

Defrost control of recuperators

The Frosting of plate and tube recuperators was examined by a diploma thesis of the Helsinki University of Technology (E. Sandberg 1978). The results provided new information on frosting and its prevention:

1. Frosting starts on the entire cold side of the exchanger at the same time. The ice on the extract side forms a triangle that grows as the freezing progresses over the entire heat transfer surface, unless frosting is limited.
2. If the ventilation is continuous and there is moisture in the exhaust air (residential buildings, nursing homes etc.), the frost will spread over the entire exchanger and the exhaust air flow will stop.
3. By-passing the exchanger on outside air side (“bypass defrost”) does not work or stop freezing. Exhaust air flow is reduced, the building is pressurized, air quality deteriorates and structural damage may occur.
4. If the defrosting is not allowed to proceed too far frost melting will occur in minutes when the cold air flow is completely blocked. In sector defrosting system this is done, however, only in part of the heat exchanger at a time.§
5. Reasonable frosting does not reduce the efficiency of the exchanger.

Ice formation inside the heat exchanger

If freezing is not prevented the ice advances to the opposite corner of the exchanger and frost is blocking it. Ex-haust air ceases.

Extract air runs from top to bottom and cold air from left to right. The picture shows the ice triangle inside of a glass tube exchanger.

The frost behaves in the same way in plate exchangers. Only frosting rate of glass tube and plate exchanger are different but the end result is the same.

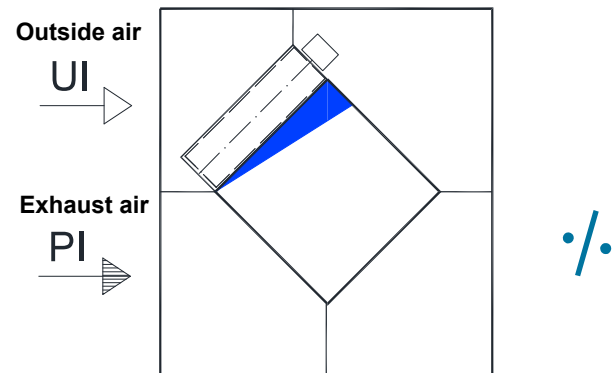
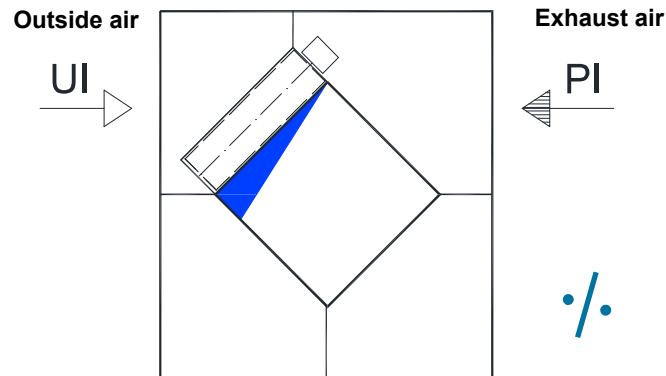
Conduction of exhaust air from the bottom up slows down the frosting. When condensed, the water then runs away from the ice layer towards the warmer air.

In Mr. E.Sandberg's 1978 study glass modules were used. The method of ice and frost formation and the speed of this process could be easily studied and documented.



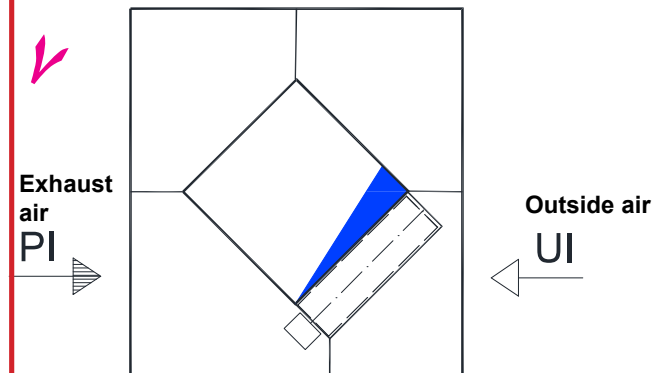
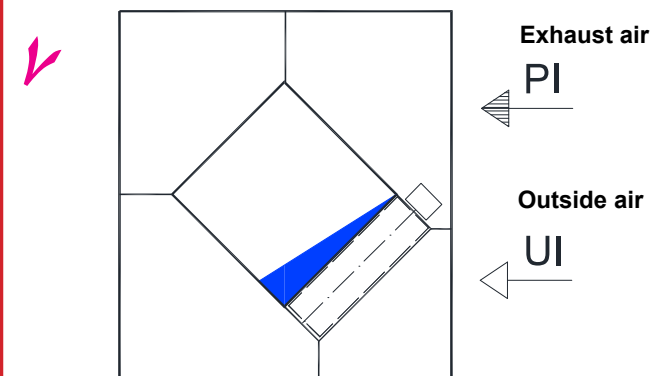
Effect of installation execution on frosting

WORKING EXECUTION: CONDENSATE FLOWS TOWARD THE WARM EDGE OF THE EXCHANGER



With these connections the sector defrost operates at all outdoor temperatures if the structure of the plate or tube pack is such that the condensed water drains out quickly.

NOT RECOMMENDED EXECUTION: CONDENSATE FLOWS TOWARDS THE COLD EDGE OF THE EXCHANGER



With these air flow connections, the formation of ice on the exhaust side of the exchanger is accelerated and increased. There may be problems with defrosting.