Press release

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Regulating output with the bypass system

Energy recovery always acts like a temperature rectifier between the two air streams. Output control is therefore not necessary as long as the extract air temperature corresponds to the setpoint/room temperature. However, since most rooms have internal heat loads (machines, lighting, processing systems, people) which increase the extract air temperature above the setpoint value, it is necessary to check whether this causes the room to heat up and thus reduces the output of the energy recovery unit.

The European regulation EU 1253 - 2014 also takes account of this situation by demanding a "thermal bypass" for all energy recovery systems. For the plate heat exchanger, this means that at least one air stream is routed past the exchanger via a bypass. Together with the face and bypass damper, a bypass system is created with which the output of the energy recovery unit can be reduced or switched off. As a side effect, if the bypass is located in the outside air, it can also prevent the plate heat exchanger from freezing.

The bypass system, consisting of bypass, exchanger damper and bypass damper, not only fulfils several functions, but is also mandated by the EU regulation as part of the plate heat exchanger. It therefore makes sense to examine the individual components of this system and their boundary conditions more closely.

The bypass is necessary

The thermal bypass of the energy recovery system prescribed by EU 1253 - 2014 is only possible with a plate heat exchanger with a bypass. "Bypass" means that an air stream is completely or partially routed past a component (here energy recovery). It makes sense that the pressure loss (with dampers) should be the same as through the exchanger.

With the plate heat exchanger, the usual arrangement of the bypass is parallel to the plates (Fig. 1); with smaller exchangers it is on the side and with wider exchangers it is in the middle because of the better assignment. (The position of the bypass also influences the loading of downstream components, such as the heating register.)

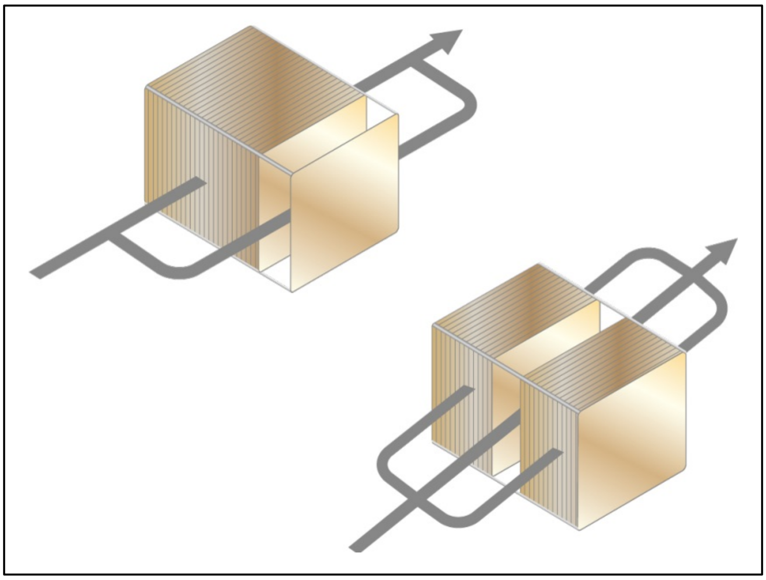

Fig. 1: Side and middle bypass

The arrangement of the bypass above or below the exchangers is rare, but possible, for example, with twin exchangers (Fig. 2). This is an advantage for uniform loading.

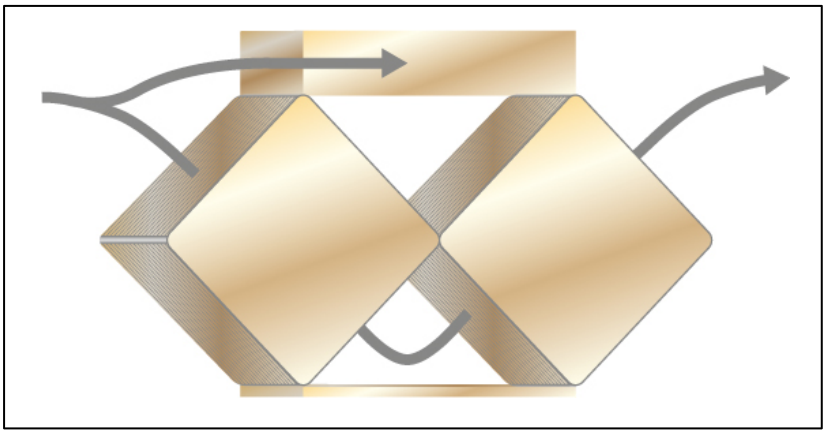

Fig. 2: Bypass above the exchangers

Another point of discussion is in which air flow the bypass is installed:

- **Bypass in the outside air**
  Between 0 and 100 % of the outside air is routed via the bypass; this cools the extract air accordingly. This also prevents the condensate from freezing up (the danger of freezing is avoided). This position is therefore the most common application in practice.
- **Bypass in the extract air**
  The output is controlled via the extract air volume in the energy recovery unit. Since the entire extract air volume passes through the bypass during summer operation, this variant is sometimes used for heavily polluted extract air.
- **Bypass in the outside air and in the extract air**
  In process engineering, bypasses are rarely arranged in both air streams for reasons of operational safety (contamination, controllability).

With regard to the design, it must be ensured that the pressure loss is as small as possible. This is because the space for the energy recovery unit with bypass system in a ventilation unit is limited both in width and in height. The bypass system should therefore take up as little space as possible, i.e. it should

- if possible be part of the plate heat exchanger
- have no cross-sectional changes
- ensure favourable inflow and outflow (uniform loading)

Damper requirements

For the output control, two dampers are required operating in opposition to one another; one is for the bypass and one for the heat exchanger:

- Bypass damper closed à Exchanger damper open à Maximum output
- Bypass damper open à Exchanger damper closed à No output

Any intermediate position is possible between these two extreme points. To ensure correct functioning, the two dampers should be mechanically coupled to each other so that only one drive is required.

For space reasons, the dampers used are what are referred to as louver dampers with slats; these can be in the same or opposite direction. Both principles have advantages and disadvantages; co-rotating dampers direct the air flow better (low pressure drop), while counter-rotating dampers have better throttling characteristics. Which is the optimal solution can only be decided in connection with the overall concept.

Figure 3: Co-rotating and counter-rotating slats

Another criterion for the damper design is the height of the slats:

- Large slat à High damper à Few slats
- Small slat à Low damper à Many slats

Many (small) slats reduce the free cross-section in the "open" position, which increases the pressure loss. Here, too, the optimum dimensions depend on the overall concept.
Due to the parallel connection of bypass and heat exchanger, in which at least one air path is always open, the tightness requirements of the dampers are low. It is also important to note a possible additional function, namely recirculation mode with the so-called recirculation air bypass. One side of the bypass is designed as a damper (Fig. 4). If this is opened, circulating air and mixed air operation is possible via the bypass. This saves the otherwise necessary mixing chamber; the ventilation unit becomes considerably shorter.

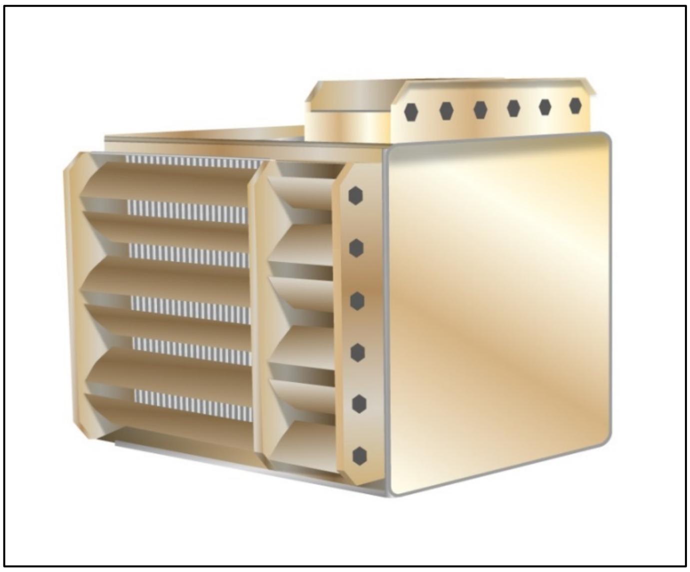

Fig. 4: Plate heat exchanger with recirculation bypass

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Summary

According to EU 1253, a plate heat exchanger for energy recovery must be equipped with a bypass system consisting of bypass, bypass damper and exchanger damper. The following functions are thus possible:

- Continuous control of energy recovery
- Avoidance of the risk of freezing
- Recirculation/mixed air operation (with additional damper)

The bypass must be designed so that the pressure loss (with damper) via the bypass is the same as via the plate heat exchanger. In order to achieve an optimum result, the bypass system must be an integral part of the energy recovery process. This complete unit also significantly reduces the time and cost required for installation (plug and play). A combination of uncoordinated components from different suppliers does not make it possible to create a system that fulfils all functions perfectly with low pressure loss and a small space requirement.

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