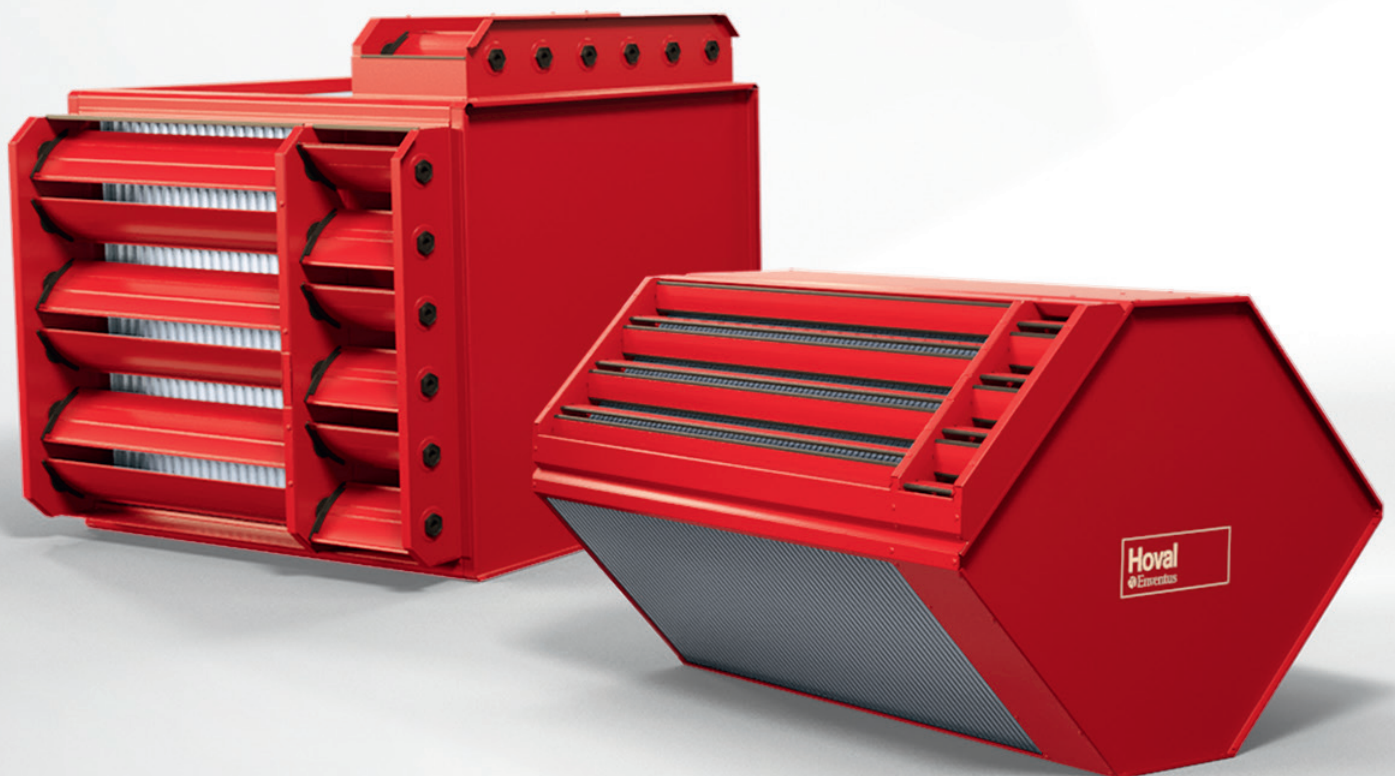


# Hoval Enventus Plate heat exchangers

For energy recovery in ventilation systems  
and in process engineering

Design handbook

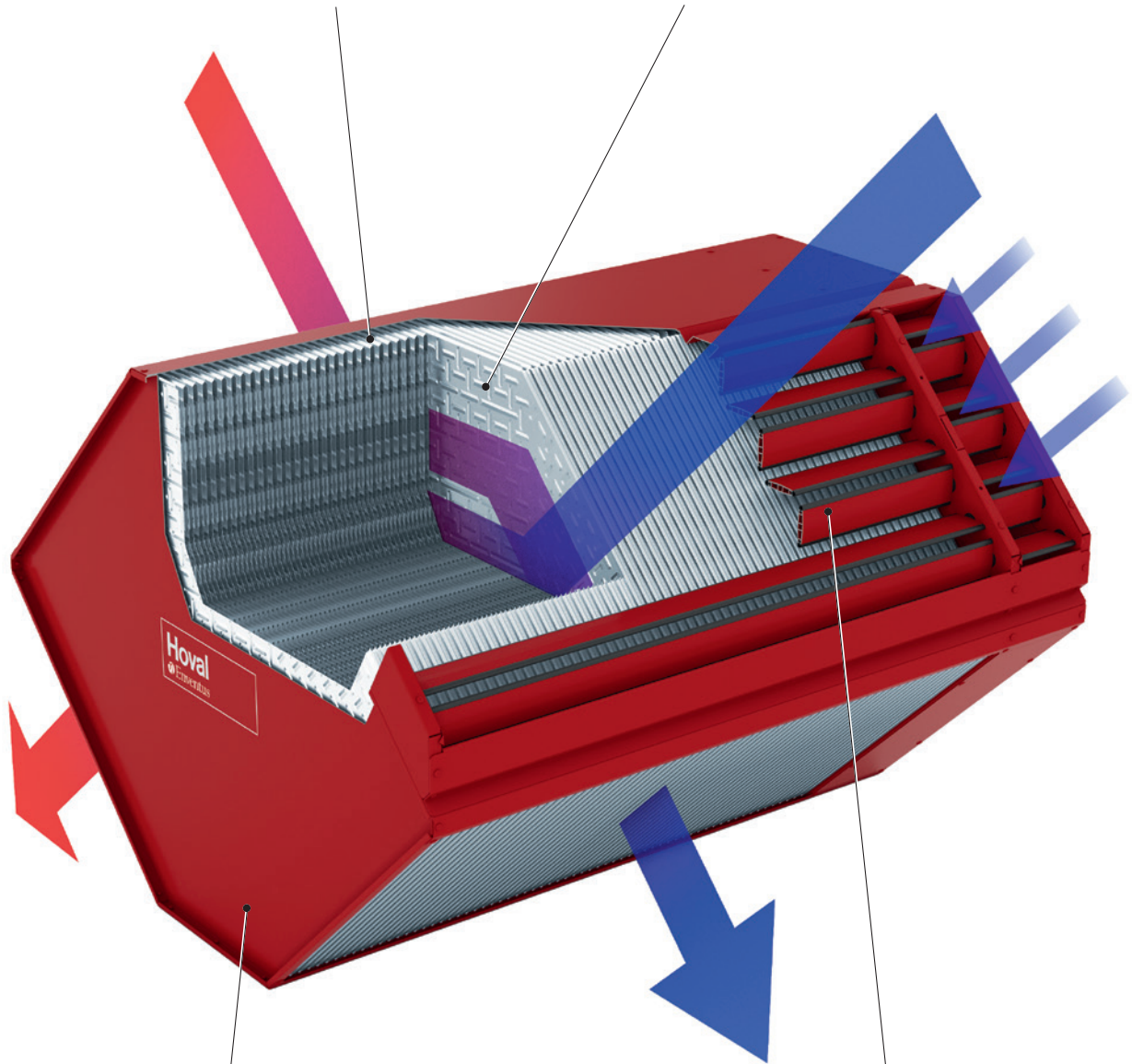


**Hoval**  
Enventus

# Gotthard



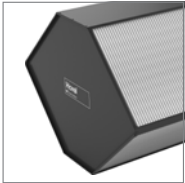
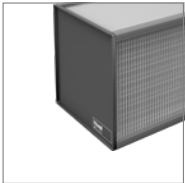




Tight fold connections  
for good stability and  
leak-tightness

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

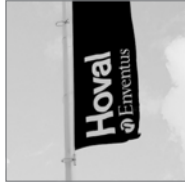


Side walls either flat or with  
double folded edges

Complete package with  
bypass and control dampers  
from a single source

|   |   |          |
|---|---|----------|
|    | <p><b>Hoval Enventus energy recovery</b> 3<br/>                 Economical. Reliable. Competent.</p>                      | <p>A</p> |
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|  | <p><b>Design S</b> 25<br/>                 Plate heat exchangers for air flow rates from 200 to 100000 m³/h</p>           | <p>E</p> |
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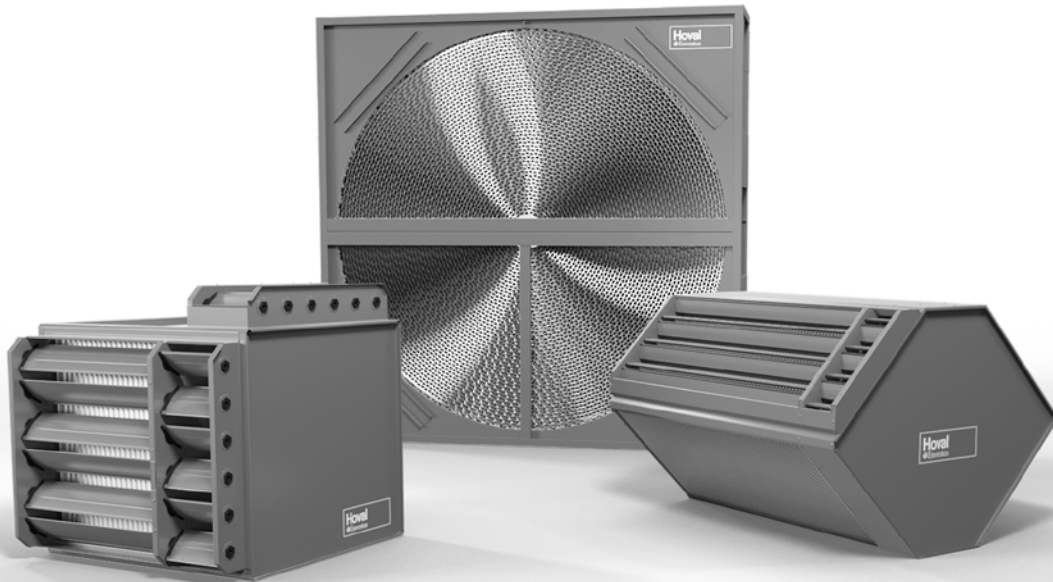




## Hoval Enventus energy recovery

Economical. Reliable. Competent.

A



## Economical. Reliable. Competent.

Hoval Enventus 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 Enventus 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 humidity 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 Enventus 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 Enventus 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 Enventus 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**

5

Model range, type codes and availability

- 1 Model range .....6
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B

# 1 Model range

Hoval Enventus plate heat exchangers are important elements for saving energy in air handling units, in ductwork systems and in process engineering. A wide range of models is available for optimum adaptation to the application in question.

## 1.1 Designs

The technical demands on the exchanger package depend on the air flow rate and the application. The following designs are available:

| Design          | Air flow rate       | Principle          |
|-----------------|---------------------|--------------------|
| G<br>(Gotthard) | 200...10 000 m³/h   | Counter-cross flow |
| K<br>(Krivan)   | 200...15 000 m³/h   | Crossflow          |
| S               | 200...100 000 m³/h  | Crossflow          |
| F               | 1000...100 000 m³/h | Crossflow          |

Table B1: Designs

## 1.2 Series

Different series are available with different materials depending on the design.

| Series | Description  |
|--------|--|
| V      | <b>Standard</b><br>Plates made of aluminium, casing made of aluminium sections and aluzinc sheet, silicone-free              |
| T      | <b>High-temperature</b><br>Temperature-resistant up to 200 °C, materials as for series V, but with high-temperature silicone |
| G      | <b>Coated</b><br>Materials as for series V, but the exchanger is coated and therefore better protected against corrosion.    |
| C      | <b>Coated casing</b><br>Materials as for series V, but the casing is coated.   |
| D      | <b>Coated plates</b><br>Materials as for series V, the plates are coated.  |

Table B2: Series

## 1.3 Construction types

| Construction type | Description   |
|-------------------|---|
| -                 | <b>Standard</b><br>Standard plate heat exchangers are single exchangers with double folded edges  |
| F                 | <b>Flat side walls</b><br>Exchangers in design G are optionally available with side walls that do not have folded edges.  |
| Z                 | <b>Twin exchangers, only one with dampers, if any</b><br>Twin exchangers are 2 single exchangers supplied separately, which are installed in the air-conditioning unit as a twin. Design Z is available as an exchanger package without bypass, with bypass or with bypass and control dampers. If dampers are ordered, they are only mounted on one of the two exchangers. |
| Y                 | <b>Twin exchangers, both with dampers</b><br>Design Y twin exchangers are always equipped with bypass and control dampers. Dampers are mounted on both exchangers.  |

Table B3: Construction types

## 1.4 Exchanger sizes

Hoval Enventus plate heat exchangers are available with edge lengths from approx. 400 mm to 2400 mm in finely spaced steps. Some sizes are composed of 4 packages.

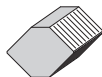

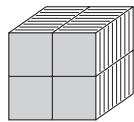
| Structure   | Size | Design |   |   |   |
|---|------|--------|---|---|---|
|   |      | G      | K | S | F |
|  | 055  | ●      | – | – | – |
|   | 065  | ●      | – | – | – |
|   | 075  | ●      | – | – | – |
|   | 085  | ●      | – | – | – |
|  | 040  | –      | – | ● | – |
|   | 050  | –      | – | ● | – |
|   | 060  | –      | – | ● | – |
|   | 070  | –      | – | ● | – |
|   | 085  | –      | ● | ● | – |
|   | 100  | –      | ● | ● | ● |
|   | 120  | –      | – | ● | ● |
|   | 140  | –      | – | – | ● |
|  | 160  | –      | – | – | ● |
|   | 140  | –      | – | ● | – |
|   | 170  | –      | – | ● | – |
|   | 200  | –      | – | ● | ● |
|   | 240  | –      | – | ● | ● |

Table B4: Exchanger sizes



## 1.5 Exchanger width

The width of the plate heat exchangers can be selected in steps of 1 mm:

- Counterflow exchanger: 200...1900 mm
- Crossflow exchanger: 200...4100 mm

In order to simplify transport and installation, very wide exchangers are delivered in 2 parts. This applies for the following exchanger sizes:

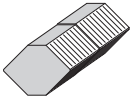
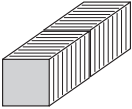
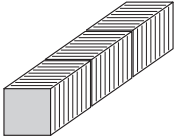
| Structure   | Width          | Design                            |
|---|----------------|-----------------------------------|
|    | > 950 mm       | G-055 to G-085                    |
|   | 1401...2800 mm | S-040 to S-060                    |
|   | > 2050 mm      | K-085 and K-100<br>S-070 to S-240 |
|   | > 2200 mm      | F-100 to F-240                    |
|  | > 2800 mm      | S-040 to S-060                    |

Table B5: Exchangers with split width

## 1.6 Options

Optional components are precisely matched to the respective Hoval Enventus plate heat exchanger and round it off to form a complete package from a single source, for example:

- Bypass for performance control with control dampers
- Recirculation bypass with recirculation damper



Fig. B1: Bypass for performance control



Fig. B2: Recirculation bypass

## 2 Type codes and availability

| Availability  | S V - 200 / AL / 2100 / BSK 140 , 4P , L , H , Q1 , G2 , B4 , K001  |
|---|---|
| <p>↓</p> <p><b>Design</b></p> <p>G ..... Design G (Gotthard)</p> <p>K ..... Design K (Krivan)</p> <p>S ..... Design S</p> <p>F ..... Design F</p> <p><b>Series</b></p> <p>• • • • V ..... Standard</p> <p>• • • • T ..... High-temperature</p> <p>• • • • G ..... Corrosion-protected</p> <p>• • • • C ..... Coated casing, uncoated plates</p> <p>• • • • D ..... Uncoated casing, coated plates</p> <p><b>Construction type</b></p> <p>• • • • - ..... Standard</p> <p>• • • • F ..... Flat side walls (only without bypass and dampers)</p> <p>• • • • Z ..... Twin exchangers (only one with dampers, if any)</p> <p>• • • • Y ..... Twin exchangers (both with dampers)</p> <p><b>Size</b></p> <p>• • • • Code for the size of the exchanger plates (040 – 240)</p> <p><b>Efficiency / plate spacing</b></p> <p>• • • • Code for temperature efficiency</p> <p><b>Exchanger width</b> (outside width, any required size in steps of 1 mm)</p> <p>• • • • GV-055 - GV-065: 0200 mm – 1400 mm (with bypass: min. 500 mm)</p> <p>• • • • GV-075 - GV-085: 0200 mm – 1900 mm (with bypass: min. 500 mm)</p> <p>• • • • 0200 mm – 4100 mm</p> <p><b>Bypass and dampers</b></p> <p>• • • • BS-.....Side bypass</p> <p>• • • • BSK.....Side bypass with dampers</p> <p>• • • • XS-.....Side bypass on the opposite side</p> <p>• • • • XSK.....Side bypass with dampers on the opposite side</p> <p>• • • • BM .....Middle bypass</p> <p>• • • • BMK.....Middle bypass with dampers</p> <p>• • • • USK .....Side recirculation bypass with dampers</p> <p>• • • • YSK.....Side recirculation bypass with dampers on the opposite side</p> <p>• • • • UMK.....Middle recirculation bypass with dampers</p> <p><b>Bypass width</b> (inside width, any required size in steps of 1 mm)</p> <p>• • • • GV-055 - GV-065: 060 mm – 260 mm   GV-075 - GV-085: 060 mm – 360 mm</p> <p>• • • • 050 mm – 999 mm</p> | <p>Availability</p> <p>Design</p> <p>Series</p> <p>Construction type</p> <p>Size</p> <p>Efficiency / plate spacing</p> <p>Exchanger width</p> <p>Bypass and dampers</p> <p>Bypass width</p> |

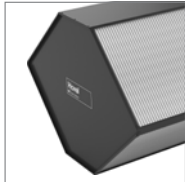
Availability

S V - 200 / AL / 2100 / BSK 140 , 4P , L , H , Q1 , G2 , B4 , K001

| G | K | S | F |   |
|---|---|---|---|---|
|   |   |   |   | <b>Leakage test</b>   |
|   | • | • | • | 4P .....Leakage test on 4 sides   |
|   |   |   |   | <b>Horizontal installation</b>  |
| • | • | • | • | L.....Horizontal installation (for design G with dampers for widths up to 950 mm) |
|   |   |   |   | <b>Adapter for actuator</b>   |
| • | • | • | • | H.....Adapter for actuator  |
|   |   |   |   | <b>Packaging</b>  |
|   | • | • | • | Q1 .....Stronger packaging  |
|   |   |   |   | <b>Partitioned delivery</b>   |
| • | • | • | • | G2.....Partitioned delivery   |
|   |   |   |   | <b>Block of 4, supplied loose</b>   |
|   |   | • | • | B4 .....Supplied loose  |
|   |   |   |   | <b>Customer code</b>  |
| • | • | • | • | K001 ....Code for customer-specific attributes                                    |

Table B6: Type codes and availability





**Gotthard – design G**

Plate heat exchangers for air flow rates from 200 to 10000 m<sup>3</sup>/h

|                           |    |
|---------------------------|----|
| 1 Use .....               | 12 |
| 2 Structure .....         | 12 |
| 3 Specification text..... | 13 |
| 4 Technical data.....     | 14 |

C

## 1 Use

Hoval Enventus plate heat exchangers of design G (Gotthard) are energy recovery units for installation in ventilation and air-conditioning units. They are available in different sizes, suitable for air flow rates from approx. 200 to 10000 m<sup>3</sup>/h.

The suitability of the heat exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

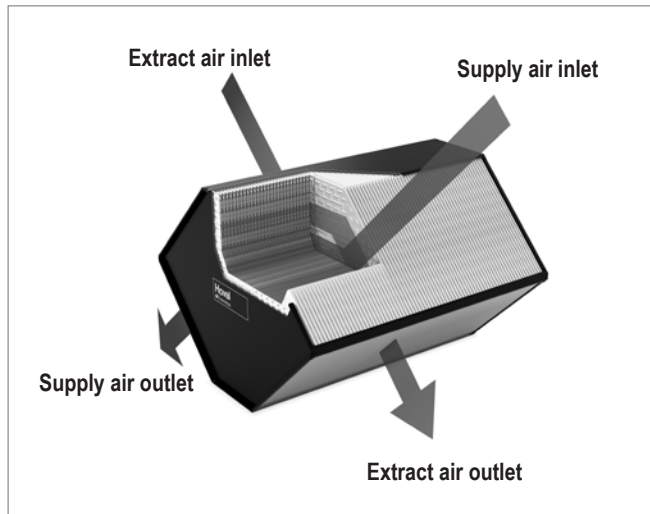
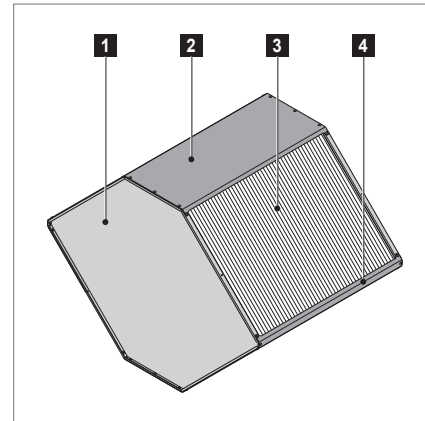


Fig. C1: Air flow through Gotthard plate heat exchanger

## 2 Structure

Gotthard plate heat exchangers consist of the exchanger package and the casing.



- 1 Side wall
- 2 Connection plate
- 3 Exchanger package
- 4 Connection profile

Fig. C2: Structure of Gotthard plate heat exchanger

### 2.1 Exchanger package

The exchanger package consists of specially formed aluminium plates. Their profile is an optimum design resulting from detailed tests for temperature efficiency, pressure drop and rigidity.

There are different plate sizes, which are formed with different profile depths, i.e. for different plate spacings and thus different efficiency values.

The connection of the plates is made by a fold. This gives a several-fold material thickness at air entry and exit, which lends the exchanger package a particularly high stability and leak-tightness.



Fig. C3: Folded connections give the exchanger package several-fold material thickness for the leading and trailing edges

## 2.2 Casing

The exchanger package is fitted into a casing of connection profiles and side walls.

- The corners of the exchanger package are sealed into the aluzinc sheet steel connection profiles with a sealing compound.
- The side walls made of aluzinc sheet steel are riveted onto the connection profiles.

### Standard construction type

The side walls of the casing have a double-folded edge. This facilitates the handling of the exchanger with lifting tools and enables control dampers to be mounted.

### Construction type F

The side walls of the casing are flat. That creates more space for the exchanger package and thus greater performance.

## 2.3 Exchanger sizes and efficiency

The installed exchanger area and thus the plate spacing are the determining factors for the efficiency. Hoval Enventus offers several plate spacings for most exchanger sizes so that an optimum solution can be achieved for each project.

| Efficiency / plate spacing | Gotthard |     |     |     |
|----------------------------|----------|-----|-----|-----|
|                            | 055      | 065 | 075 | 085 |
| -D                         | -        | -   | 2.8 | 2.8 |
| -W                         | 2.9      | 3.1 | 3.5 | 4.1 |

Table C1: Clear plate spacings for Gotthard exchangers (nominal values in mm)

## 2.4 Exchanger width

The width of the plate heat exchangers can be selected in steps of 1 mm. In order to simplify transport and installation, very wide exchangers are delivered in 2 parts. Several exchangers with dampers are linked with connecting bolts when installed into the air handling unit. A connecting bolt is also supplied.

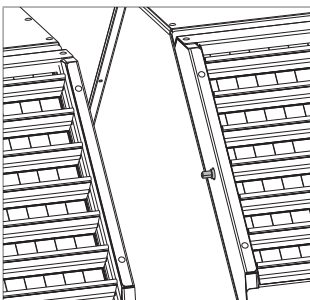


Fig. C4: Connecting bolts for damper connection for partitioned exchangers

## 3 Specification text

### Hoval Enventus plate heat exchanger design G (Gotthard)

Hoval Enventus counterflow plate heat exchangers for energy recovery, consisting of the exchanger package and the casing. The exchanger package consists of aluminium plates with pressed-in spacers; condensate drainage is possible in every direction, depending on the installation position. The plates are connected by a fold, which gives a severalfold material thickness at air entry and exit. The corners of the exchanger package are sealed into especially rigid aluzinc sheet steel connection profiles in the casing with a sealing compound. The side walls of aluzinc sheet steel are riveted tightly to these extrusions. All performance data is certified by Eurovent and TÜV Süd. The suitability of the exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

### Series

- V: Aluminium plates and aluzinc sheet steel; differential pressure stability: max. 2000 Pa; silicone-free; resistant to temperatures up to 80 °C.

### Construction types

- Double-folded edges on side walls (standard)
- Flat side walls (only available without bypass and dampers)

### Options

- Side bypass: suited to the exchanger package.
- Control dampers: installed in front of exchanger package and bypass; aluminium damper blades, aluzinc sheet steel housing; high-quality plastic drive gears outside the air flow; leak-tightness class 2 according to EN 1751.
- Horizontal installation: plates arranged horizontally (for exchangers with control dampers up to widths of 950 mm).
- Adapter for actuator: for inside drive of the control dampers.

## 4 Technical data

### 4.1 Application limits

| Gotthard                   | Series V    |
|----------------------------|-------------|
| Temperature                | -40...80 °C |
| Max. differential pressure | 2000 Pa     |

Table C2: Application limits

### 4.2 Specification of material

| Exchanger                      |                                    |
|--------------------------------|------------------------------------|
| Plates                         | Aluminium                          |
| Side walls                     | Aluzinc sheet steel <sup>1)</sup>  |
| Connection profiles            | Aluzinc sheet steel                |
| Sealing                        | Silicone-free 2-component-adhesive |
| Rivets <sup>2)</sup>           | Aluminium                          |
| Dampers + adapter              |                                    |
| Casing                         | Aluzinc sheet steel                |
| Damper blades                  | Extruded aluminium section         |
| Bearing, end caps, gear wheels | Polypropylene                      |

1) Aluzinc sheet steel is sheet steel coated with an alloy of 55% aluminium and 45% zinc.  
2) Between side walls and connection profiles/plates

Table C3: Specification of material

### 4.3 Sound attenuation

| Efficiency / plate spacing | Gotthard |     |     |      |
|----------------------------|----------|-----|-----|------|
|                            | 055      | 065 | 075 | 085  |
| -D                         | -        | -   | 8.7 | 10.4 |
| -W                         | 6.4      | 6.8 | 6.9 | 7.0  |

Table C4: Sound attenuation at 1000 Hz (values in dB)

| Hz | 63   | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |
|----|------|------|------|------|------|------|------|------|
| f  | 0.24 | 0.48 | 0.67 | 0.85 | 1.00 | 1.15 | 1.27 | 1.36 |

Table C5: Frequency correction factors



**Note**

For more information about sound attenuation see chapter 9 in the system design section.

### 4.4 Exchanger widths


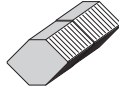

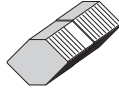
| Gotthard   | 055 - 065  | 075 - 085  |
|--|------------|------------|
| <b>Exchanger without bypass</b>  |            |            |
|  | 200...950  | 200...950  |
|  | 951...1400 | 951...1900 |
| <b>Exchanger with bypass</b>   |            |            |
|  | 500...950  | 500...950  |
|  | 951...1400 | 951...1900 |
| <b>Inside bypass width</b>   | 60...260   | 60...360   |

Table C6: Exchanger widths in mm (can be selected in steps of 1 mm)



### 4.5 Exchanger dimensions

Standard construction type (= with side walls with double folded edges)

| Size | 055                                 | 065 | 075  | 085  |
|------|-------------------------------------|-----|------|------|
| H    | 533                                 | 674 | 815  | 957  |
| D    | 758                                 | 899 | 1040 | 1182 |
| A    | 361                                 | 461 | 561  | 661  |
| ak   | 227                                 | 327 | 427  | 527  |
| B    | Exchanger width (outside dimension) |     |      |      |
| S    | Bypass width (inside width)         |     |      |      |

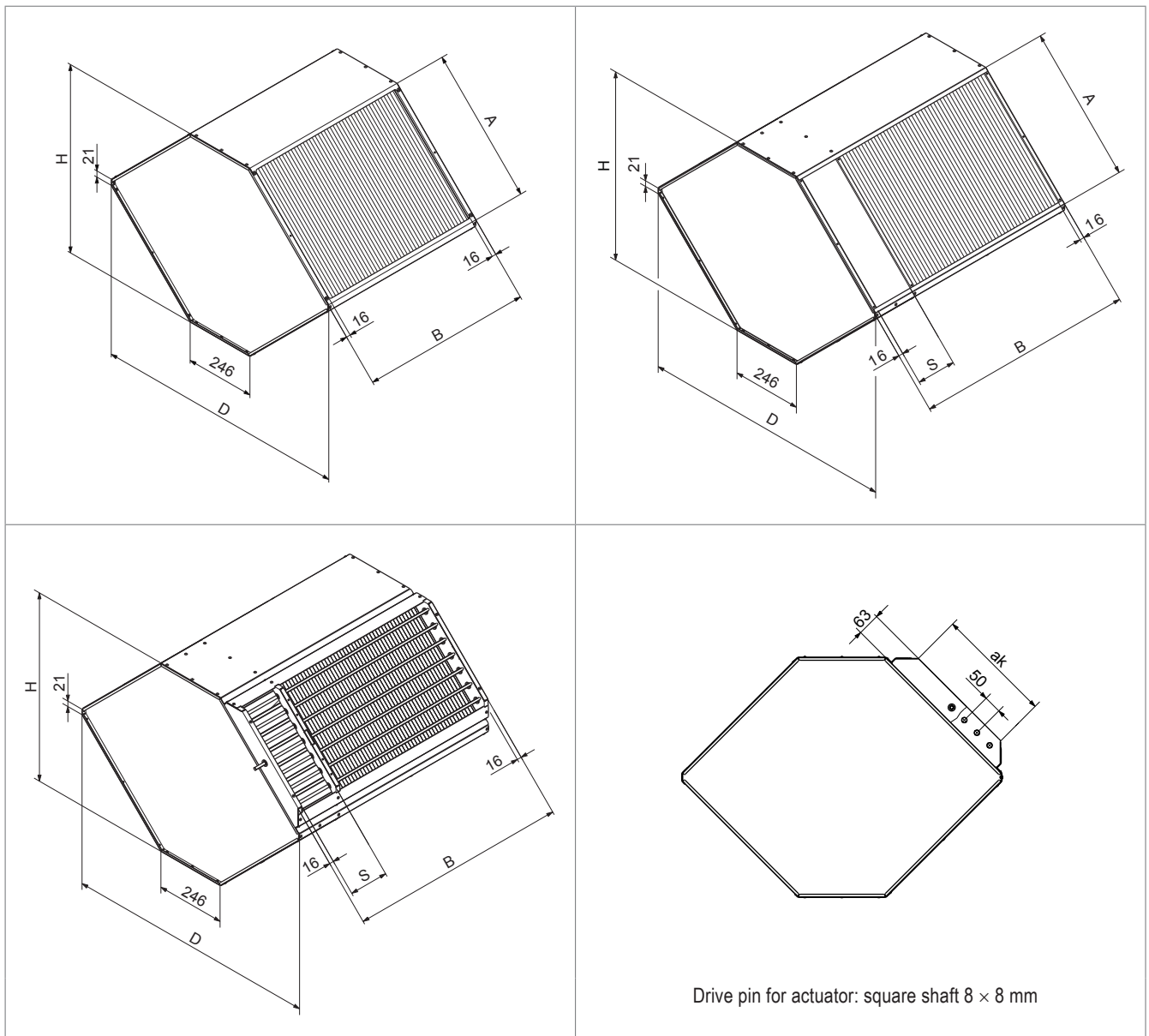


Fig. C5: Dimension sheet for Gotthard plate heat exchanger (dimensions in mm)

Construction type F (= with flat side walls)

| Size | 055                                 | 065 | 075  | 085  |
|------|-------------------------------------|-----|------|------|
| H    | 533                                 | 674 | 815  | 957  |
| D    | 758                                 | 899 | 1040 | 1182 |
| A    | 361                                 | 461 | 561  | 661  |
| B    | Exchanger width (outside dimension) |     |      |      |

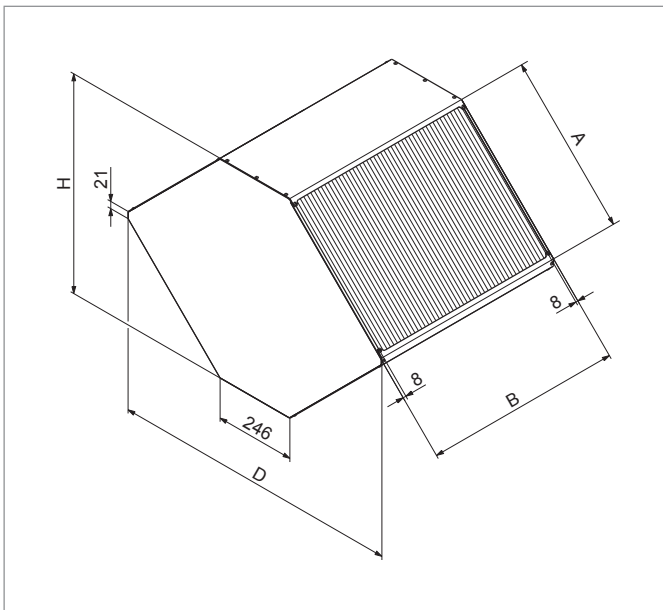
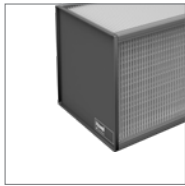


Fig. C6: Dimension sheet for Gotthard plate heat exchanger with flat side walls (dimensions in mm)



**Krivan – design K**

Plate heat exchangers for air flow rates from 200 to 15000 m<sup>3</sup>/h

|                           |    |
|---------------------------|----|
| 1 Use .....               | 18 |
| 2 Structure .....         | 18 |
| 3 Specification text..... | 20 |
| 4 Technical data.....     | 21 |

D

## 1 Use

Hoval Enventus plate heat exchangers of design K (Krivan) are energy recovery units for installation in ventilation and air-conditioning units. They are available in different sizes, suitable for air flow rates from approx. 200 to 15000 m<sup>3</sup>/h.

The suitability of the heat exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

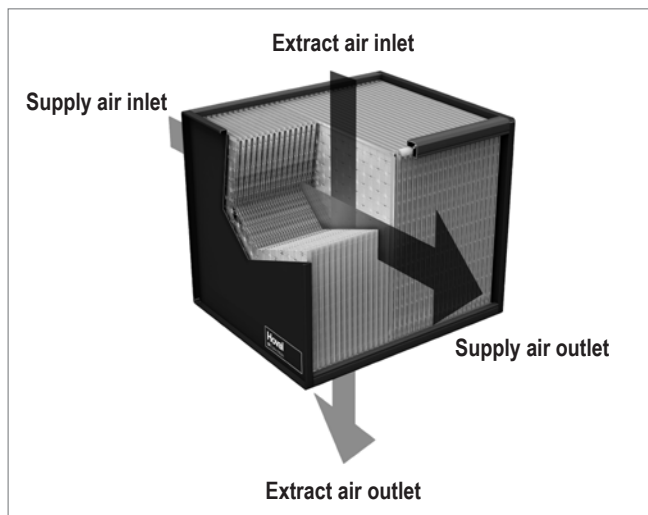


Fig. D1: Air flow through Krivan plate heat exchanger

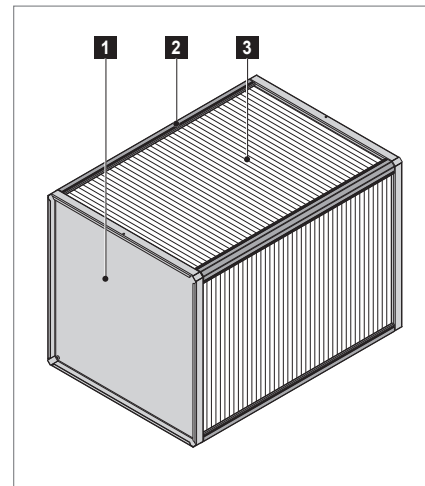


### Note

Krivan exchangers are the latest addition to the Hoval Enventus family of plate heat exchangers. They are characterised by an optimal ratio between thermal efficiency and pressure drop. In the near future, Krivan plate heat exchangers will be available in further sizes.

## 2 Structure

Krivan plate heat exchangers consist of the exchanger package and the casing.



- 1 Side wall
- 2 Corner section
- 3 Exchanger package

Fig. D2: Structure of Krivan plate heat exchanger

### 2.1 Exchanger package

The exchanger package consists of specially formed aluminium plates. The surface profile has been designed and extensively tested to provide maximum efficiency. The focus was on performance: Krivan plate exchangers offer an optimal ratio between thermal efficiency and pressure drop. The main advantages are:

- High thermal efficiency with low pressure drop at the same time
- Very high differential pressure stability due to optimised arrangement of longitudinal and transverse ribs
- Condensate can drain freely in all directions

There are different plate sizes, which are formed with different profile depths, i.e. for different plate spacings and thus different efficiency values.

The connection of the plates is made by a fold. This gives a several-fold material thickness at air entry and exit, which lends the exchanger package a particularly high stability and leak-tightness.



Fig. D3: Folded connections give the exchanger package several-fold material thickness for the leading and trailing edges

## 2.2 Casing

The exchanger package is fitted into a casing consisting of corner sections and side walls.

- The corners of the exchanger package are sealed into the aluminium corner sections with a sealing compound.
- The side walls made of aluzinc sheet steel are bolted onto the corner sections.
- The 45° corners facilitate installation and reduce the diagonal dimension.
- Other components can be bolted or riveted directly to the corner sections.
- The double folding of the side walls facilitates the handling of the exchanger with lifting tools.

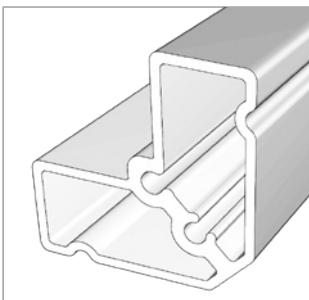


Fig. D4: The specially developed aluminium corner section offers particular advantages

## 2.3 Exchanger sizes and efficiency

The installed exchanger area and thus the plate spacing are the determining factors for the efficiency. Hoval Enventus offers several spacings for all sizes so that an optimum solution can be achieved for each project.

| Efficiency / plate spacing | Krivan |     |
|----------------------------|--------|-----|
|                            | 085    | 100 |
| P1                         | 2.5    | 3.1 |
| P3                         | 2.5    | 3.1 |

Table D1: Clear plate spacings for Krivan exchangers (nominal values in mm)

## 2.4 Exchanger width

The width of the plate heat exchangers can be selected in steps of 1 mm. In order to simplify transport and installation, very wide exchangers are delivered in 2 parts. Several exchangers with dampers are linked with connecting bolts when installed into the air handling unit. For this purpose, one or more connecting bolts are provided, depending on the exchanger size.

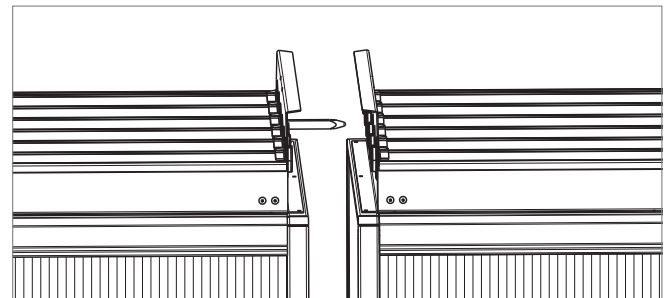


Fig. D5: Connecting bolts for damper connection for partitioned exchangers

### 3 Specification text

#### Hoval Enventus plate heat exchanger design K (Krivan)

Hoval Enventus crossflow plate heat exchangers for energy recovery, consisting of the exchanger package and the casing. The exchanger package consists of specially formed aluminium plates. The surface profile has been designed and extensively tested to provide maximum efficiency. The focus was on performance: Krivan plate exchangers offer an optimal ratio between thermal efficiency and pressure drop. The plates are connected by a fold, which gives a severalfold material thickness at air entry and exit. The corners of the exchanger package are sealed into especially rigid aluminium extrusions in the casing with a sealing compound. The side walls of aluzinc sheet steel are bolted tightly to these extrusions. All performance data is certified by Eurovent and TÜV Süd. The suitability of the exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

#### Series

- V: Aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.
- T: Aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 1000 Pa; special sealing compound; resistant to temperatures up to 200 °C.
- G: Coated aluminium plates, coated aluzinc sheet steel and coated corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.
- C: Aluminium plates, coated aluzinc sheet steel and coated corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.
- D: Coated aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.

#### Construction types

- -: Individual plate heat exchanger (standard)
- Z: Twin plate heat exchanger – 2 single plate heat exchangers, optionally without bypass, with bypass or with bypass and dampers. If dampers are ordered, they are only mounted on one of the two exchangers. Assembled on site in the air handling unit.
- Y: Twin plate heat exchanger – 2 single plate heat exchangers with bypass and dampers on both exchangers. Assembled on site in the air handling unit.

#### Options

- Side or middle bypass: suited to the exchanger package.
- Control dampers: installed in front of exchanger package and bypass; sheet steel damper blades, aluzinc sheet steel housing; high-quality plastic drive gears outside the air flow; leak-tightness class 2 according to EN 1751; series G and C are powder-coated.
- Side or middle circulating air bypass: suited to exchanger package; incl. control dampers and circulating air damper with sheet steel damper blades, aluzinc sheet steel casing and high-quality plastic drive gears outside the air flow; leak-tightness class 2 according to EN 1751; series G and C are powder-coated.
- Leak-tightness test: additional sealing with casting resin; thus extremely watertight design; incl. water test.
- Horizontal installation: plates arranged horizontally.
- Adapter for actuator: for inside drive of the control and circulating air dampers.
- Reinforced packaging: additional wooden crate on top, 4-sided covering of the exchanger package with wood fibre boards, machine wrapping foil.

## 4 Technical data

### 4.1 Application limits

| Krivan                     | Series V, G, C, D | Series T    |
|----------------------------|-------------------|-------------|
| Temperature                | -40...80°C        | -40...200°C |
| Max. differential pressure | 2500 Pa           | 1000 Pa     |

Table D2: Application limits

### 4.2 Specification of material

| Series                                | V                                  | T                          | G  | C   | D                                  |
|---------------------------------------|------------------------------------|----------------------------|--|---|------------------------------------|
| <b>Exchanger</b>                      |                                    |                            |  |   |                                    |
| <b>Plates</b>                         | Aluminium                          | Aluminium                  | Aluminium epoxy-coated                           | Aluminium                                 | Aluminium epoxy-coated             |
| <b>Side walls</b>                     | Aluzinc sheet steel <sup>1)</sup>  | Aluzinc sheet steel        | Aluzinc sheet steel, powder-coated <sup>2)</sup> | Aluzinc sheet steel, powder-coated        | Aluzinc sheet steel                |
| <b>Corner sections</b>                | Extruded aluminium section         | Extruded aluminium section | Extruded aluminium section, powder-coated        | Extruded aluminium section, powder-coated | Extruded aluminium section         |
| <b>Sealing</b>                        | Silicone-free 2-component-adhesive | HT silicone                | Silicone-free 2-component-adhesive               | Silicone-free 2-component-adhesive        | Silicone-free 2-component-adhesive |
| <b>Screws <sup>3)</sup></b>           | Galvanised steel                   | Galvanised steel           | Chromium steel                                   | Chromium steel                            | Galvanised steel                   |
| <b>Dampers + adapter</b>              |                                    |                            |  |   |                                    |
| <b>Casing</b>                         | Aluzinc sheet steel                | –                          | Aluzinc sheet steel, powder-coated               | Aluzinc sheet steel, powder-coated        | Aluzinc sheet steel                |
| <b>Damper blades</b>                  | Galvanised sheet steel             | –                          | Galvanised sheet steel, powder-coated            | Galvanised sheet steel, powder-coated     | Galvanised sheet steel             |
| <b>Bearing, end caps, gear wheels</b> | Polypropylene                      | –                          | Polypropylene                                    | Polypropylene                             | Polypropylene                      |

1) Aluzinc sheet steel is sheet steel coated with an alloy of 55% aluminium and 45% zinc.  
 2) All powder coatings in red (RAL 3000)  
 3) Between side walls and corner sections

Table D3: Specification of material

### 4.3 Sound attenuation

| Efficiency / plate spacing | Krivan |      |
|----------------------------|--------|------|
|                            | 055    | 100  |
| P1                         | 11.8   | 11.5 |
| P3                         | 11.8   | 11.5 |

Table D4: Sound attenuation at 1000 Hz (values in dB)

| Hz | 63   | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |
|----|------|------|------|------|------|------|------|------|
| f  | 0.24 | 0.48 | 0.67 | 0.85 | 1.00 | 1.15 | 1.27 | 1.36 |

Table D5: Frequency correction factors

### 4.4 Exchanger widths



| Krivan  | 085 - 100   |
|---|-------------|
| <b>Exchanger with/without bypass</b>  |             |
|  | 200...2050  |
|  | 2051...4100 |
| <b>Inside bypass width</b>  | 50...999    |

Table D6: Exchanger widths in mm (can be selected in steps of 1 mm)



**Note**

For more information about sound attenuation see chapter 9 in the system design section.

### 4.5 Exchanger dimensions

#### Exchanger without dampers

| Size  | 085                                 | 100  |
|-------|-------------------------------------|------|
| H = L | 840                                 | 990  |
| D     | 1175                                | 1387 |
| B     | Exchanger width (outside dimension) |      |
| S     | Bypass width (inside width)         |      |

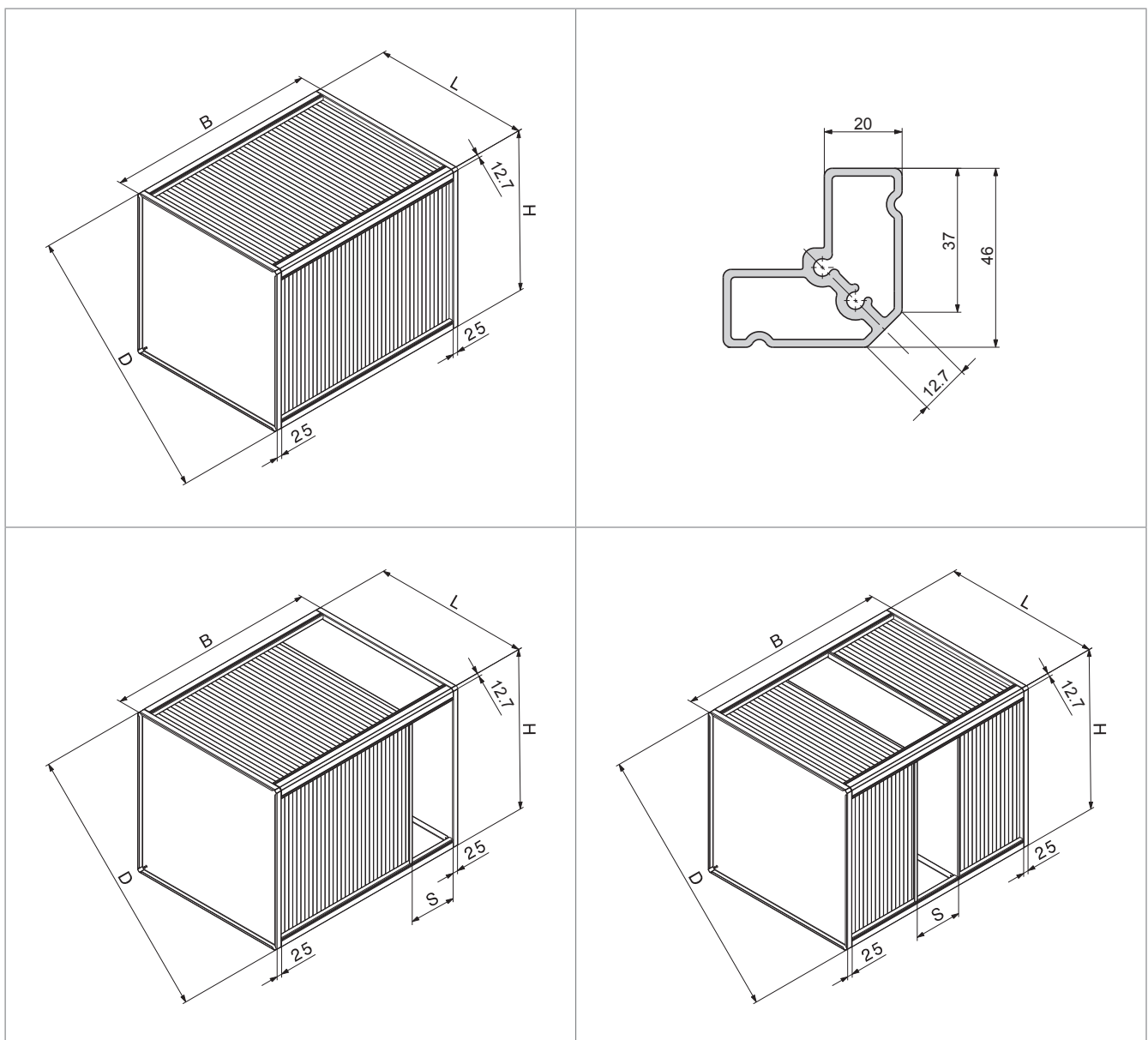


Fig. D6: Dimension sheet for Krivan plate heat exchanger without dampers (dimensions in mm)



Exchanger with dampers

| Size  | 085                                 | 100  |
|-------|-------------------------------------|------|
| H = L | 840                                 | 990  |
| D     | 1175                                | 1387 |
| X     | 16                                  | 34   |
| B     | Exchanger width (outside dimension) |      |
| S     | Bypass width (inside width)         |      |

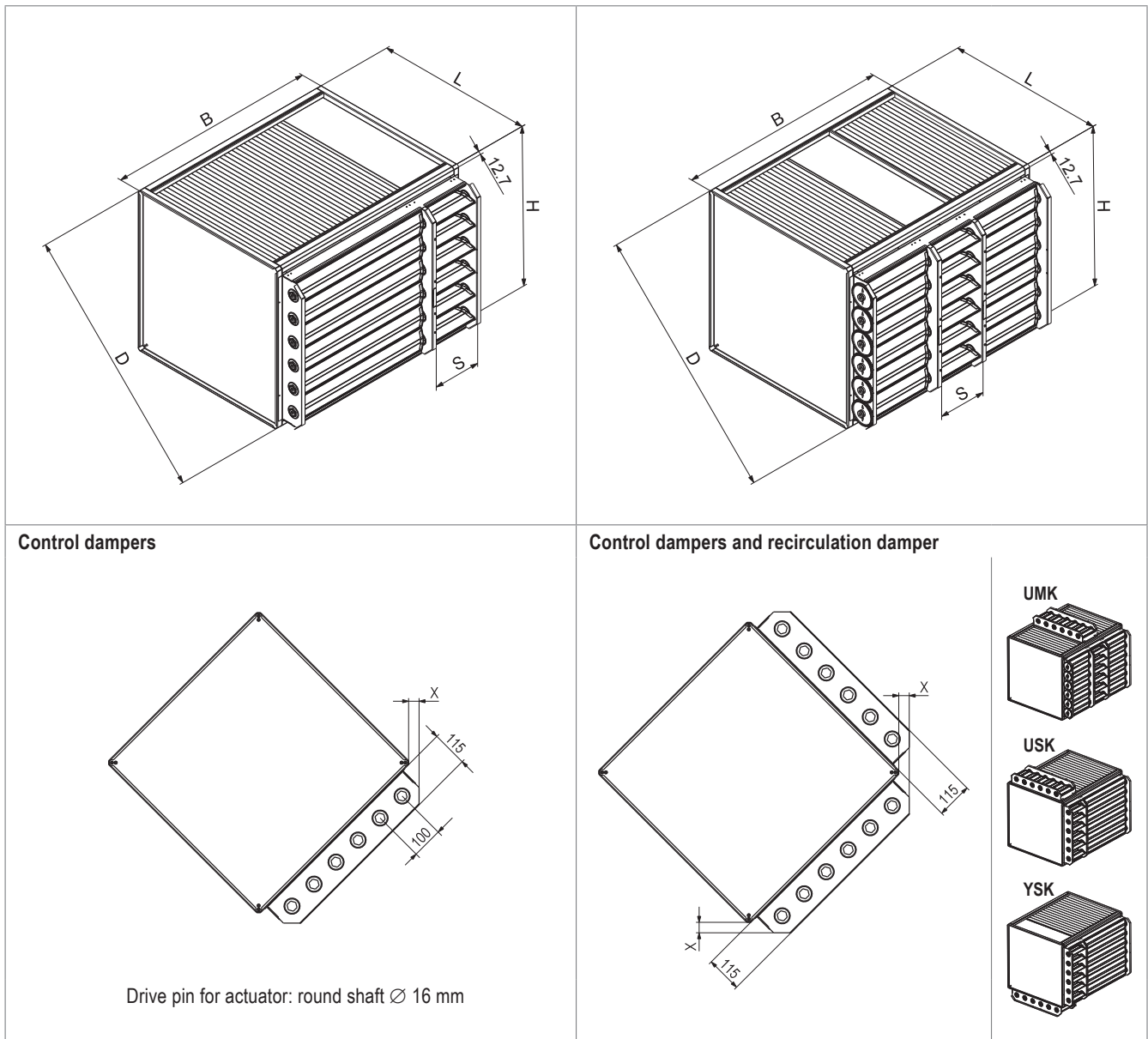


Fig. D7: Dimension sheet for Krivan plate heat exchanger with dampers (dimensions in mm)





**Design S**

Plate heat exchangers for air flow rates from 200 to 100000 m<sup>3</sup>/h

|                           |    |
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E

## 1 Use

Hoval Enventus plate heat exchangers of design S are energy recovery units for installation in ventilation and air-conditioning units. They are available in different sizes, suitable for air flow rates from approx. 200 to 100000 m<sup>3</sup>/h.

The suitability of the heat exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

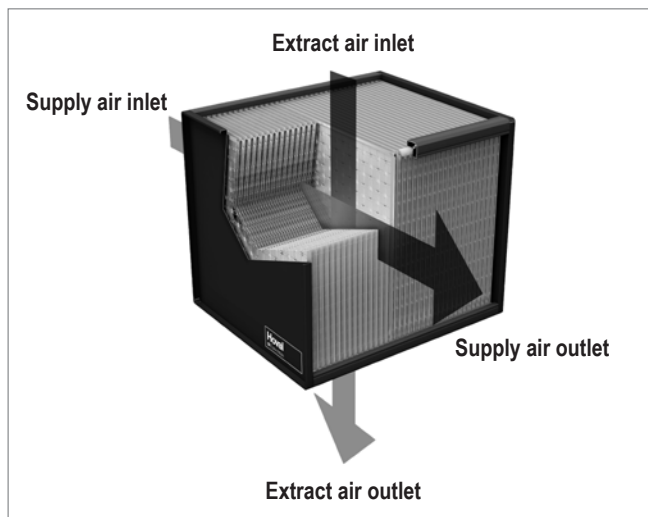


Fig. E1: Air flow through design S plate heat exchanger

## 2 Construction

Design S plate heat exchangers consist of the exchanger package and the casing.

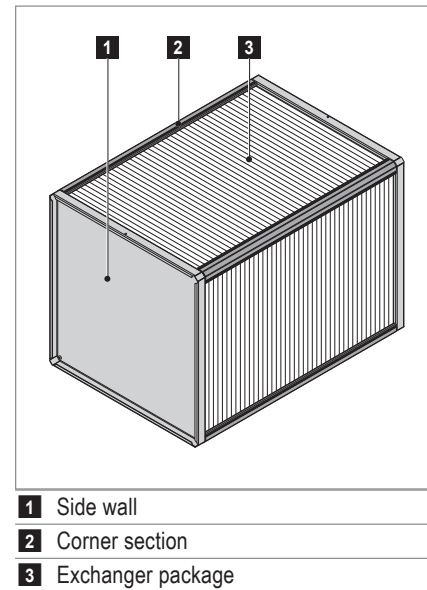


Fig. E2: Structure of design S plate heat exchanger

### 2.1 Exchanger package

The exchanger package consists of specially formed aluminium plates. Their profile is an optimum design resulting from detailed tests for temperature efficiency, pressure drop and rigidity.

There are different plate sizes, which are formed with different profile depths, i.e. for different plate spacings and thus different efficiency values.

The connection of the plates is made by a fold. This gives a several-fold material thickness at air entry and exit, which lends the exchanger package a particularly high stability and leak-tightness.



Fig. E3: Folded connections give the exchanger package several-fold material thickness for the leading and trailing edges

## 2.2 Casing

The exchanger package is fitted into a casing consisting of corner sections and side walls.

- The corners of the exchanger package are sealed into the aluminium corner sections with a sealing compound.
- The side walls made of aluzinc sheet steel are bolted onto the corner sections.
- The 45° corners facilitate installation and reduce the diagonal dimension.
- Other components can be bolted or riveted directly to the corner sections.
- The double folding of the side walls facilitates the handling of the exchanger with lifting tools.

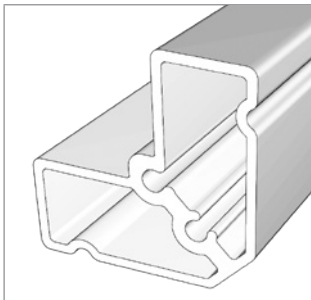


Fig. E4: The specially developed aluminium corner section offers particular advantages

## 2.3 Exchanger sizes and efficiency

The installed exchanger area and thus the plate spacing are the determining factors for the efficiency. Hoval Enventus offers several spacings for all sizes so that an optimum solution can be achieved for each project.

| Efficiency / plate spacing | Design S |     |     |     |     |     |     |
|----------------------------|----------|-----|-----|-----|-----|-----|-----|
|                            | 040      | 050 | 060 | 070 | 085 | 100 | 120 |
| -A                         | 2.3      | 2.0 | 2.0 | 2.0 | 2.0 | 2.5 | 3.2 |
| -C                         | -        | -   | 2.0 | 2.0 | 2.0 | -   | -   |
| AD                         | -        | -   | 2.5 | -   | 3.0 | -   | -   |
| -D                         | 2.3      | -   | 2.5 | -   | 3.0 | -   | -   |
| -E                         | -        | -   | -   | 2.0 | 2.0 | 2.5 | 3.2 |
| AR                         | -        | -   | 3.0 | 3.2 | 3.9 | -   | -   |
| -R                         | -        | -   | 3.0 | 3.2 | 3.9 | 2.5 | 3.2 |
| AS                         | -        | -   | -   | -   | -   | 3.5 | -   |
| AX                         | -        | -   | -   | -   | 5.1 | 4.4 | 4.8 |
| -X                         | -        | -   | -   | -   | 5.1 | 4.4 | -   |
| AY                         | -        | -   | -   | -   | -   | 5.4 | -   |
| AL                         | -        | -   | 4.7 | 5.3 | 6.3 | 6.3 | 6.3 |
| -L                         | -        | 4.4 | 4.7 | 5.3 | 6.3 | 6.3 | 6.3 |
| AW                         | -        | -   | 6.3 | 6.3 | -   | -   | -   |
| -W                         | -        | -   | 6.3 | 6.3 | -   | -   | -   |
| Structure                  |          |     |     |     |     |     |     |

| Efficiency / plate spacing | Size |     |     |     |
|----------------------------|------|-----|-----|-----|
|                            | 140  | 170 | 200 | 240 |
| -A                         | -    | 2.0 | -   | -   |
| -C                         | -    | 2.0 | -   | -   |
| -D                         | -    | 3.0 | -   | -   |
| -E                         | -    | -   | 6.3 | 6.3 |
| -R                         | 3.2  | 3.9 | 2.5 | -   |
| -X                         | 4.3  | 5.1 | 4.4 | 4.8 |
| AL                         | -    | 6.3 | 6.3 | 6.3 |
| -L                         | -    | 6.3 | 6.3 | 6.3 |
| AW                         | 6.3  | -   | -   | -   |
| -W                         | 6.3  | -   | -   | -   |
| Structure                  |      |     |     |     |

Table E1: Clear plate spacings of the design S exchangers (nominal values in mm)

## 2.4 Exchanger width

The width of the plate heat exchangers can be selected in steps of 1 mm. In order to simplify transport and installation, very wide exchangers are delivered in parts. Several exchangers with dampers are linked with connecting bolts when installed into the air handling unit. For this purpose, one or more connecting bolts are provided, depending on the exchanger size.

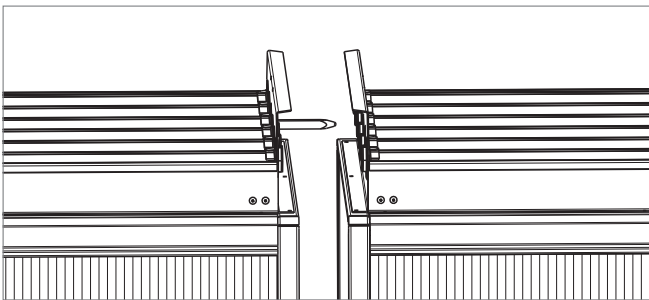


Fig. E5: Connecting bolts for damper connection for partitioned exchangers

## 3 Specification text

### Hoval Enventus plate heat exchanger design S

Hoval Enventus crossflow plate heat exchangers for energy recovery, consisting of the exchanger package and the casing. The exchanger package consists of aluminium plates with pressed-in spacers; condensate drainage is possible in every direction, depending on the installation position. The plates are connected by a fold, which gives a severalfold material thickness at air entry and exit. The corners of the exchanger package are sealed into especially rigid aluminium extrusions in the casing with a sealing compound. The side walls of aluzinc sheet steel are bolted tightly to these extrusions. All performance data is certified by Eurovent and TÜV Süd. The suitability of the exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

#### Series

- V: Aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.
- T: Aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 1000 Pa; special sealing compound; resistant to temperatures up to 200 °C.
- G: Coated aluminium plates, coated aluzinc sheet steel and coated corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.
- C: Aluminium plates, coated aluzinc sheet steel and coated corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.
- D: Coated aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 2500 Pa; silicone-free; resistant to temperatures up to 80 °C.

#### Construction types

- -: Individual plate heat exchanger (standard)
- Z: Twin plate heat exchanger – 2 single plate heat exchangers, optionally without bypass, with bypass or with bypass and dampers. If dampers are ordered, they are only mounted on one of the two exchangers. Assembled on site in the air handling unit.
- Y: Twin plate heat exchanger – 2 single plate heat exchangers with bypass and dampers on both exchangers. Assembled on site in the air handling unit.

#### Options

- Side or middle bypass: suited to the exchanger package.
- Control dampers: installed in front of exchanger package and bypass; sheet steel damper blades, aluzinc sheet steel housing; high-quality plastic drive gears outside the air flow; leak-tightness class 2 according to EN 1751; series G and C are powder-coated.
- Side or middle circulating air bypass: suited to exchanger package; incl. control dampers and circulating air damper with sheet steel damper blades, aluzinc sheet steel casing and high-quality plastic drive gears outside the air flow; leak-tightness class 2 according to EN 1751; series G and C are powder-coated.
- Leak-tightness test: additional sealing with casting resin; thus extremely watertight design; incl. water test.
- Horizontal installation: plates arranged horizontally.
- Adapter for actuator: for inside drive of the control and circulating air dampers.
- Reinforced packaging: additional wooden crate on top, 4-sided covering of the exchanger package with wood fibre boards, machine wrapping foil.
- Block of 4 delivered loose: exchanger sizes composed of 4 packages, delivered loose, assembly on site.

## 4 Technical data

### 4.1 Application limits

| Design S                   | Series V, G, C, D | Series T    |
|----------------------------|-------------------|-------------|
| Temperature                | -40...80°C        | -40...200°C |
| Max. differential pressure | 2500 Pa           | 1000 Pa     |

Table E2: Application limits

### 4.2 Specification of material

| Series                                | V                                  | T                          | G  | C   | D                                  |
|---------------------------------------|------------------------------------|----------------------------|--|---|------------------------------------|
| <b>Exchanger</b>                      |                                    |                            |  |   |                                    |
| <b>Plates</b>                         | Aluminium                          | Aluminium                  | Aluminium epoxy-coated                           | Aluminium                                 | Aluminium epoxy-coated             |
| <b>Side walls</b>                     | Aluzinc sheet steel <sup>1)</sup>  | Aluzinc sheet steel        | Aluzinc sheet steel, powder-coated <sup>2)</sup> | Aluzinc sheet steel, powder-coated        | Aluzinc sheet steel                |
| <b>Corner sections</b>                | Extruded aluminium section         | Extruded aluminium section | Extruded aluminium section, powder-coated        | Extruded aluminium section, powder-coated | Extruded aluminium section         |
| <b>Sealing</b>                        | Silicone-free 2-component-adhesive | HT silicone                | Silicone-free 2-component-adhesive               | Silicone-free 2-component-adhesive        | Silicone-free 2-component-adhesive |
| <b>Screws <sup>3)</sup></b>           | Galvanised steel                   | Galvanised steel           | Chromium steel                                   | Chromium steel                            | Galvanised steel                   |
| <b>Dampers + adapter</b>              |                                    |                            |  |   |                                    |
| <b>Casing</b>                         | Aluzinc sheet steel                | –                          | Aluzinc sheet steel, powder-coated               | Aluzinc sheet steel, powder-coated        | Aluzinc sheet steel                |
| <b>Damper blades</b>                  | Galvanised sheet steel             | –                          | Galvanised sheet steel, powder-coated            | Galvanised sheet steel, powder-coated     | Galvanised sheet steel             |
| <b>Bearing, end caps, gear wheels</b> | Polypropylene                      | –                          | Polypropylene                                    | Polypropylene                             | Polypropylene                      |

1) Aluzinc sheet steel is sheet steel coated with an alloy of 55% aluminium and 45% zinc.

2) All powder coatings in red (RAL 3000)

3) Between side walls and corner sections

Table E3: Specification of material

## 4.3 Sound attenuation

| Efficiency / plate spacing | Design S |     |     |      |      |      |      |      |      |      |      |
|----------------------------|----------|-----|-----|------|------|------|------|------|------|------|------|
|                            | 040      | 050 | 060 | 070  | 085  | 100  | 120  | 140  | 170  | 200  | 240  |
| -A                         | 5.7      | 8.3 | 9.9 | 11.6 | 14.0 | 13.2 | 12.4 | -    | 28.1 | -    | -    |
| -C                         | -        | -   | 9.9 | 11.6 | 14.0 | -    | -    | -    | 28.1 | -    | -    |
| AD                         | -        | -   | 7.9 | -    | 9.5  | -    | -    | -    | -    | -    | -    |
| -D                         | 5.7      | -   | 7.9 | -    | 9.5  | -    | -    | -    | 19.0 | -    | -    |
| -E                         | -        | -   | -   | 11.6 | 14.0 | 13.2 | 12.4 | -    | -    | 10.5 | 12.6 |
| AR                         | -        | -   | 6.6 | 7.3  | 7.2  | -    | -    | -    | -    | -    | -    |
| -R                         | -        | -   | 6.6 | 7.3  | 7.2  | 13.2 | 12.4 | 14.7 | 14.4 | 26.4 | -    |
| AS                         | -        | -   | -   | -    | -    | 10.3 | -    | -    | -    | -    | -    |
| AX                         | -        | -   | -   | -    | 5.5  | 7.5  | 8.3  | -    | -    | -    | -    |
| -X                         | -        | -   | -   | -    | 5.5  | 7.5  | -    | 10.7 | 11.0 | 15.0 | 16.7 |
| AY                         | -        | -   | -   | -    | -    | 6.4  | -    | -    | -    | -    | -    |
| AL                         | -        | -   | 4.3 | 4.4  | 4.5  | 5.2  | 6.3  | -    | 8.9  | 10.5 | 12.6 |
| -L                         | -        | 3.8 | 4.3 | 4.4  | 4.5  | 5.2  | 6.3  | -    | 8.9  | 10.5 | 12.6 |
| AW                         | -        | -   | 3.1 | 3.7  | -    | -    | -    | 7.3  | -    | -    | -    |
| -W                         | -        | -   | 3.1 | 3.7  | -    | -    | -    | 7.3  | -    | -    | -    |

Table E4: Sound attenuation at 1000 Hz (values in dB)

| Hz | 63   | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |
|----|------|------|------|------|------|------|------|------|
| f  | 0.24 | 0.48 | 0.67 | 0.85 | 1    | 1.15 | 1.27 | 1.36 |

Table E5: Frequency correction factors

## 4.4 Exchanger widths



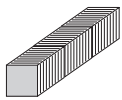

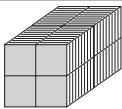
| Design S  | 040 - 060   | 070 - 120   | 140 - 240   |
|---|-------------|-------------|-------------|
| Exchanger with/without bypass   |             |             |             |
|  | 200...1400  | 200...2050  | -           |
|  | 1401...2800 | 2051...4100 | -           |
|  | 2801...4100 | -           | -           |
|  | -           | -           | 2051...4100 |
|  | -           | -           | 2051...4100 |
| Inside bypass width   | 50...999    | 50...999    | 50...999    |

Table E6: Exchanger widths in mm (can be selected in steps of 1 mm)



### Note

For more information about sound attenuation see chapter 9 in the system design section.



4.5 Exchanger dimensions

Exchanger without dampers

| Size  | 040                                 | 050 | 060 | 070 | 085  | 100  | 120  | 140  | 170  | 200  | 240  |
|-------|-------------------------------------|-----|-----|-----|------|------|------|------|------|------|------|
| H = L | 367                                 | 467 | 567 | 690 | 840  | 990  | 1190 | 1380 | 1680 | 1980 | 2380 |
| D     | 506                                 | 648 | 789 | 963 | 1175 | 1387 | 1670 | 1939 | 2363 | 2787 | 3353 |
| B     | Exchanger width (outside dimension) |     |     |     |      |      |      |      |      |      |      |
| S     | Bypass width (inside width)         |     |     |     |      |      |      |      |      |      |      |

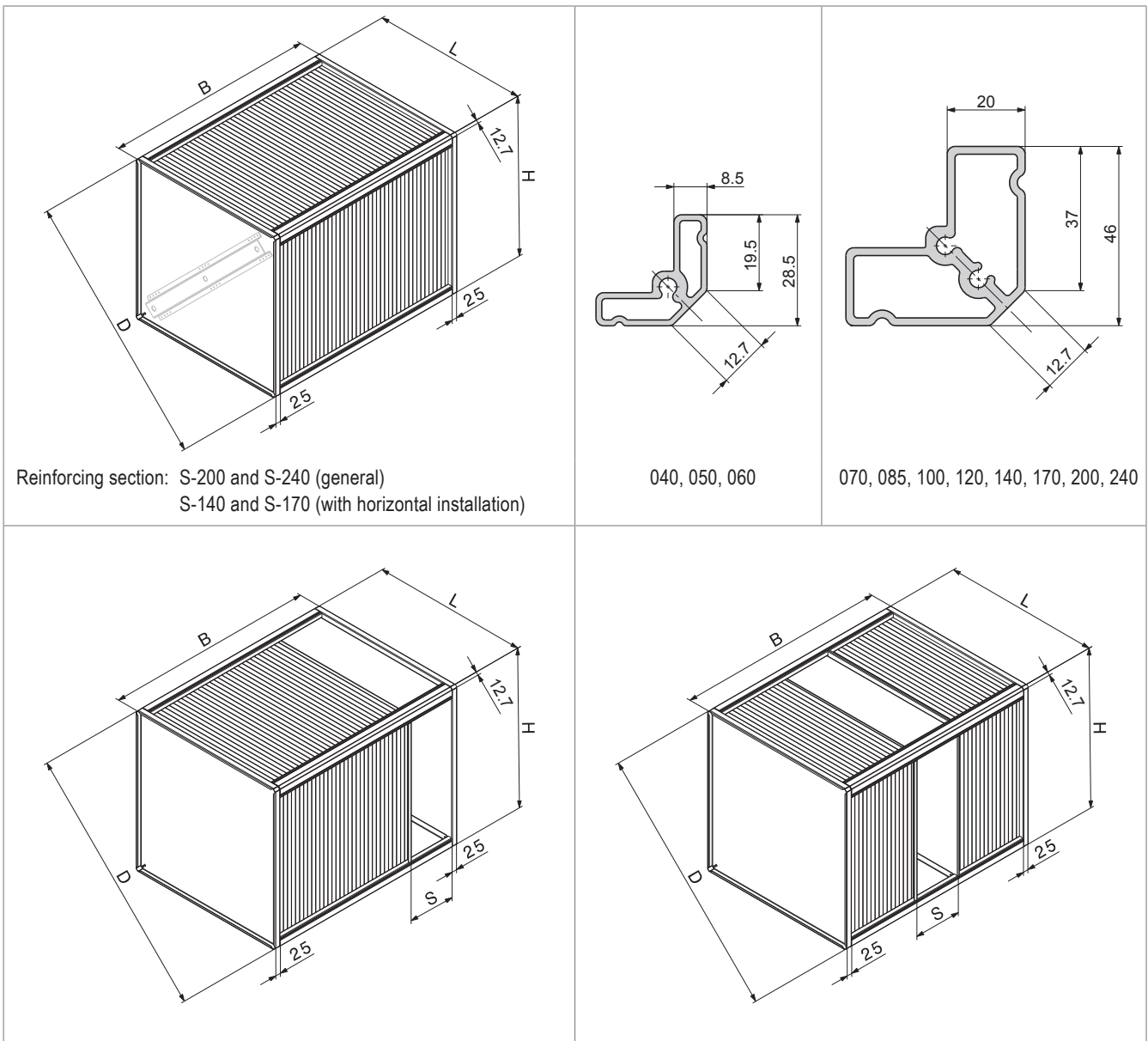


Fig. E6: Dimension sheet for design S plate heat exchanger without dampers (dimensions in mm)

## Exchanger with dampers

| Size  | 040                                 | 050 | 060 | 070 | 085  | 100  | 120  | 140  | 170  | 200  | 240  |
|-------|-------------------------------------|-----|-----|-----|------|------|------|------|------|------|------|
| H = L | 367                                 | 467 | 567 | 690 | 840  | 990  | 1190 | 1380 | 1680 | 1980 | 2380 |
| D     | 506                                 | 648 | 789 | 963 | 1175 | 1387 | 1670 | 1939 | 2363 | 2787 | 3353 |
| X     | 42                                  | 42  | 42  | 34  | 16   | 34   | 34   | 37   | 37   | 34   | 34   |
| B     | Exchanger width (outside dimension) |     |     |     |      |      |      |      |      |      |      |
| S     | Bypass width (inside width)         |     |     |     |      |      |      |      |      |      |      |

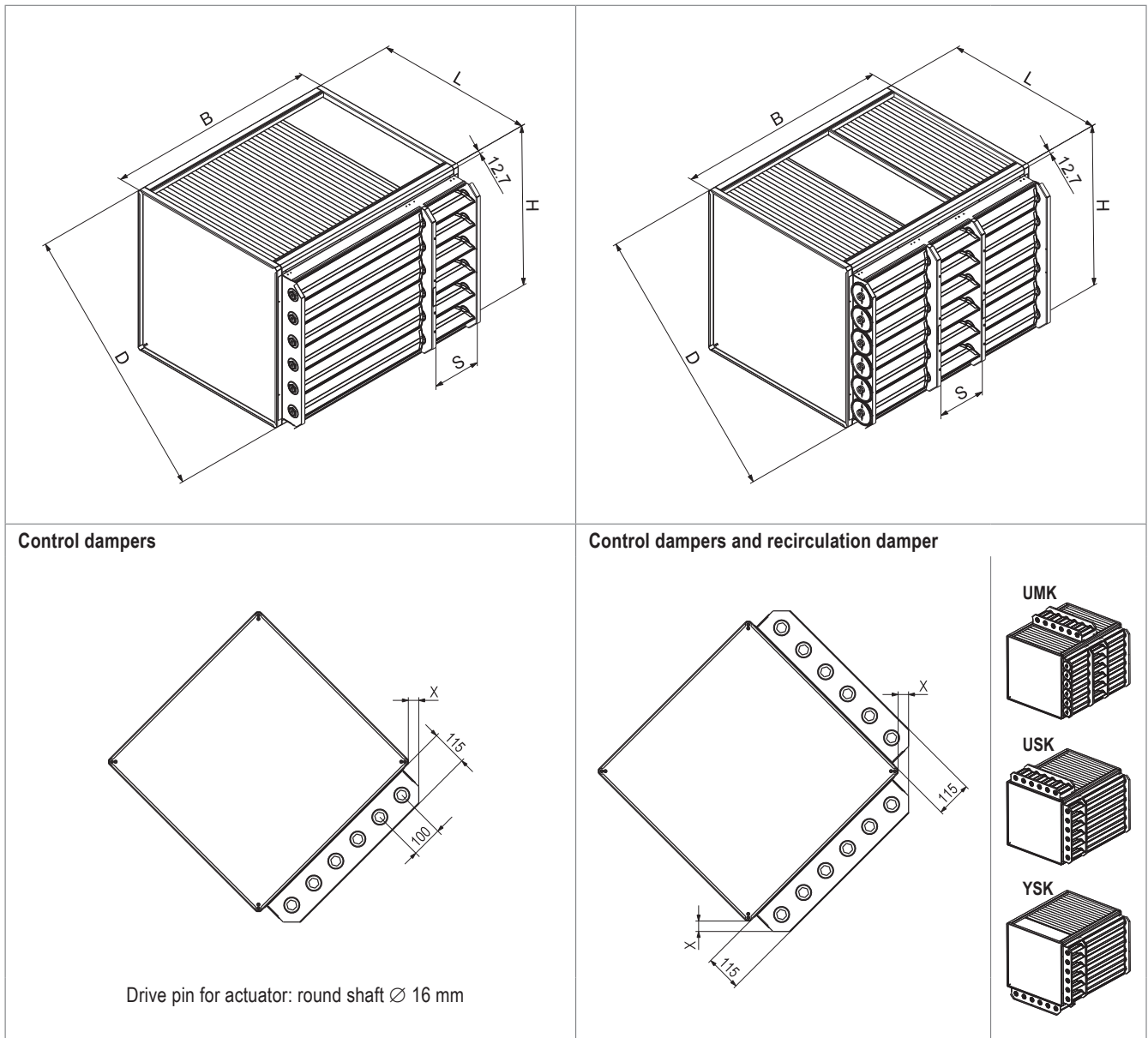


Fig. E7: Dimension sheet for design S plate heat exchanger with dampers (dimensions in mm)



**Design F**

Plate heat exchangers for air flow rates from 1000 to 100000 m<sup>3</sup>/h

|                           |    |
|---------------------------|----|
| 1 Use .....               | 34 |
| 2 Construction.....       | 34 |
| 3 Specification text..... | 36 |
| 4 Technical data.....     | 37 |

## 1 Use

Hoval Enventus plate heat exchangers of design F 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. 1000 to 100000 m<sup>3</sup>/h.

The suitability of the heat exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

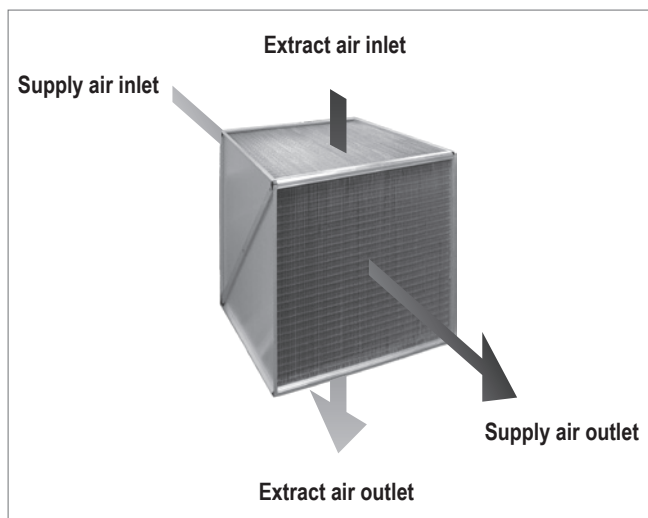


Fig. F1: Air flow through design F plate heat exchanger

## 2 Construction

Design F plate heat exchangers consist of the exchanger package and the casing.

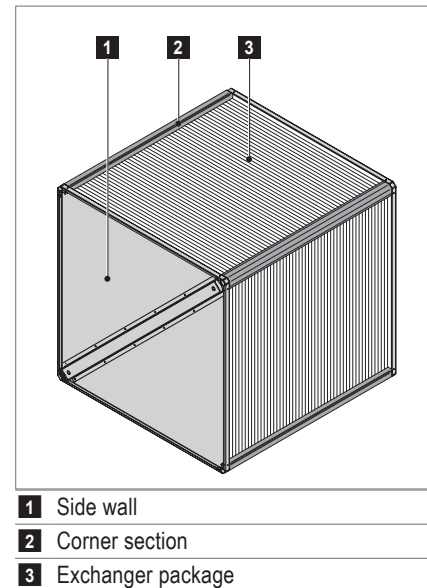


Fig. F2: Structure of design F plate heat exchanger

### 2.1 Exchanger package

The exchanger package consists of aluminium plates with V-shaped spacing ribs. Their profile is an optimum design resulting from detailed tests for temperature efficiency, pressure drop and rigidity.

There are different plate sizes, which are formed with different profile depths, i.e. for different plate spacings and thus different efficiency values.

The connection of the plates is made by a fold. This gives a several-fold material thickness at air entry and exit, which lends the exchanger package a particularly high stability and leak-tightness.

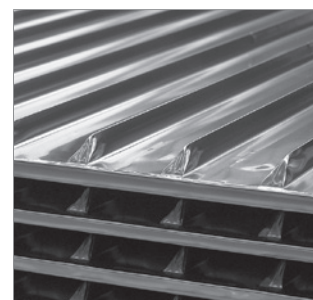


Fig. F3: Folded connections of design F

## 2.2 Casing

The exchanger package is fitted into a casing consisting of corner sections and side walls.

- The corners of the exchanger package are cast into the aluminium corner sections with epoxy resin.
- The side walls made of aluzinc sheet steel are bolted onto the corner sections.
- The 45° corners facilitate installation and reduce the diagonal dimension.
- Other components can be bolted or riveted directly to the corner sections.
- The double folding of the side walls facilitates the handling of the exchanger with lifting tools.

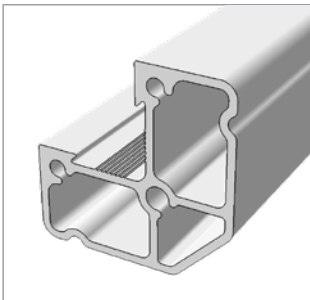


Fig. F4: The specially developed aluminium corner section offers particular advantages

## 2.3 Exchanger sizes and efficiency

The installed exchanger area and thus the plate spacing are the determining factors for the efficiency. Hoval Enventus offers several spacings for all sizes so that an optimum solution can be achieved for each project.



| Efficiency / plate spacing | Design F  |     |      |   |      |      |
|----------------------------|---|-----|------|---|------|------|
|                            | 100   | 120 | 140  | 160   | 200  | 240  |
| -C                         | -   | -   | -    | -   | -    | 5.6  |
| -D                         | -   | -   | -    | -   | 5.6  | 7.2  |
| -R                         | -   | 4.6 | 5.6  | 5.6   | 7.2  | 9.3  |
| -S                         | -   | -   | 7.2  | 7.2   | -    | -    |
| -X                         | -   | 5.6 | 8.3  | 9.3   | 9.3  | 12.0 |
| -L                         | 5.6   | 7.2 | 10.3 | 11.3  | 12.0 | -    |
| -W                         | 7.2   | 9.3 | -    | -   | -    | -    |
| Structure                  |  |     |      |  |      |      |

Table F1: Clear plate spacings of the design F exchangers (nominal values in mm)

## 2.4 Exchanger width

The width of the plate heat exchangers can be selected in steps of 1 mm. In order to simplify transport and installation, very wide exchangers are delivered in 2 parts. Several exchangers with dampers are linked with connecting bolts when installed into the air handling unit. For this purpose, one or more connecting bolts are provided, depending on the exchanger size.

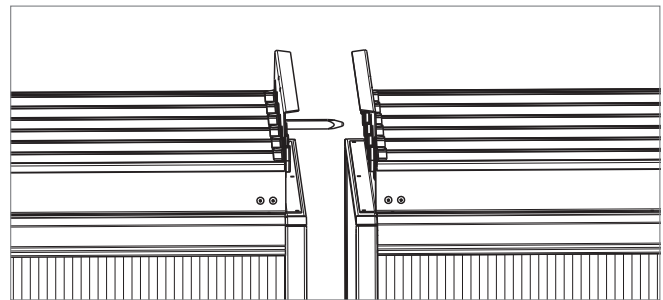


Fig. F5: Connecting bolts for damper connection for partitioned exchangers

### 3 Specification text

#### Hoval Enventus plate heat exchanger design F

Hoval Enventus crossflow plate heat exchangers for energy recovery, consisting of the exchanger package and the casing. The exchanger package consists of aluminium plates with V-shaped spacer grooves; condensate drainage is possible in every direction, depending on the installation position. The plates are connected by a fold, which gives a severalfold material thickness at air entry and exit. The corners of the exchanger package are cast into especially rigid aluminium extrusions in the casing with epoxy resin. The side walls of aluzinc sheet steel are bolted tightly to these extrusions. All performance data is certified by Eurovent and TÜV Süd. The suitability of the exchangers for use both in general ventilation technology and in hospitals is certified by independent test institutes.

#### Series

- V: Aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 2000 Pa; silicone-free; resistant to temperatures up to 80 °C.
- T: Aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 1000 Pa; special sealing compound; resistant to temperatures up to 200 °C.
- G: Coated aluminium plates, coated aluzinc sheet steel and coated corner sections; differential pressure stability: max. 2000 Pa; silicone-free; resistant to temperatures up to 80 °C.
- C: Aluminium plates, coated aluzinc sheet steel and coated corner sections; differential pressure stability: max. 2000 Pa; silicone-free; resistant to temperatures up to 80 °C.
- D: Coated aluminium plates, aluzinc sheet steel and aluminium corner sections; differential pressure stability: max. 2000 Pa; silicone-free; resistant to temperatures up to 80 °C.

#### Construction types

- -: Individual plate heat exchanger (standard)
- Z: Twin plate heat exchanger – 2 single plate heat exchangers, optionally without bypass, with bypass or with bypass and dampers. If dampers are ordered, they are only mounted on one of the two exchangers. Assembled on site in the air handling unit.
- Y: Twin plate heat exchanger – 2 single plate heat exchangers with bypass and dampers on both exchangers. Assembled on site in the air handling unit.

#### Options

- Side or middle bypass: suited to the exchanger package.
- Control dampers: installed in front of exchanger package and bypass; aluminium damper blades, aluzinc sheet steel housing; high-quality plastic drive gears outside the

air flow; leak-tightness class 2 according to EN 1751; series G and C are powder-coated.

- Side or middle circulating air bypass: suited to exchanger package; incl. control dampers and circulating air damper with aluminium damper blades, aluzinc sheet steel casing and high-quality plastic drive gears outside the air flow; leak-tightness class 2 according to EN 1751; series G and C are powder-coated.
- Leak-tightness test: additional sealing with epoxy resin; thus extremely watertight design; incl. water test.
- Horizontal installation: plates arranged horizontally.
- Adapter for actuator: for inside drive of the control and circulating air dampers.
- Reinforced packaging: additional wooden crate on top, 4-sided covering of the exchanger package with wood fibre boards, machine wrapping foil.
- Block of 4 delivered loose: exchanger sizes composed of 4 packages, delivered loose, assembly on site.

## 4 Technical data

### 4.1 Application limits

| Design F                   | Series V, G, C, D | Series T    |
|----------------------------|-------------------|-------------|
| Temperature                | -40...80°C        | -40...200°C |
| Max. differential pressure | 2000 Pa           | 1000 Pa     |

Table F2: Application limits

### 4.2 Specification of material

| Series  | V                                 | T                          | G  | C   | D                           |
|---|-----------------------------------|----------------------------|--|---|-----------------------------|
| <b>Exchanger</b>  |                                   |                            |  |   |                             |
| <b>Plates</b>   | Aluminium                         | Aluminium                  | Aluminium epoxy-coated                           | Aluminium                                 | Aluminium epoxy-coated      |
| <b>Side walls</b>   | Aluzinc sheet steel <sup>1)</sup> | Aluzinc sheet steel        | Aluzinc sheet steel, powder-coated <sup>2)</sup> | Aluzinc sheet steel, powder-coated        | Aluzinc sheet steel         |
| <b>Corner sections</b>  | Extruded aluminium section        | Extruded aluminium section | Extruded aluminium section, powder-coated        | Extruded aluminium section, powder-coated | Extruded aluminium section  |
| <b>Sealing</b>  | Epoxy resin                       | HT silicone                | Epoxy resin                                      | Epoxy resin                               | Epoxy resin                 |
| <b>Screws <sup>3)</sup></b>   | Galvanised steel                  | Galvanised steel           | Chromium steel                                   | Chromium steel                            | Galvanised steel            |
| <b>Dampers + adapter</b>  |                                   |                            |  |   |                             |
| <b>Casing</b>   | Aluzinc sheet steel               | –                          | Aluzinc sheet steel, powder-coated               | Aluzinc sheet steel, powder-coated        | Aluzinc sheet steel         |
| <b>Damper blades</b>  | Extruded aluminium sections       | –                          | Extruded aluminium section, powder-coated        | Extruded aluminium section, powder-coated | Extruded aluminium sections |
| <b>Bearing, end caps, gear wheels</b>   | Polypropylene                     | –                          | Polypropylene                                    | Polypropylene                             | Polypropylene               |
| <p>1) Aluzinc sheet steel is sheet steel coated with an alloy of 55% aluminium and 45% zinc.<br/>           2) All powder coatings in red (RAL 3000)<br/>           3) Between side walls and corner sections</p> |                                   |                            |  |   |                             |

Table F3: Specification of material

### 4.3 Sound attenuation

| Efficiency /<br>plate spacing | Design F |     |     |     |      |      |
|-------------------------------|----------|-----|-----|-----|------|------|
|                               | 100      | 120 | 140 | 160 | 200  | 240  |
| -C                            | -        | -   | -   | -   | -    | 14.1 |
| -D                            | -        | -   | -   | -   | 11.8 | 11.0 |
| -R                            | -        | 8.6 | 8.3 | 9.4 | 9.2  | 8.8  |
| -S                            | -        | -   | 6.4 | 7.3 | -    | -    |
| -X                            | -        | 7.1 | 5.6 | 5.7 | 6.9  | 6.6  |
| -L                            | 5.9      | 5.5 | 4.5 | 4.7 | 5.5  | -    |
| -W                            | 4.6      | 4.4 | -   | -   | -    | -    |

Table F4: Sound attenuation at 1000 Hz (values in dB)

| Hz | 63   | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |
|----|------|------|------|------|------|------|------|------|
| f  | 0.24 | 0.48 | 0.67 | 0.85 | 1.00 | 1.15 | 1.27 | 1.36 |

Table F5: Frequency correction factors



**Note**

For more information about sound attenuation see chapter 9 in the system design section.

### 4.4 Exchanger widths




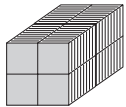
| Design F  | 100 - 160   | 200 - 240   |
|---|-------------|-------------|
| Exchanger with/without bypass   |             |             |
|  | 200...2200  | -           |
|  | 2201...4100 | -           |
|  | -           | 200...2200  |
|  | -           | 2201...4100 |
| Inside bypass width   | 50...999    | 50...999    |

Table F6: Exchanger widths in mm (can be selected in steps of 1 mm)



4.5 Exchanger dimensions

Exchanger without dampers

| Size  | 100                                 | 120  | 140  | 160  | 200  | 240  |
|-------|-------------------------------------|------|------|------|------|------|
| H = L | 968                                 | 1168 | 1387 | 1567 | 1936 | 2336 |
| D     | 1349                                | 1632 | 1942 | 2196 | 2718 | 3284 |
| B     | Exchanger width (outside dimension) |      |      |      |      |      |
| S     | Bypass width (inside width)         |      |      |      |      |      |

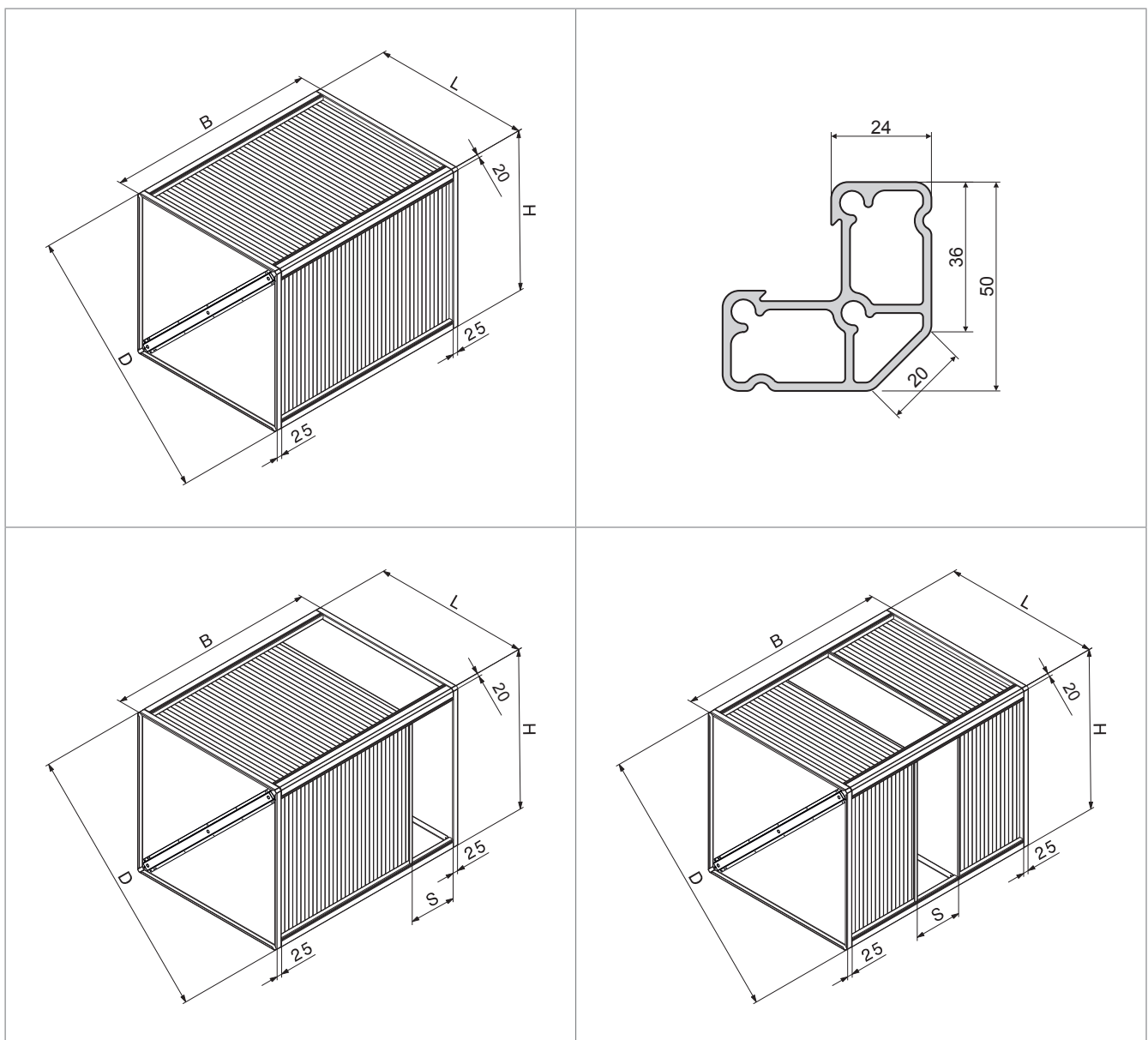


Fig. F6: Dimension sheet for design F plate heat exchanger without dampers (dimensions in mm)

### Exchanger with dampers

| Size  | 100                                 | 120  | 140  | 160  | 200  | 240  |
|-------|-------------------------------------|------|------|------|------|------|
| H = L | 968                                 | 1168 | 1387 | 1567 | 1936 | 2336 |
| D     | 1349                                | 1632 | 1942 | 2196 | 2718 | 3284 |
| X     | 9                                   | 16   | 26   | 28   | 9    | 16   |
| B     | Exchanger width (outside dimension) |      |      |      |      |      |
| S     | Bypass width (inside width)         |      |      |      |      |      |

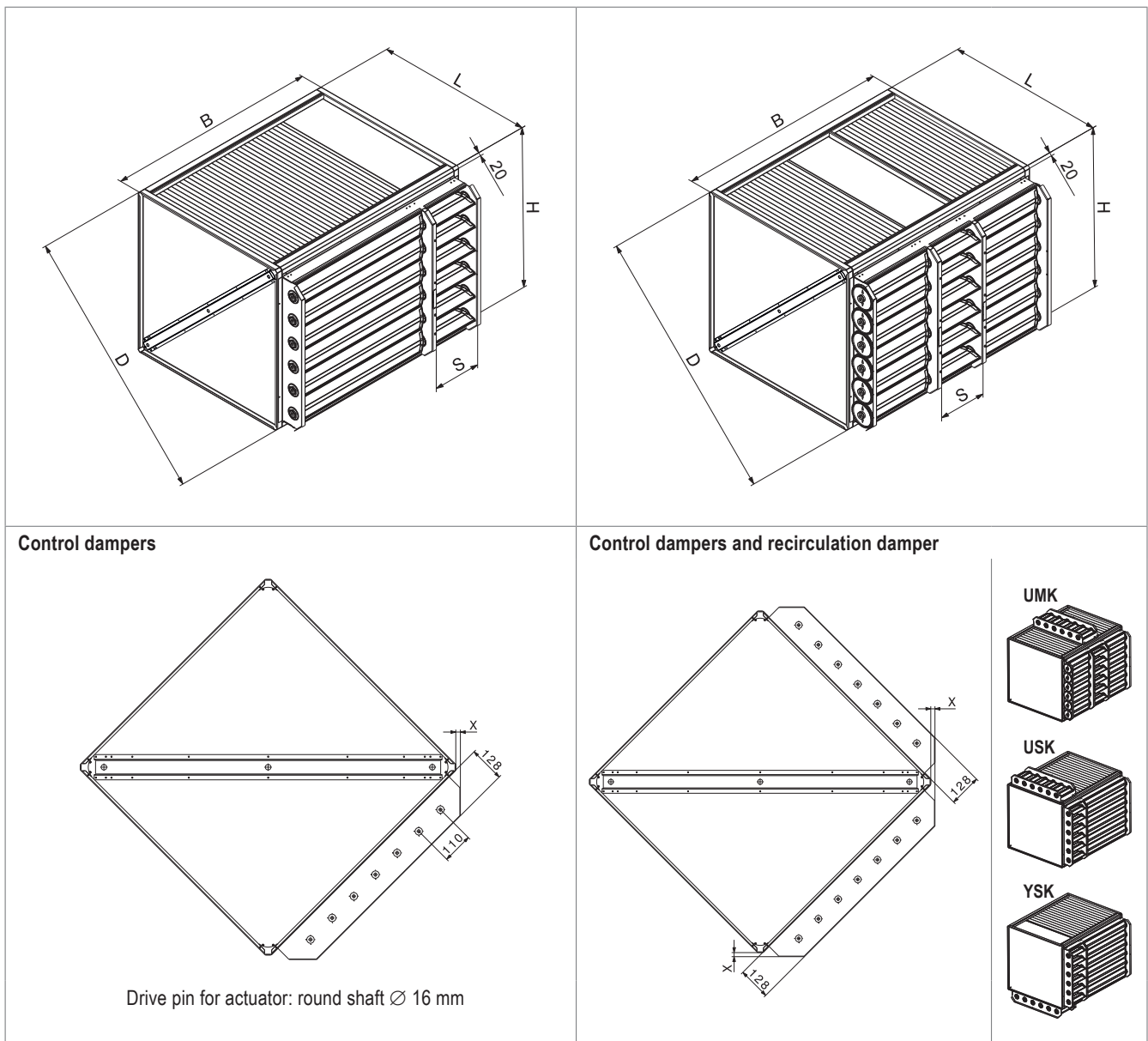


Fig. F7: Dimension sheet for design F plate heat exchanger with dampers (dimensions in mm)

|                                    |    |
|------------------------------------|----|
| 1 Bypass.....                      | 42 |
| 2 Control dampers .....            | 42 |
| 3 Adapter for actuator .....       | 43 |
| 4 Recirculation bypass.....        | 44 |
| 5 Leakage test.....                | 46 |
| 6 Horizontal installation.....     | 46 |
| 7 Stronger packaging.....          | 46 |
| 8 Block of 4, supplied loose ..... | 46 |



**Options**

G

## 1 Bypass

A bypass is installed in the exchanger casing for controlling the performance of the plate heat exchanger. There are various options for integration into the casing:

- When it comes to crossflow exchangers, the bypass can be built in at the side or in the middle. For aerodynamic reasons, Hoval Enventus recommends the central arrangement if the exchanger is 1500 mm wide or wider.
- When it comes to counterflow exchangers, the bypass can be built in on the left or right.

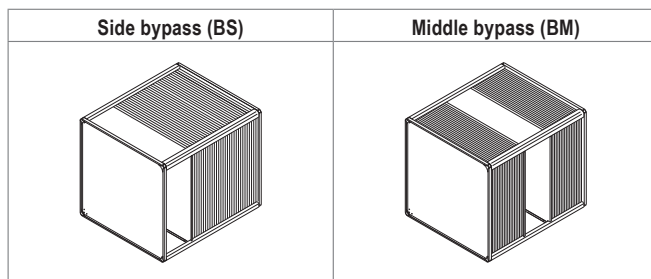


Fig. G1: Side or middle bypass in crossflow exchangers

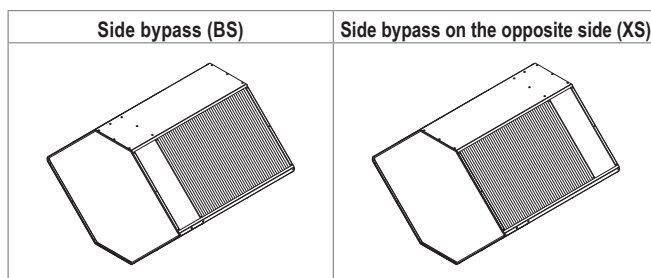


Fig. G2: Bypass left or right in counterflow exchangers

The CASER design program automatically calculates the bypass width so that the bypass has approximately the same pressure drop as the exchanger package. Of course, the bypass width can also be specified.

For installation in the ventilation unit, Hoval Enventus recommends arranging the bypass in the supply air flow. This arrangement prevents the plate heat exchanger from freezing if this is necessary at very low outside temperatures (defrost circuit).

## 2 Control dampers

Opposed control dampers are required for performance control via bypass. They are mounted directly on the flange of the casing in front of the exchanger package and the bypass. The specially designed dampers are characterised by the following features:

- There is no narrowing of the cross-section of the air inlet opening.
- The gear wheels are protected from the air stream.
- Thanks to the space-saving design, the dampers are easy to integrate into the ventilation unit.

Depending on the exchanger size, one or more actuators are required for the drive. Drive pins are supplied loose. Install them in the middle of the damper for an optimum force application. The required torque depends on the exchanger width.

The maximum damper blade width is 1200 mm; an intermediate bar is provided for bigger dimensions.

| Design         | Width (mm)  | Number          |           |
|----------------|-------------|-----------------|-----------|
|                |             | Control dampers | Actuators |
| G-055 to G-085 | ≤ 1900      | 1               | 1         |
| K-085, K-100   | ≤ 2050      | 1               | 1         |
|                | ≥ 2051      | 2               | 1         |
| S-040 to S-060 | ≤ 1400      | 1               | 1         |
|                | 1401...2800 | 2               | 1         |
|                | ≥ 2801      | 3               | 2         |
| S-070 to S-140 | ≤ 2050      | 1               | 1         |
|                | ≥ 2051      | 2               | 1         |
| S-170          | ≤ 2050      | 1               | 1         |
|                | ≥ 2051      | 2               | 2         |
| S-200 to S-240 | ≤ 2050      | 2               | 2         |
|                | ≥ 2051      | 4               | 2         |
| F-100 to F-160 | ≤ 2200      | 1               | 1         |
|                | ≥ 2201      | 2               | 2         |
| F-200 to F-240 | ≤ 2200      | 2               | 2         |
|                | ≥ 2201      | 4               | 4         |

Table G1: Number of actuators required

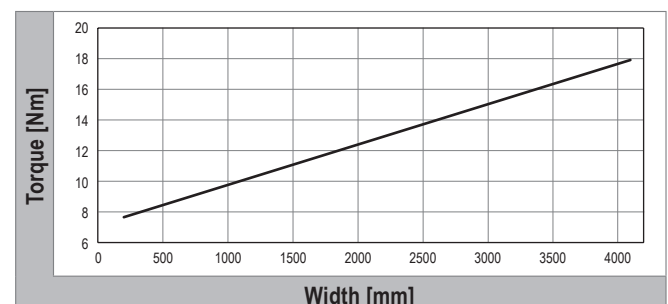


Fig. G3: Necessary torque per actuator



Fig. G4: Plate heat exchanger with bypass and control dampers

### 3 Adapter for actuator

The adapter for actuator enables dampers to be driven with commercially available actuators within a ventilation unit or duct (suitable for control and recirculation dampers). It is supplied loose for on-site mounting on the damper. The number of adapters supplied corresponds to the number of actuators required for the respective exchanger.

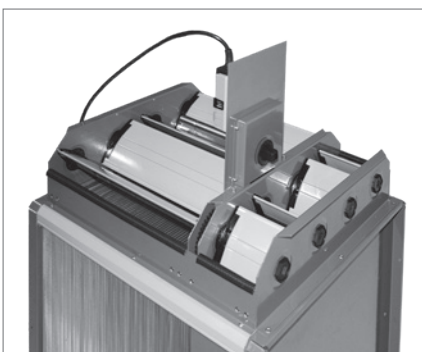


Fig. G5: Plate heat exchanger with adapter for actuator

Please note the following:

- Check that there is sufficient space available.
- Install the adapter in the middle of the damper for an optimum force application. For this, the plate flange is cut out above a gear wheel so that the adapter gear wheel can be put on directly.
- Make sure that no electric cables obstruct the function of the dampers.

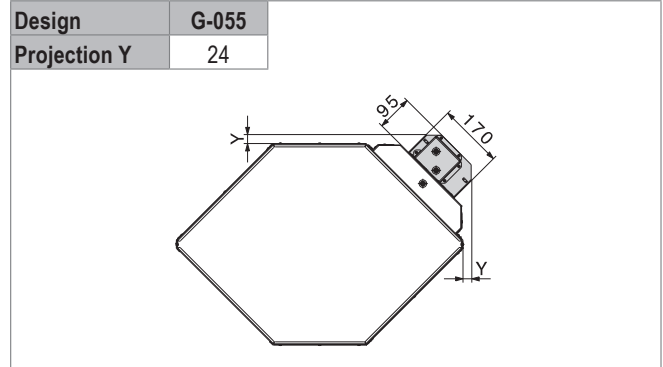


Fig. G6: Diagram showing dimensions of Gotthard (in mm)

| Design       | S-040 | S-050 | S-060 | S-070 | S-085<br>K-085 |
|--------------|-------|-------|-------|-------|----------------|
| Projection Y | 193   | 193   | 122   | 113   | 26             |
| Projection Z | –     | 122   | –     | 44    | –              |

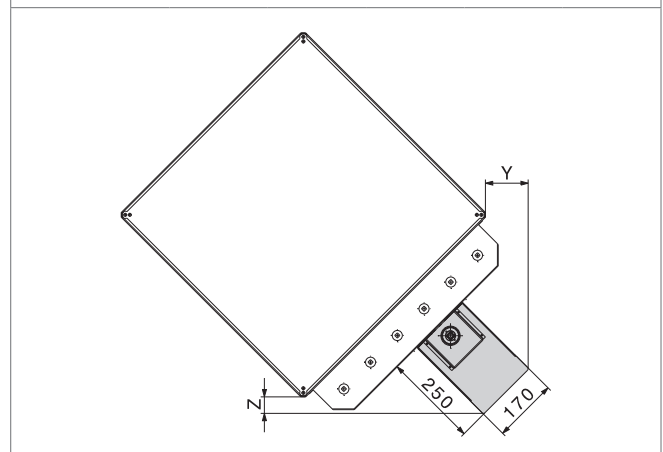
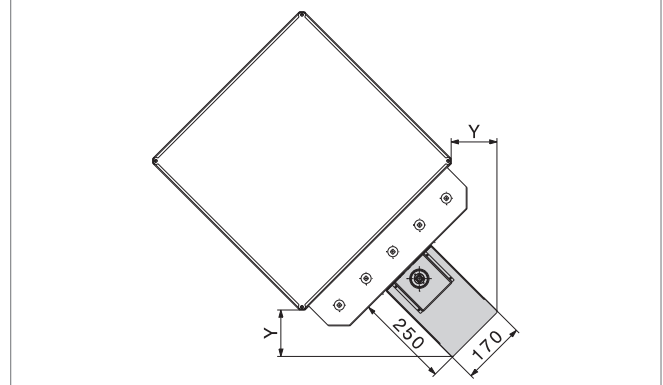


Fig. G7: Diagram showing dimensions of Krivan / design S (in mm)

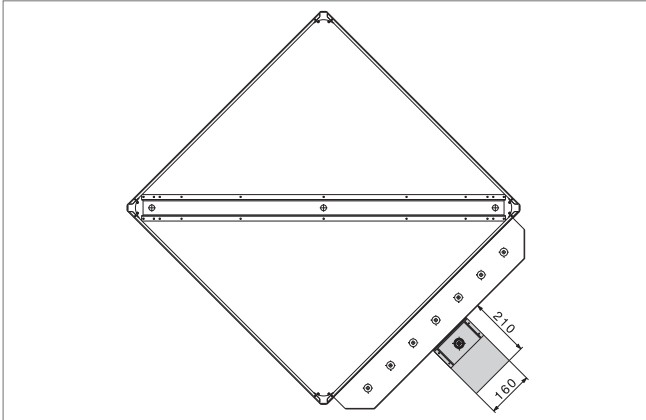


Fig. G8: Diagram showing dimensions of design F (in mm)

## 4 Recirculation bypass

The recirculation bypass enables recirculation and mixed air operation via the plate heat exchanger and thus replaces the mixed air section in the air-conditioning unit. It offers the following advantages:

- The air-conditioning unit can be built shorter.
- There is no narrowing of the cross-section of the air inlet opening.
- The gear wheels are protected from the air stream.

The recirculation bypass is always combined with a bypass for performance control. Depending on the exchanger size, one or more actuators are required for the drive. Drive pins are supplied loose. Install them in the middle of the damper for an optimum force application.

The following applies to the control of recirculation operation and the arrangement in the ventilation unit:

- Regulation of the recirculation damper must be opposed to the fresh air and exhaust air dampers.
- Comply with the notes in Table G3 for the arrangement in the ventilation unit.

| Design         | Width (mm)  | Number                |           |
|----------------|-------------|-----------------------|-----------|
|                |             | Recirculation dampers | Actuators |
| G-055 to B-085 | ≤ 1900      | 1                     | 1         |
| K-085, K-100   | ≤ 2050      | 1                     | 1         |
|                | ≥ 2051      | 1                     | 1         |
| S-040 to S-060 | ≤ 1400      | 1                     | 1         |
|                | 1401...2800 | 1                     | 1         |
| S-070 to S-140 | ≤ 2050      | 1                     | 1         |
|                | ≥ 2051      | 1                     | 1         |
| S-170          | ≤ 2050      | 1                     | 1         |
|                | ≥ 2051      | 1                     | 1         |
| S-200 to S-240 | ≤ 2050      | 2                     | 2         |
|                | ≥ 2051      | 2                     | 2         |
| F-100 to F-160 | ≤ 2200      | 1                     | 1         |
|                | ≥ 2201      | 2                     | 2         |
| F-200 to F-240 | ≤ 2200      | 2                     | 2         |
|                | ≥ 2201      | 2                     | 2         |

Table G2: Number of actuators required for the recirculation damper

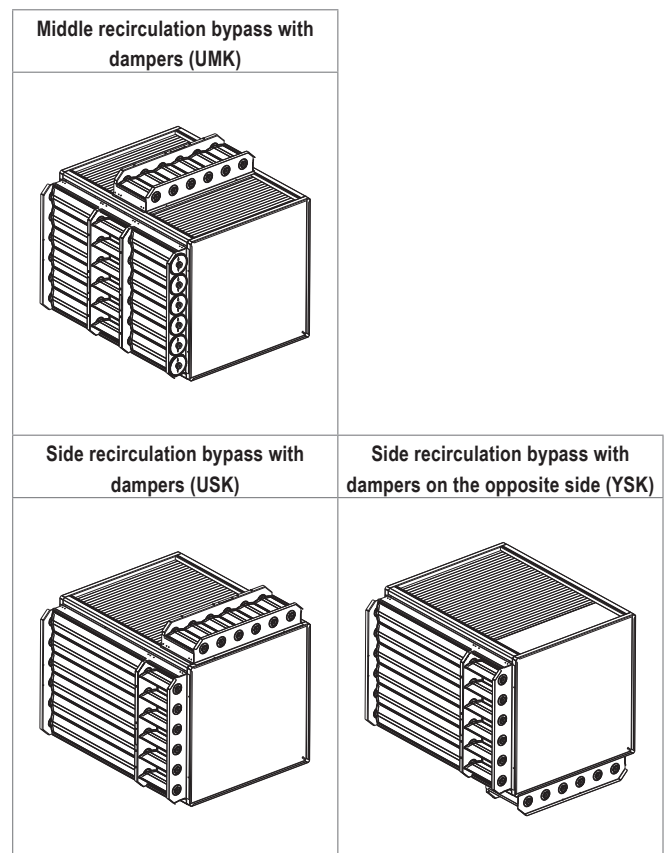


Fig. G9: Recirculation bypass variants

| Recirculation bypass in the supply air stream   | Recirculation bypass in the extract air stream   | <ul style="list-style-type: none"> <li><b>1</b> Extract air</li> <li><b>2</b> Recirculation damper</li> <li><b>3</b> Exhaust air damper</li> <li><b>4</b> Exhaust air</li> <li><b>5</b> Fresh air</li> <li><b>6</b> Fresh air damper</li> <li><b>7</b> Bypass damper</li> <li><b>8</b> Face damper</li> <li><b>9</b> Supply air</li> </ul> |
|---|--|--|
|   |  | <p><b>Fresh air operation</b></p>  |
| <p>Recirculation damper ..... closed<br/> Exhaust air damper ..... open<br/> Fresh air damper ..... open<br/> Bypass damper ..... 0-100 % <sup>1)</sup><br/> Face damper ..... 0-100 % <sup>1)</sup></p> <p><sup>1)</sup> Control of the energy recovery</p>  | <p>Recirculation damper ..... closed<br/> Exhaust air damper ..... open<br/> Fresh air damper ..... open<br/> Bypass damper ..... 0-100 % <sup>1)</sup><br/> Face damper ..... 0-100 % <sup>1)</sup></p> <p><sup>1)</sup> Control of the energy recovery</p> | <p><b>Recirculation operation</b></p>  |
| <p>Recirculation damper ..... open<br/> Exhaust air damper ..... closed<br/> Fresh air damper ..... closed<br/> Bypass damper ..... not relevant<br/> Face damper ..... not relevant</p>  | <p>Recirculation damper ..... open<br/> Exhaust air damper ..... closed<br/> Fresh air damper ..... closed<br/> Bypass damper ..... open<br/> Face damper ..... closed</p>   | <p><b>Mixed air operation</b></p>  |
| <p>Recirculation damper ..... 0-100 % <sup>1)</sup><br/> Exhaust air damper ..... 0-100 % <sup>1)</sup><br/> Fresh air damper ..... 0-100 % <sup>1)</sup><br/> Bypass damper ..... open <sup>2)</sup><br/> Face damper ..... closed <sup>2)</sup></p> <p><sup>1)</sup> Control of the fresh air percentage<br/> <sup>2)</sup> Full use of energy recovery</p> | <p>not possible</p>  |  |

Table G3: Arrangement of the recirculation bypass in the ventilation unit

## 5 Leakage test

Hoval Enventus plate heat exchangers are highly leak-tight. The internal air leakage is max. 0.1% of the nominal air volume (at 250 Pa differential pressure). By optional additional sealing of the exchanger package, Hoval Enventus can ensure that the exchanger is watertight on delivery.



### Note

The leakage test is not available for exchangers of series T.

## 6 Horizontal installation

Note the following for the horizontal installation of Hoval Enventus plate heat exchangers:

- Arrange the side bypass centrally or at the top.
- There is a higher icing-up hazard because condensate can remain on the plates. Examine whether an angled installation orientation is possible.
- The condensate drains out without any control. Install a condensate drip tray under the entire exchanger.
- A leakage test is recommended.
- Always order an adapter for actuator.
- For Gotthard heat exchangers with control dampers, the 'horizontal installation' option is only available up to a width of 950 mm.
- In exchangers of design S, supports are fitted in the exchanger package to increase stability.
- Install horizontal plate heat exchangers of design F in such a way that the spacing ribs stand upwards.



Fig. G10: Exchanger design S with supports for horizontal installation

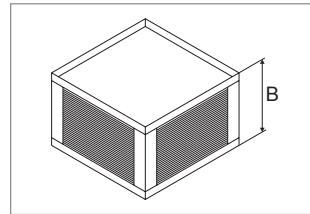


Fig. G11: The width B corresponds to the exchanger height.

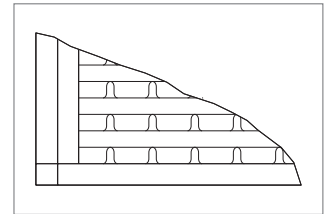


Fig. G12: Spacing ribs standing upwards (design F)

## 7 Stronger packaging

Hoval Enventus plate 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 top
- Covering of the exchanger package with wood fibre boards on all 4 sides
- Machine wrapping foil

## 8 Block of 4, supplied loose

Plate heat exchangers composed of 4 individual exchanger blocks can be supplied separately if required. This facilitates installation into the ventilation unit if space is restricted.

The individual exchanger blocks and possibly the dampers are then assembled on site. Sealing compound, rivets and screws are provided, as are the necessary auxiliary materials. The side walls have a special profile for a sealing bead. This together with the sealing bead in the corner section ensures tight connection of the individual exchanger blocks. Follow the installation instructions.



Fig. G13: The circumferential sealing bead in the frame of each exchanger block ensures tight connection of compound exchangers.



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## System design

## 1 Design programme

For quick and accurate design of Hoval Enventus energy recovery systems, you should use the Hoval Enventus CASER design program.

(COMPUTER AIDED SELECTION OF ENERGY RECOVERY)



Hoval Enventus  
CASER

### 1.1 Availability

You can download the Hoval Enventus CASER design program free of charge from our website ([www.hoval-enventus.com](http://www.hoval-enventus.com)). 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 Enventus plate heat exchanger or rotary heat exchanger
- Calculation of all appropriate Hoval Enventus 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, for explanation see chapter 1.3)
- Frost limit (only for plate heat exchangers)
- Pressure drop increase due to pressure difference (only for plate heat exchangers)
- Leakage according to Eurovent (only for rotary heat exchangers)
- Calculation of the performance figures for OACF (Outdoor Air Correction Factor) and EATR (Exhaust Air Transfer Ratio) (only for rotary heat exchangers)
- Simplified ordering process due to optimised type code
- Price calculation

### 1.3 Calculation mode

The '73 air' calculation mode filters and sorts the result list of the calculated plate heat exchangers according to the best efficiency/pressure loss ratio. In line with the Ecodesign Directive ErP 1253/2014, two values are mathematically combined:

- Thermal efficiency  $\eta_{t\_nrvu}$
- Internal specific fan power  $SFP_{int}$

The dynamic calculation algorithm considers the pressure losses of the plate heat exchanger and the filters as well as the system efficiencies of the fans and determines a pressure reserve  $\Delta p_{HRS}$ . This value is displayed in the result list. Even during the design of the plate heat exchanger, it shows which theoretical residual pressure loss is still available to fulfil the Ecodesign Directive.

The pressure reserve  $\Delta p_{HRS}$  applies to the reference configuration of a bidirectional ventilation unit (i.e. at least 1 fan per air direction, 1 heat recovery system, 1 supply air filter and 1 extract air filter) and can be used for an economical design of the ventilation unit. Possible measures are:

- Design of a smaller ventilation unit
- Use of less expensive filters with a slightly higher pressure drop
- Use of less expensive fans with a slightly higher power consumption

## 2 Leakage

Components of air handling units are not normally 100% leakproof. This is mainly because it is not necessary for correct functioning and it would be very expensive. In practical use, however, leakage must remain within technically acceptable limits.

A distinction is made between 2 types of leakage:

- External leakage:  
Leakage to the outside is above all a question of assembly quality and normally does not represent any problem.
- Internal leakage:  
The leakage between supply air and extract air depends primarily on the product and design. Hoval Enventus plate heat exchangers are very leak-tight; the internal leakage is a maximum of 0.1% of the nominal air volume (at 250 Pa pressure difference).

### 3 Pressure difference

#### 3.1 External pressure difference

The external pressure difference, i.e. the pressure difference between the plate heat exchanger and the environment, is decisive for the external leakage. With correct and careful installation, however, it is insignificant.

More important is the influence of the external pressure difference on the mechanical strength of the exchanger. Particularly the side walls are heavily stressed at big pressure differences.

#### 3.2 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.

##### Internal leakage

The internal pressure difference is decisive for the internal leakage and thus has an effect on the supply air quality. For this reason, note the following when planning:

- Arrange the fans in the ventilation unit so that the pressure difference in the plate heat exchanger is as low as possible.
- Arrange the fans in the ventilation unit so that the pressure drop is directed from the supply air to the extract air. This prevents the supply air quality from being impaired by the extract air in the event of a leakage.



##### Notice

The pressure difference depends on the position of fans. Overpressure on one side and underpressure on the other side add up.

##### Pressure drop increase

The internal pressure difference in the plate heat exchanger can cause deformation of the plates, resulting in higher pressure drop and thus higher operating costs. The expected pressure drop increase also depends on the exchanger design and the plate spacing. An exact statement about the pressure drop increase is only possible after a measurement. In most cases, however, a sufficiently accurate estimate can be given with the values shown in Table H1. It shows the maximum values of several measurements in the test laboratory.

| Internal pressure difference | Pressure drop increase $\Delta p$ (%) |        |          |          |
|------------------------------|---------------------------------------|--------|----------|----------|
|                              | Gotthard                              | Krivan | Design S | Design F |
| 250 Pa                       | 1.02                                  | 1.01   | 1.03     | 1.06     |
| 500 Pa                       | 1.05                                  | 1.02   | 1.05     | 1.13     |
| 750 Pa                       | 1.08                                  | 1.03   | 1.09     | 1.20     |
| 1000 Pa                      | 1.10                                  | 1.04   | 1.12     | 1.28     |

Table H1: Pressure drop increase due to internal pressure difference (maximum values of several measurements)

### 4 Condensation

Hoval Enventus plate heat exchangers can use part of the latent heat of moist extract air. At low outside temperatures, the extract air is cooled down to such a degree that the saturation temperature is reached and condensation is formed. Thus the latent heat of evaporation is released and this reduces further cooling of the extract air. Also the heat transfer is better. The temperature efficiency is raised significantly overall. This can be seen clearly in the hx diagram. The cold air stream is heated more than the warm air is cooled. Nonetheless the enthalpy difference is the same, assuming equal water content.

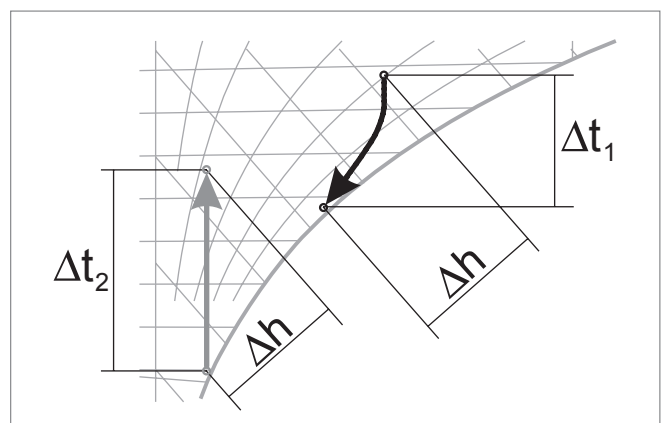


Fig. H1: Changes of condition in the hx diagram

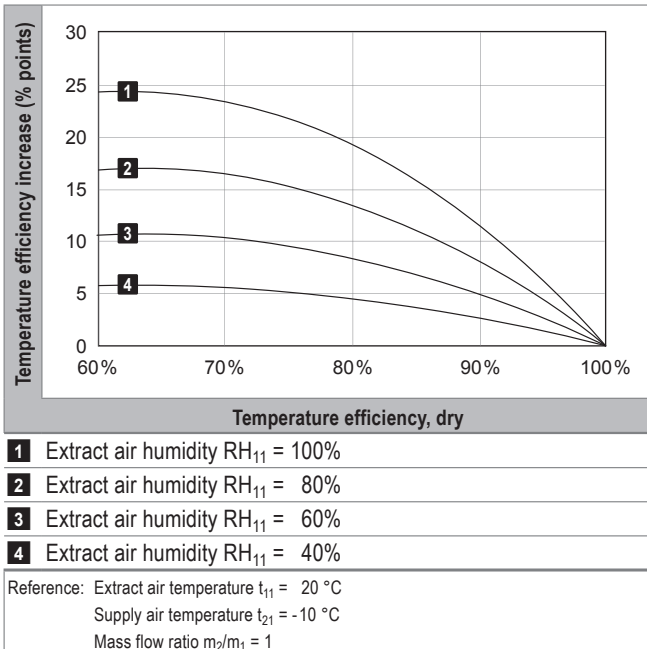


Fig. H2: Temperature efficiency increase due to condensation

However, condensation in the extract air also narrows the free flow cross-section. The pressure loss is increased. Therefore it is important that the condensation can drain away. This depends mainly on the fitting position of the heat exchanger and on the form of the plates.



**Note**

Plate heat exchangers are not 100% water-tight. If condensation occurs the internal and external leakage of the exchanger is of particular importance.

The Hoval Enventus CASER design program calculates the expected amount of condensate. Note the following when planning:

- Provide suitable condensate trays and condensate connections and ensure that the condensate can drain freely.
- Observe all relevant regulations (e.g. VDI 6022-1, VDI 3803-1).
- Order plate heat exchangers with the 'Leakage test' option.

## 5 Frost limit

If the warm extract air stream is very strongly cooled, condensate can be formed and it 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, starting at the cold corner:

- Very low temperature of the cold air
- High efficiency of the exchanger
- More cold air than warm air (the larger the mass flow ratio  $m_2/m_1$ , the greater the risk of freezing)
- Relatively little condensation
- Poor condensation drainage due to the installation situation

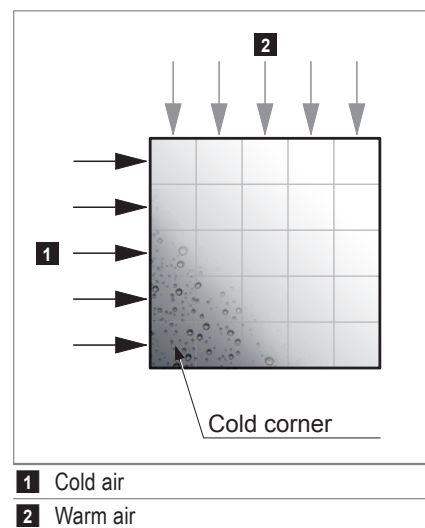


Fig. H3: Under extreme conditions the exchanger can ice up, starting at the 'cold corner'.

Icing causes the pressure drop to increase accordingly or the air flow rate is reduced. In extreme cases the whole exchanger can slowly ice up. Therefore you should calculate the frost limit for each project with the CASER design program from Hoval Enventus and take necessary precautions.



**Note**

If the extract air humidity is less than 4 g/kg, the dew point is below 0 °C, i.e. there is no condensation. The water vapour immediately changes from a gaseous to a solid state and sublimates (→ it 'snows').

## 6 Pressure drop

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

- Increased pressure drop due to dampers
- Increased pressure drop due to pressure difference
- Increased pressure drop due to condensate, which reduces the flow cross-section
- Increased pressure drop due to the installation situation (changes of direction, narrowing of cross-sections)

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.
- Due to unavoidable construction tolerances, the performance data of fans in practice deviate from the nominal values. When determining volume flows, consider the accuracy class of the fans.

| Operating values    |               | Limit deviation in class |             |           |            |
|---------------------|---------------|--------------------------|-------------|-----------|------------|
|                     |               | 0                        | 1           | 2         | 3          |
| Volume flow         | $\Delta V$    | $\pm 1\%$                | $\pm 2.5\%$ | $\pm 5\%$ | $\pm 10\%$ |
| Pressure increase   | $\Delta p$    | $\pm 1\%$                | $\pm 2.5\%$ | $\pm 5\%$ | $\pm 10\%$ |
| Drive power         | $\Delta P$    | + 2%                     | + 3%        | + 8%      | + 16%      |
| Efficiency          | $\Delta \eta$ | - 1%                     | - 2%        | - 5%      | -          |
| A sound power level | $L_{WA}$      | + 3 dB                   | + 3 dB      | + 4 dB    | + 6 dB     |

Table H2: Accuracy classes to DIN 24166

## 7 Corrosion danger

The standard exchanger package of Hoval Enventus plate heat exchangers in series V consists of 99% pure aluminium. Its resistance to many substances is similar to that of stainless steel 1.4301, and it is slightly more resistant to weak acids than to weak alkalis.

In applications with an increased risk of corrosion – e.g. in swimming pools, kitchens, near the sea and in industry – the G series (corrosion-protected) is usually sufficient. The Hoval Enventus technical department will advise which series is suitable for specific applications.

## 8 Cleaning capability

The exchanger package can be cleaned as follows:

- Remove dust and fibres with a soft brush or with a vacuum cleaner. Take care when cleaning with compressed air that the exchanger package is not damaged. Keep at a distance!
- Oils, solvents, etc. can be removed with hot water or grease solvents, by washing or immersing. Cleaning with high-pressure devices is possible if:
  - Use of a flat nozzle 40°
  - Min. 20 cm distance between nozzle and exchanger
  - Max. water pressure is 100 bar

## 9 Sound attenuation

Plate heat exchangers have a sound-attenuating effect. An exact statement about sound attenuation is only possible after a measurement. An estimate of the insertion attenuation which is sufficiently accurate for most cases can be made using the values given in the tables (see the 'Technical data' chapter in each of the various exchanger descriptions).

You can find the attenuation for a given frequency by multiplying the value of the exchanger in question by the frequency correction factor.

| Hz | 63   | 125  | 250  | 500  | 1000 | 2000 | 4000 | 8000 |
|----|------|------|------|------|------|------|------|------|
| f  | 0.24 | 0.48 | 0.67 | 0.85 | 1.00 | 1.15 | 1.27 | 1.36 |

Table H3: Frequency correction factors

### Example

Given: Plate heat exchanger SV-085/-X  
 Attenuation of the sound power  $\Delta L_w$  at 1000 Hz = 5.5 dB  
 Find: Attenuation for a frequency of 500 Hz  
 Solution:  $5.5 \times 0.85 = 4.7$  dB



### Attention

The sound attenuation applies only for the exchanger package. If the air flows through the bypass no attenuation is to be expected.

## 10 Counterflow/parallel flow

When installing counterflow heat exchangers and twin 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 two 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.

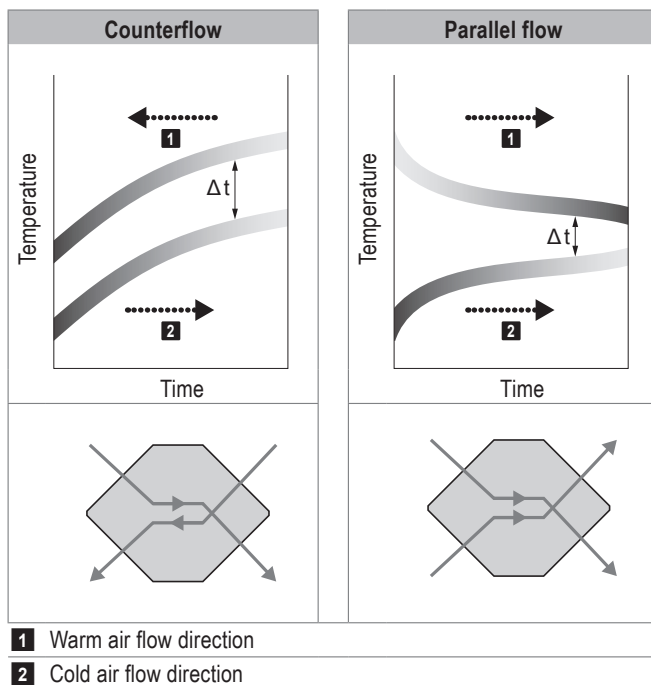


Fig. H4: Counterflow – parallel flow

## 11 ATEX

The following Hoval Eventus plate heat exchangers for use in potentially explosive atmospheres are available on request in accordance with ATEX Directive 2014/34/EU:

- Designs K, S, F
- Series V
- Without dampers

For more detailed information, please contact the Hoval Eventus application consulting service.

## 12 Twin exchangers

The term "twin exchangers" is used when 2 exchangers are fitted in series. The air flows pass through the two plate heat exchangers in counterflow.

Due to the twin arrangement, very good efficiencies can be achieved with relatively small exchangers or with relatively large plate spacings. This saves space and costs. The plate heat exchangers are supplied individually and only installed as twin exchangers in the air-conditioning unit. The total efficiency can easily be calculated with the CASER design program.

**Note**  
Dimension an on-site bypass above or below the twin exchanger so that the pressure loss of the bypass corresponds to that of the exchanger package. Otherwise the heat recovery will not be controllable. For more detailed information, please contact the Hoval Eventus application consulting service.

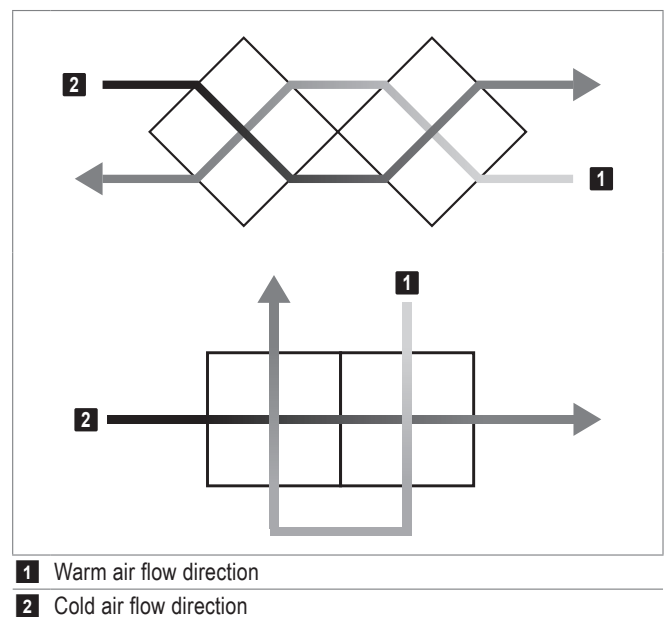


Fig. H5: Classic arrangements of a twin exchanger with air flows passing through

Tight fold connections  
for good stability and  
leak-tightness

The recirculation bypass  
replaces the mixed air section  
in the ventilation unit



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

Corner section sealing  
with permanently elastic  
sealing compound

# Hoval Enventus

## You can count on us.

As a specialist for energy recovery systems, Hoval Enventus is your experienced partner with decades of experience in the industry. Hoval Enventus 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 Enventus is one of the leading international companies for energy recovery systems, which are exported worldwide.

We take our responsibility for the environment seriously. Energy efficiency is at the heart of what we develop.

## Responsibility for energy and environment



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The logo features the word 'Hoval' in a large, bold, white sans-serif font, with a small circular icon containing a stylized 'H' to its left. Below it, the word 'Enventus' is written in a smaller, white sans-serif font.