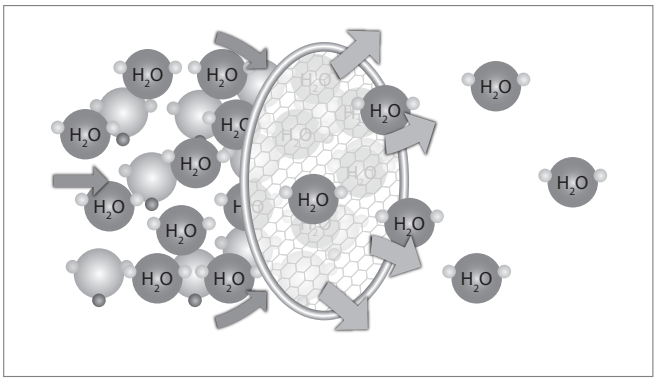


Fig. I7: Selective adsorption capability for water molecules

9 Pressure drop

Real pressure drops in an energy recovery system usually differ from the calculated values. They depend on various factors:

- Increased pressure drop due to condensate, which reduces the flow cross-section
- Increased pressure drop due to the installation situation (inflow and outflow)

Deviations of the measured values from the calculated values can also be due to inaccuracies in measurement.
It is important to correctly consider the altitude above sea level and thus the air density when converting mass flow into volume flow.

Notice
The air stream presses against the wheel and is thus responsible for its inclination within the casing. Note the application limits.

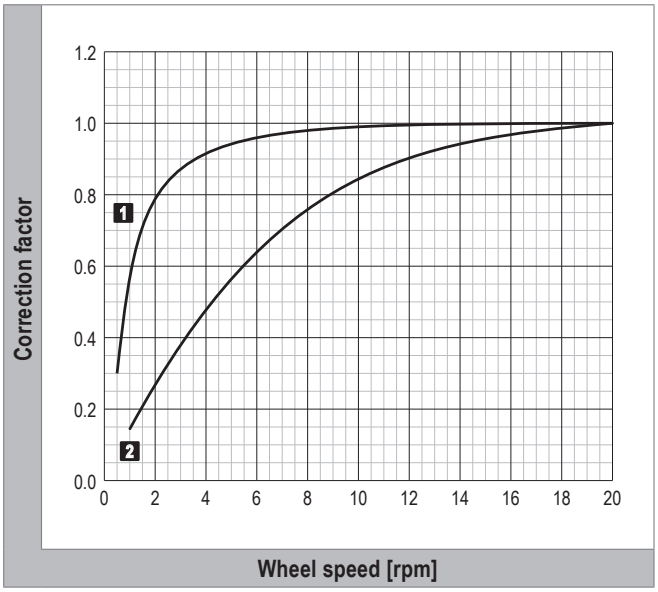
10 Adjustment

For the proper operation of rotary heat exchangers, it is important that the wheel rotates exactly parallel to the end wall of the casing. An inclined position of the wheel can cause excessive seal abrasion and leakage.
Due to the pressure conditions in the ventilation unit, the position of the wheel in the casing can also shift during operation (especially with larger wheel diameters). Therefore:

- Check the position of the wheel during commissioning and regular maintenance. If necessary, adjust the inclination of the wheel in the casing.
- Ensure good accessibility in the ventilation unit for adjusting the wheel in the installed state.

11 Performance control

The performance of rotary heat exchangers can be easily regulated by adjusting the speed. Temperature and moisture efficiency vary differently depending on the wheel speed:



1 Temperature efficiency – Designs ST1, SC1, SE3, SH1, HM1
2 Moisture efficiency – Design HM1

Fig. I8: Change in temperature and moisture efficiency depending on the wheel speed

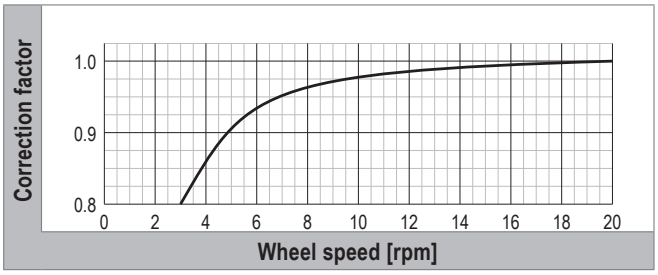


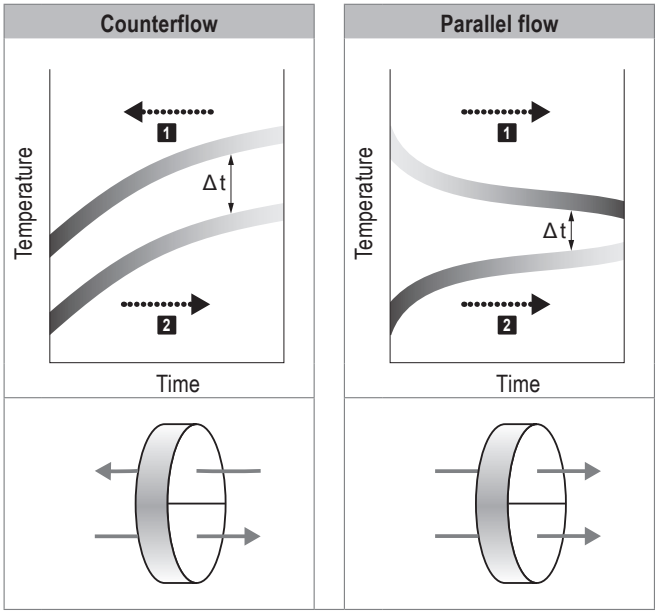
Fig. I9: Change in temperature efficiency depending on the wheel speed – Design ST3

Notice
According to the Ecodesign Regulation ErP 1253/2014, it is mandatory in the EU to equip rotary heat exchangers with speed control.

12 Counterflow / parallel flow

When installing rotary heat exchangers, pay attention to the flow direction of the air. The exchangers only achieve the specified efficiency if warm air and cold air are led past each other in counterflow.

If the 2 air streams flow in parallel, efficiency losses of up to 30% occur due to the ever decreasing temperature differential between the warm air and cold air.



1 Warm air flow direction
2 Cold air flow direction

Fig. I10: Counterflow – parallel flow

13 Maintenance

To ensure long-term proper operation, rotary heat exchangers must be maintained on a regular basis.

13.1 Maintenance schedule

Activities
■ Visual inspection of the exchanger for dirt build-up, damage, corrosion and leakage. – If necessary: adjust seals, clean, repair, remove production chips and abrasion. ■ Check the tension of the V-belt. – If necessary: Shorten the belt. ■ Check the clamping screws of the peripheral plates. – If necessary: Retighten (torque 40 Nm). ■ Check the position of the wheel in the casing. – If necessary: Adjust the inclination. ■ Check that the rotary heat exchanger is operating within the specified limits: – Is the volume flow rate within the specified range? – Is the pressure drop within the permissible range? Measure and record both values.
Intervals
■ For the fist time after 4 hours of operation ■ Following that, every 6 months

Table I1: Maintenance schedule

13.2 Cleaning capability

Dry cleaning
■ Remove dust and fibres with a soft brush, a vacuum cleaner or compressed air. ■ Use caution when cleaning with compressed air: – Min. 20 cm distance between nozzle and exchanger – Max. air pressure 8 bar – Direct the air jet at a right angle to the inflow surface.
Wet cleaning
■ Remove oils, solvents and similar with hot water and grease solvents. – Spray on grease solvents with a spray bottle. – Recommended cleaning agents are, for example: Frosch, Fairy, Largo ■ Remove cleaning agents with a high-pressure cleaner. – Use a 40° flat nozzle – Min. 20 cm distance between nozzle and exchanger – Max. water pressure is 100 bar – Direct the water jet at a right angle to the inflow surface.
Disinfection
■ Spray on disinfectants with a spray bottle. – Recommended disinfectants are, for example: Bacillol® 30 Foam, Dr. Becher Schnelldesinfektion ■ Allow disinfectants to act for approx. 30 minutes. ■ Remove disinfectants with a high-pressure cleaner. – Use a 40° flat nozzle – Min. 20 cm distance between nozzle and exchanger – Max. water pressure is 100 bar – Direct the water jet at a right angle to the inflow surface.
Descaling
■ Decalcifier: – NALCO ACITOL CL-931 as 10% solution ■ On-site circulation equipment with pH control is necessary ■ Maintain the pH value below 2.5 during descaling: – Add new ACITOL CL-931 as a 10% solution as required. ■ Repeat descaling until no more limescale residues are visually visible. ■ Remove decalcifier with a high-pressure cleaner. – Use a 40° flat nozzle – Min. 20 cm distance between nozzle and exchanger – Max. water pressure is 100 bar – Direct the water jet at a right angle to the inflow surface.

Table I2: Cleaning methods for rotary heat exchangers

Notice
The minimum space required for cleaning is at least 500 mm in front of and behind the exchanger.

14 Vibration isolation

The transmission of vibrations to the rotary heat exchanger can cause considerable damage to the rotor. Therefore, when planning and designing air handling systems, make sure to avoid transmission of vibration to the rotor:

- Ensure a good isolation efficiency for all vibration-producing components such as fans, pumps, frequency converters, etc. (isolation efficiency > 90 %).
- Use anti-vibration mounts for installing the wheel casing.

15 Sound attenuation

Rotary heat exchangers have a sound-absorbing effect. An exact statement about sound attenuation is only possible after a measurement. In most cases, a sufficiently accurate estimate of the insertion attenuation (standard values) can be given by using the values shown in the table.

Frequency [Hz]	63	125	250	500	1000	2000	4000	8000
Condensation wheel	3	3	4	3	4	5	6	10
Enthalpy wheel	3	3	4	3	4	5	6	10
Sorption wheel	3	3	4	4	5	6	7	11

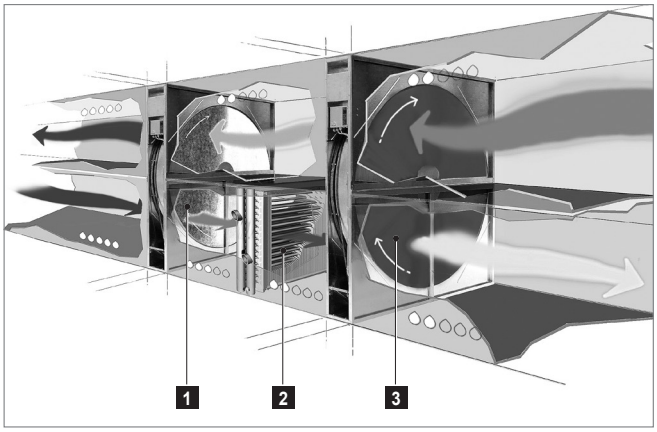
Table I3: Insertion attenuation L_W (values in dB)

16 Double wheel concept

The Hoval double wheel concept saves energy and costs in regions with high outside temperatures and humidity. It cools and dehumidifies the supply air much more efficiently than conventional systems. The cooling requirement to be covered by a chiller is reduced by up to 60%, which significantly reduces both investment and energy costs for cooling.

This is how the concept works:

- The sorption wheel pre-cools and dehumidifies the supply air (with very high efficiency thanks to pre-cooled extract air).
- The cooling coil supercools the supply air for further dehumidification by condensation.
- The condensation wheel heats the supply air to the required temperature and simultaneously pre-cools the extract air.



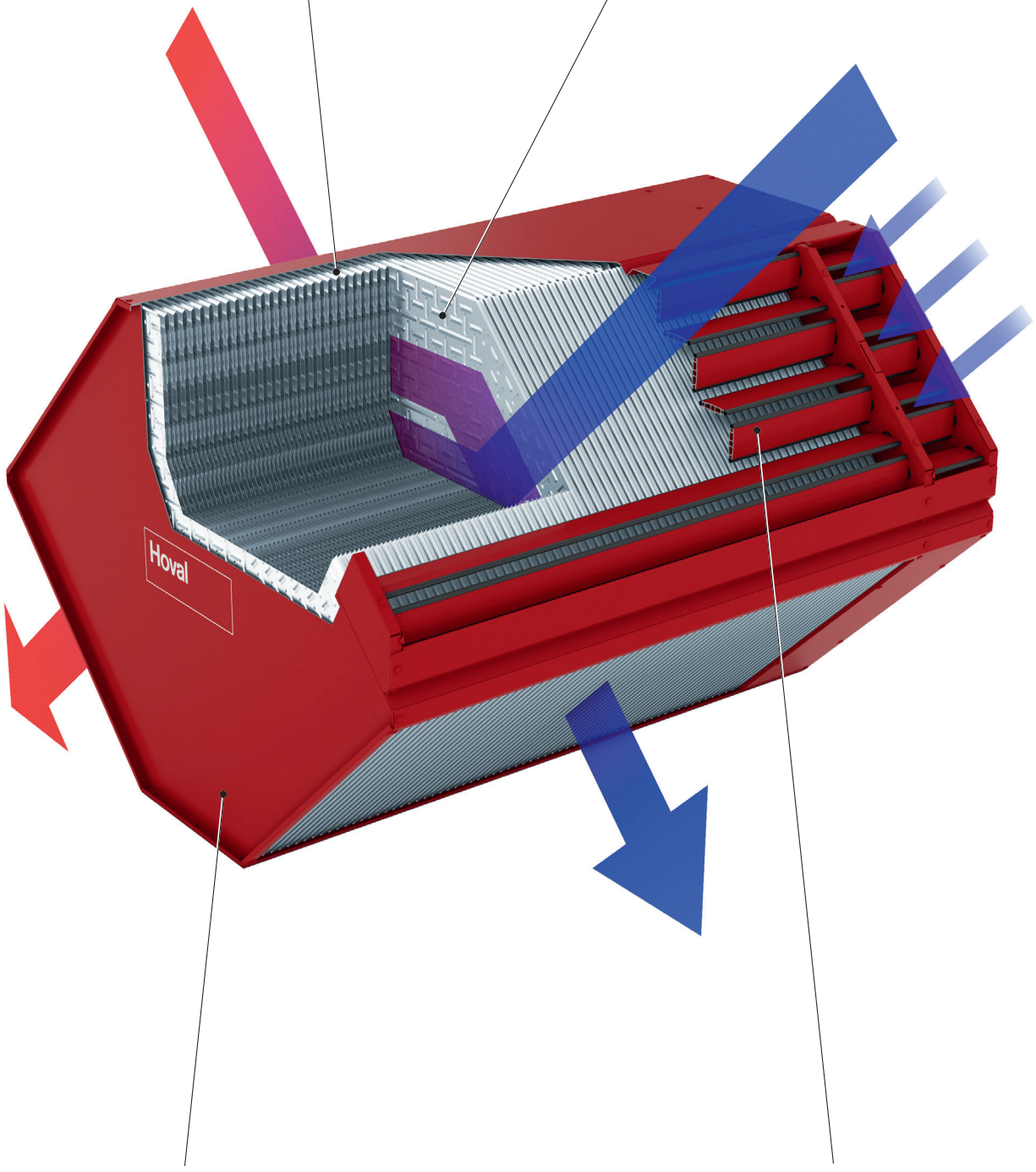
1	Sorption wheel
2	Cooling coil
3	Condensation wheel

Fig. I11: Double wheel concept

Plate heat exchangers

Tight fold connections for good stability and leak-tightness

Profile optimised for highest air flow rate with a low pressure drop



Side walls either flat or with double folded edges

Complete package with bypass and control dampers from a single source

Hoval energy recovery.
You can count on us.

Hoval

As a specialist for energy recovery systems, Hoval is your reliable partner with decades of experience in the industry. Hoval develops and produces components for heat, cold and moisture recovery for today and tomorrow. The systems are used in ventilation systems and in process technology. You can be sure to save both energy and costs while protecting the environment.

Hoval is one of the leading international companies for energy recovery systems, which are exported worldwide.

Hoval takes its responsibility for the environment seriously. Energy efficiency is at the heart of what we develop.

Responsibility for energy and environment

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