ROTARY HEAT EXCHANGER

Energy Recovery Ventilation Specialist

Beijing Holtop Artificial Environment Technology Co., Ltd

ISO9001 CE EUROVENT
Holtop is dedicated to the research and technology development in the field of indoor air quality. It is the leading company in China who professionally produces heat recovery ventilation system. Covering a land of 20000 square meters, Holtop was created in May, 2002 furnished with first-class plants and equipments. Through innovation, it developed its own key components like plate and rotary heat exchangers for various heat & energy recovery systems. It provides now full lines of products covering 5 series and 98 specifications which can basically satisfy the needs of various airflows and installations worldwidely.

Holtop is trusted by the users for its advanced technology, superb product quality and all-around services. By the end of year 2006, Holtop has supplied successfully to over 3000 customers in the domestic market and exported its products to Japan, Korea, Russia, Italy, Belgium, Australia, New Zealand, etc.

Let's join together to contribute to our commitment of energy saving and pollution reduction.
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**Working Principle**

Rotary heat exchanger is composed of alveolate heat wheel, case, drive system and sealing parts. The exhaust and outdoor air pass through half of the wheel separately, when the wheel rotates, the heat and moisture are exchanged between the exhaust and outdoor air. The energy recovery efficiency is up to 70% to 90%.

1. **Entering the cold air half**
   When the wheel enters the cold air half suddenly from warm air half, temperature drops quickly. Heat is absorbed by cold air and the temperature of cold air rises slightly. Heat exchange efficiency is high at this moment due to the bigger temperature difference. Meanwhile, the moisture on the wheel goes into the dry and cold air.

2. **In the middle of cold air half**
   When the wheel rotates to the middle of cold air half, the air temperature continues to drop and moisture continues to dissipate. The dry and cold air is heated and humidified continually. Heat exchange efficiency drops due to the reducing temperature difference.

3. **Leaving the cold air half**
   When the wheel is leaving the cold air half, its temperature and humidity become same as the cold air. The heat exchange between the wheel and cold air ends. The temperature and humidity of the cold air stop changing. Wheel temperature drops to minimum and wheel dryness increases to maximum.

4. **Entering the warm air half**
   Warm air passes though the wheel in reverse direction. Heat exchange efficiency is high at this moment due to the bigger temperature difference. Temperature of this humid and warm air drops quickly, and its moisture is absorbed heavily by the wheel.

5. **In the middle of warm air half**
   When the wheel rotates to the middle of the warm half, efficiency drops because the wheel temperature rises and the temperature difference drops. The moisture absorbent coated on the surface of the wheel is becoming saturated, the moisture absorption capacity decrease.

6. **Leaving the warm air half**
   The wheel is heated completely. Its temperature is same as the warm air and the humidity exchange stops. The efficiency is zero.
**TECHNICAL SUMMERIZATION**

**Model Description**

**HR  T-3000-4  D A-A 2-E**

1. Stands for Holtop rotary heat exchanger

2. T/S  
T stands for total heat wheel. The wheel is made by aluminum foils coated with 3A molecular sieve moisture absorbent, which enables the wheel to exchange both temperature and humidity, in another word to exchange both sensible heat and latent heat.  
S stands for sensible heat wheel. It generally recovers no latent heat, only when the condensation occurs, can it recover part of that latent heat.

3. Stands for effective wheel diameter

4. 1/4/8/16/24 stands for segment amount of the heat wheel, see P7.

5. A/B/C/D/E stands for the casing code, see P6

6. A/D stands for type of casing.  
A stands for inner-loaded type which has no side panels and usually is loaded inside the AHU.  
D stands for open type which has side panels and is installed between the ducts.

7. A/B/C/D/E/┄P stands for the type of installation, see P9.

8. 1/2/3/4 stands for the motor position, see P9.

9. Stands for intelligent control. It’s optional, users can use their own control device to control the ON/OFF of wheel.

**Wheel Materials**

The sensible heat wheel is made by aluminum foils of 0.05mm thickness.  
And the total heat wheel is made by aluminum foils coated with 3A molecular sieve of 0.04mm thickness.

1. Silicon gel absorbs both moisture and odor by capillarity.

2. Molecular sieve selectively absorbs moisture and expels odor by molecular lattice.
The ways of casing should be selected according to the application spaces as well as transportation capability and conditions at installation. Over segmentation will increase the assembly work, and overlarge size will cause difficulties in transportation.
## TECHNICAL SUMMERIZATION

### Wheel Construction

The wheel of the rotary heat exchanger is made of alternating layers of flat and corrugated aluminum foil to form the alveolate shape.

Various height of corrugation is available.

Flat surface ensures minimum leakage.

Interior spokes are used to mechanically bond the rotor’s laminations. These are threaded at the hub and welded at the periphery.

### Specifications

<table>
<thead>
<tr>
<th>Wheel Segmentations</th>
<th>Type 1</th>
<th>Type 4</th>
<th>Type 8/16/24</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One-piece</td>
<td>4 segments, assembly at installation.</td>
<td>8 segments along circle, assembly at installation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2600 ≤ d ≤ 3200, no segment along diameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3400 ≤ d ≤ 4000, 2 segments along diameter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4200 ≤ d ≤ 5000, 3 segments along diameter</td>
</tr>
</tbody>
</table>

The segmentations of rotor should be selected according to the application spaces as well as transportation capability and conditions at installation. Over segmentation will increase the assembly work, and overlarge size will cause difficulties in transportation.
TECHNICAL SUMMERIZATION

Laminar Flow Channels

The wave type structure of the wheel forms narrow channels in the direction of air flow. The air flow forms a laminar flow inside the wheel when passing through it. When the wheel rotates, dust won’t accumulate on the channel since outdoor air and exhaust air respectively flow through the channels from two directions. This is called self-cleaning.

Double Sealing System

Unique double-sealing system is installed around the rotor periphery and along the central beam. The sealing materials are soft and dense of small friction and longer service life.

Purge Sector

Because of the structure of rotary heat exchanger, the outdoor air and exhaust air will mix. According to the air velocity, wheel rotating speed and direction, purge sector is installed to prevent the exhaust air from entering the outdoor air. The purge sector enables a small fraction of outdoor air to blow back the exhaust air in the alveolate holes to its side. A minimum pressure difference of 200Pa between the outdoor air side and the exhaust air side is required to ensure the cleaning effectiveness. With all conditions provided, the sector can ensure a leakage below 0.3% from exhaust air to outdoor air.

Positioning of Fan and Wheel

The cleaning effect of the purge sector is bound up with the fan position and static pressure difference between outdoor air side and exhaust air side. When the pressure difference is less than 200pa, the cleaning effect is not guaranteed.

Mode 1: both fans suck out. (Top-priority)

The pressure of supply fan should be more than that of exhaust fan 200-500Pa, standard 2x5 degree of purge sector should be used.

Mode 2: supply fan drives in, and exhaust fan sucks out.

By this way, the pressure difference is 500-800pa, The outdoor air through the purge sector is increased, so 2x2.5 degree of purge sector should be used.

Mode 3: both fans drive in.

The pressure of supply fan should be more than that of exhaust fan 200-500Pa, standard 2x5 degree of purge sector should be used.

Mode 4: supply fan sucks out, and exhaust fan drives in.

In this case, the exhaust air enters the supply air inevitably, so the purge sector is prohibited.
TECHNICAL SUMMERIZATION

Bearing and Lubrication

The hub of the wheel is equipped with life-time-lubricated ball bearing or roller bearing, and with covers at both sides. No maintenance is required under normal usage.

Installation Types and Motor Position

The motor is installed at the corner of the rotary heat exchanger, the position of the corner is marked from no. 1 to 4, and the motor positions is optional.

Exhaust air
Outdoor air
TECHNICAL SUMMERIZATION

Driving System

The wheel is drove to rotate by this system. The drive system is composed of motor, turbine-worm reducer, belt pulley and V belt. The motor is installed on the special bracket tensioning by the spring, it can ensure the gradually loose of V-belt in case of sudden stop.

Operation control

Motor voltage is 380V/3ph/50Hz, with the turbine-worm reducer, the wheel rotates at about 10 rpm steadily. Standardly, we offer wheels without operation control device. However as an option, we offer ZK-100 intelligent controller which has following functions:

- Various rotary speed control by instruction signal from the exterior sensor. Speed can be steplessly adjusted.
- Manual set of rotary speed
- Automatic temperature sensing and running mode selection.
- Fault alarm and display
- Overload and undervoltage protection

Winter Operation

The rotary heat exchanger may frost in the extremely cold winter. Frost usually occurs in the exhaust air side. It would result in blockage and airflow reducing, but do no harm to the wheel. As shown on the graph, when the line connecting OA to RA across the 100% relative humidity curve, the wheel will frost. To prevent this, the air should be pre-handled till conditions such as OA1, RA1 or RA2, thus connecting line between OA1 and RA1(RA2) would not pass across the saturation humidity curve.

To avoid the frost blockage, the wheel should rotate at low speed of 2rpm or intermittently, for example stops 10 seconds each 10 minutes of operation. However, under no circumstance should the wheel stop for long period since dusts will get gathered on the wheel, resulting in lower recovery efficiency and ventilation deficiency in a worse case.
SPECIFICATIONS AND DIMENSIONS

Casing Type A

<table>
<thead>
<tr>
<th>Specifications</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>B1 (mm)</th>
<th>B2(A1) (mm)</th>
<th>F (mm)</th>
<th>D (mm)</th>
<th>Power Kw</th>
<th>Voltage</th>
<th>N.W. Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>600</td>
<td>600</td>
<td>312</td>
<td>68</td>
<td>32</td>
<td>530</td>
<td>0.09</td>
<td>3~380V50Hz</td>
<td>42</td>
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<tr>
<td>600</td>
<td>700</td>
<td>700</td>
<td>350</td>
<td>68</td>
<td>32</td>
<td>630</td>
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<td>3~380V50Hz</td>
<td>59</td>
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<tr>
<td>700</td>
<td>800</td>
<td>800</td>
<td>400</td>
<td>68</td>
<td>32</td>
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<td>450</td>
<td>68</td>
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<td>0.09</td>
<td>3~380V50Hz</td>
<td>82</td>
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<td>900</td>
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<td>1030</td>
<td>515</td>
<td>98</td>
<td>32</td>
<td>930</td>
<td>0.09</td>
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<td>102</td>
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<td>1000</td>
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<td>0.09</td>
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</tr>
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</table>

If casing is with side panel, revise the dimension as per formula: A+4, B+4, B1+2, F+2.

Casing Type B and Type C

<table>
<thead>
<tr>
<th>Specifications</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>B1 (mm)</th>
<th>F (mm)</th>
<th>D (mm)</th>
<th>Power Kw</th>
<th>Voltage</th>
<th>N.W. Kg</th>
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<td>615</td>
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<td>765</td>
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<td>766</td>
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<td>816</td>
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<td>3~380V50Hz</td>
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<td>47</td>
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<td>3~380V50Hz</td>
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<tr>
<td>1900</td>
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<td>2030</td>
<td>966</td>
<td>47</td>
<td>1930</td>
<td>0.25</td>
<td>3~380V50Hz</td>
<td>301/320</td>
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<td>2000</td>
<td>2130</td>
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<td>1016</td>
<td>47</td>
<td>2030</td>
<td>0.25</td>
<td>3~380V50Hz</td>
<td>358/370</td>
</tr>
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</table>

If the casing is with side panel, revise the dimension as per formula: A+4, B+4, B1+2, F+2.
### SPECIFICATIONS AND DIMENSIONS

Casing Type D and Type E

<table>
<thead>
<tr>
<th>Specifications</th>
<th>A mm</th>
<th>B mm</th>
<th>C mm</th>
<th>E mm</th>
<th>F mm</th>
<th>D mm</th>
<th>Power Kw</th>
<th>Voltage</th>
<th>Weight Kg</th>
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<tbody>
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<td>2200</td>
<td>2400</td>
<td>2400</td>
<td>400</td>
<td>50</td>
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<td>2230</td>
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<tr>
<td>2400</td>
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<td>2600</td>
<td>400</td>
<td>50</td>
<td>40</td>
<td>2430</td>
<td>0.37</td>
<td>3~380V50Hz</td>
<td>500</td>
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<td>2800</td>
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<td>50</td>
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<td>3~380V50Hz</td>
<td>570</td>
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<td>50</td>
<td>40</td>
<td>2830</td>
<td>0.37</td>
<td>3~380V50Hz</td>
<td>860</td>
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<td>3000</td>
<td>3200</td>
<td>3200</td>
<td>430</td>
<td>70</td>
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<td>3030</td>
<td>0.55</td>
<td>3~380V50Hz</td>
<td>950</td>
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<td>3200</td>
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<td>430</td>
<td>70</td>
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<td>3400</td>
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<td>3430</td>
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<td>3600</td>
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<td>430</td>
<td>70</td>
<td>70</td>
<td>3630</td>
<td>0.55</td>
<td>3~380V50Hz</td>
<td>1220</td>
</tr>
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<td>3800</td>
<td>4000</td>
<td>4000</td>
<td>430</td>
<td>70</td>
<td>70</td>
<td>3830</td>
<td>0.55</td>
<td>3~380V50Hz</td>
<td>1360</td>
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<tr>
<td>4000</td>
<td>4200</td>
<td>4200</td>
<td>430</td>
<td>70</td>
<td>70</td>
<td>4030</td>
<td>0.75</td>
<td>3~380V50Hz</td>
<td>1500</td>
</tr>
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<td>4200</td>
<td>4400</td>
<td>4400</td>
<td>430</td>
<td>70</td>
<td>70</td>
<td>4230</td>
<td>0.75</td>
<td>3~380V50Hz</td>
<td>1645</td>
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<td>4400</td>
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<td>1750</td>
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<td>4600</td>
<td>4800</td>
<td>4800</td>
<td>430</td>
<td>70</td>
<td>70</td>
<td>4630</td>
<td>1.1</td>
<td>3~380V50Hz</td>
<td>1830</td>
</tr>
<tr>
<td>4800</td>
<td>5000</td>
<td>5000</td>
<td>430</td>
<td>70</td>
<td>70</td>
<td>4830</td>
<td>1.1</td>
<td>3~380V50Hz</td>
<td>1980</td>
</tr>
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<td>5000</td>
<td>5200</td>
<td>5200</td>
<td>430</td>
<td>70</td>
<td>70</td>
<td>5030</td>
<td>1.1</td>
<td>3~380V50Hz</td>
<td>2100</td>
</tr>
</tbody>
</table>

Duct installed up and down

Duct installed right and left
APPLICATIONS

Selection Program

We have developed a calculation program for simple selection of a rotary heat exchanger model. It can not only be used as a single design selection program, but can also be combined into your program by DLL. We can add it to your program upon your request, too. Please contact us for the selection program.
APPLICATIONS

Selection Chart

![Diagram showing airflow, wheel diameter, air resistance, temperature efficiency, and airflow velocity parameters.](image-url)
Applications

Rotary heat exchanger can be built in air handling unit (AHU) as a main part of the heat recovery section. Usually side panel of the exchanger casing is unnecessary, except that bypass has been set in AHU.

It can also be installed in the ducts of ventilation system as a main part of the heat recovery section, connected by flange. In this case, side panel of the exchanger is necessary to prevent leakage.

Note: casing type and segment quantity should depend on the application spaces as well as transportation capability and conditions at installation. Over segmentation will increase the assembly work, and overlarge size will cause difficulties in transportation.

Application conditions
Ambient temperature: -40-70°C
Max face velocity: 5.5m/s
Max pressure on casing: 2000Pa
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E-mail: info@holtop.com

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