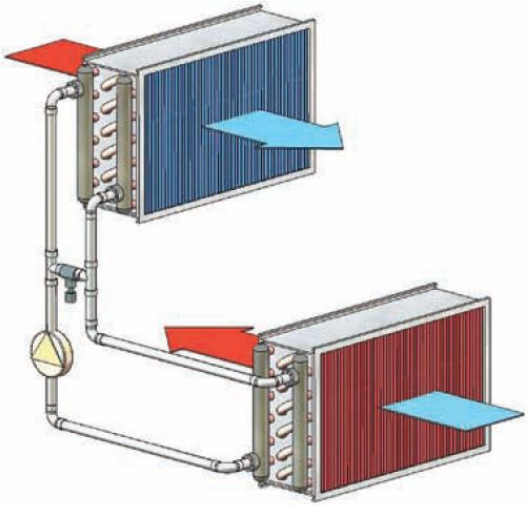
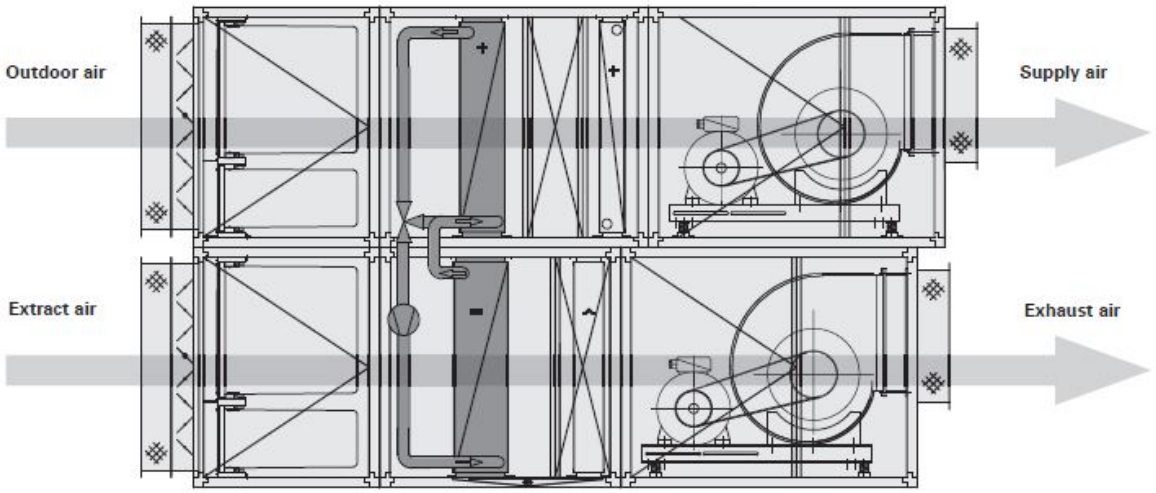
HEAT RECOVERY OPTIONS IN AHU

1. Run Around Coil –

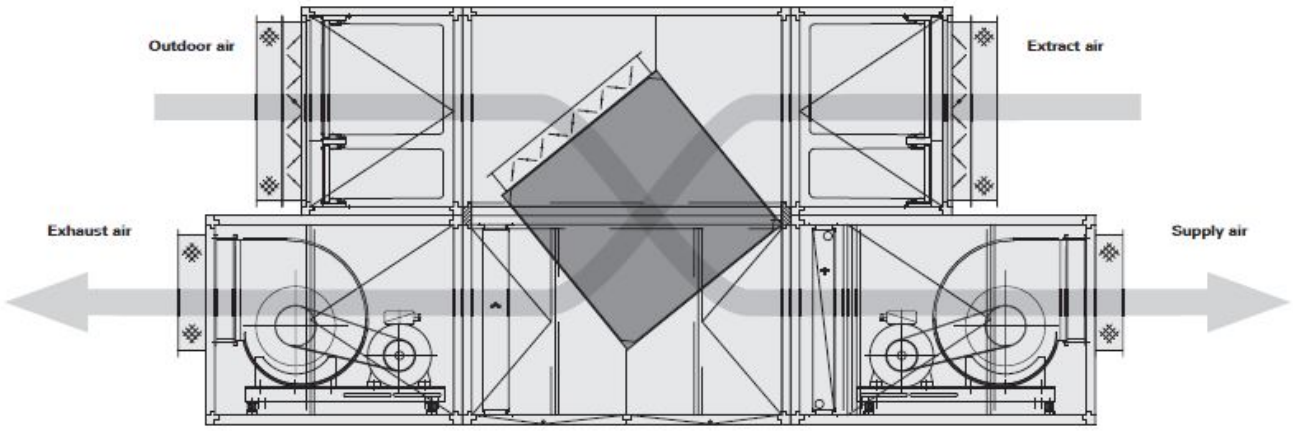


It is an air to water heat exchanger system, it is used to recover sensible heat only, it consists of two coils, one located in the exhaust air stream and the other in the supply air stream, both of them are connected with a pump in a closed circuit (pump and piping by others), the heat transfer medium is water.

When the cold air passes through the first coil of the run around system which is located in the cold air stream, it cools down the water inside the coil, after the water loses heat, the pump passes this cold water to the coil in the hot air stream, heat exchange happened thus cooling the air and warming the water, warm water returns to the coil in the cold stream and the cycle is repeated.

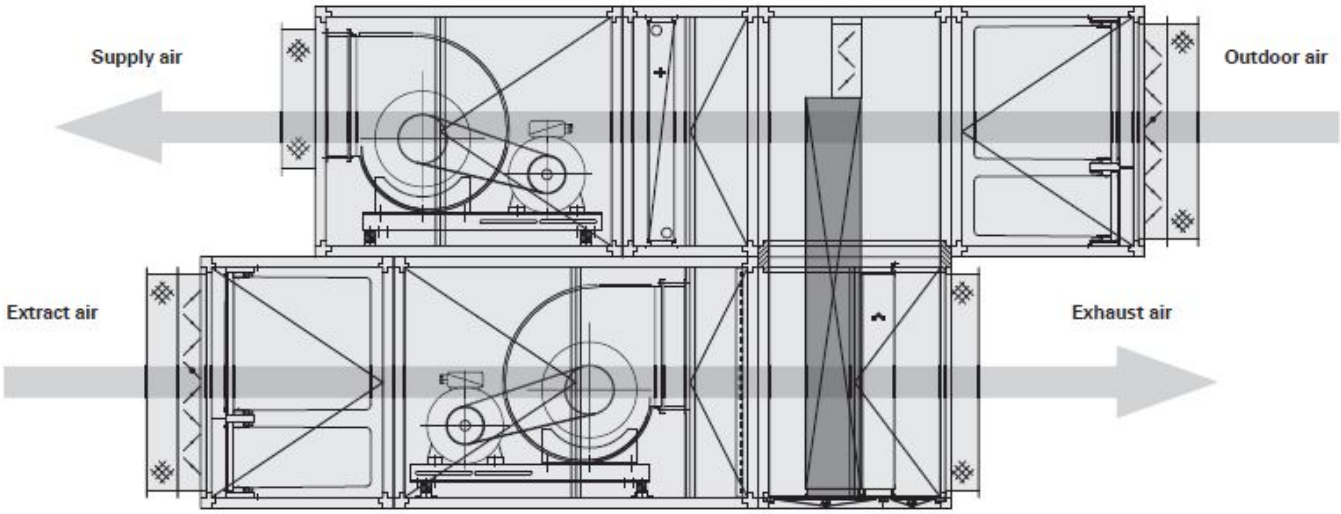


2. Plate Type Heat Exchanger



In this arrangement, a heat exchanger is situated to allow direct transfer of heat from one flow to the other. Heat is transferred from outdoor air coming into the air conditioner to the cold air leaving it. Again, the goal is to boost the portion of air conditioning capacity used for removal of latent heat by decreasing the need to remove sensible heat. To a limited extent, the exchanger itself will remove latent heat by condensing moisture on the entering air side. Outdoor air is introduced into one side of the heat exchanger, and is partially cooled. It then flows over the cold refrigeration coil for moisture removal and additional sensible cooling. The cold, saturated air then passes through the other side of the exchanger for warming before being introduced to the air handler or the space. Cross flow type heat recovery provides up to 80% efficiency. While waste heat exchanger plates are typically manufactured in aluminum, special epoxy coatings or stainless steel plates are also common.

3. **Heat Pipe System**



This type of heat recovery system utilizes the refrigerant phase change property. It con-sists of two coils connected to each other circuit by circuit independently; each circuit is filled with a refrigerant.

Two main functions can be done using this system; it can be used for dehumidification or for heat recovery, according to the arrangement of the heat pipe coils with respect to other components.

Heat pipes for dehumidification function may be described as having two sections: Pre-cool and reheat. The first section is located in the incoming air stream. When warm air passes over the heat pipes, the refrigerant vaporizes, carrying heat to the second section of heat pipes, placed downstream. Because some heat has been removed from the air before encountering the evaporator coil, the incoming air stream section is called the pre-cool heat pipe.

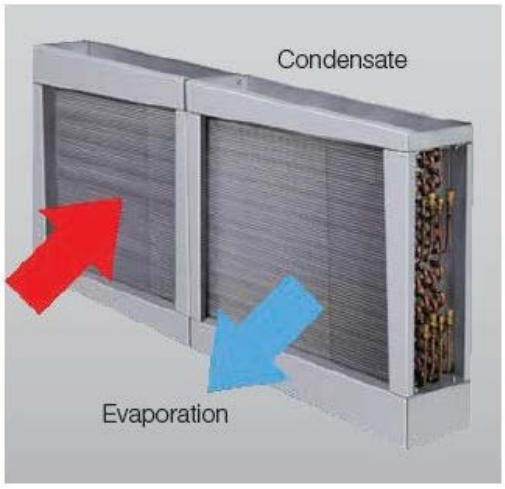
Air passing through the evaporator coil is assisted to a lower temperature, resulting in greater condensation removal. The overcooled air is then reheated to a comfortable temperature by the reheat heat pipe section reheat heat pipe section using the heat transferred from the pre-cool heat pipe.

This entire process of pre-cooling and reheating is accomplished with no additional energy use. The result is an air conditioning system with superior ability to remove moisture.

For Heat recovery function the heat pipe also consist of two sections, each of them installed in an air steams, side by side or staked depending on the unit arrangement. When warm air passes over the heat pipes, the refrigerant vaporizes; carrying heat to the second section and the warm air will be cooled down while the relatively cold air in the cold air stream will condense the refrigerant which will return back to the first part by gravity, then this cycle repeated.

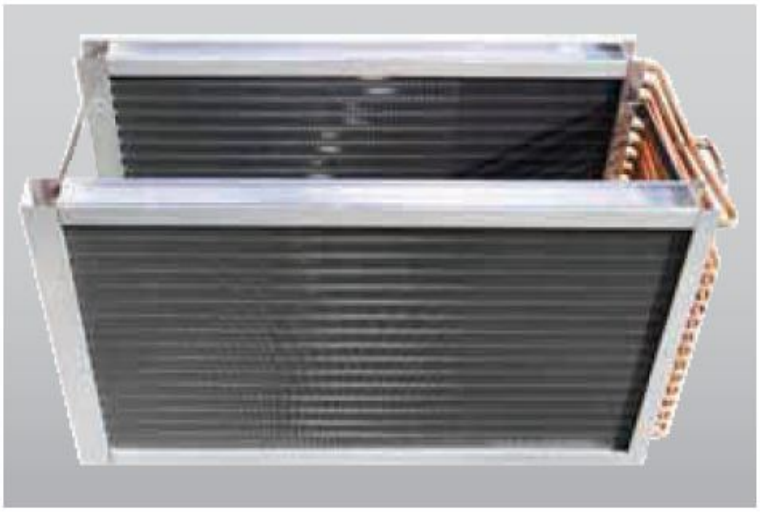
3.1 Horizontal/Vertical Heat Pipe Type Heat Recovery

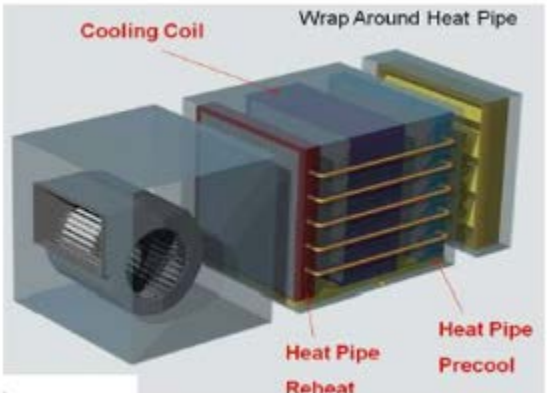
This is a typical pipe / fin exchanger that is composed of two sections that operate as a condenser and an evaporator and that has proper amount of refrigerant inside. Air, of which its heat shall be extracted, is taken through the evaporator side and it's heat is transferred to the refrigerant. Vaporized refrigerant transfers it's heat to the cold air passing outside of the exchanger on the condenser which is placed higher, and thus heat is transferred to the cold air and heat recovery is ensured. It is of the sensible type, heat transfer occurs between two airs, there is no humidity transfer.



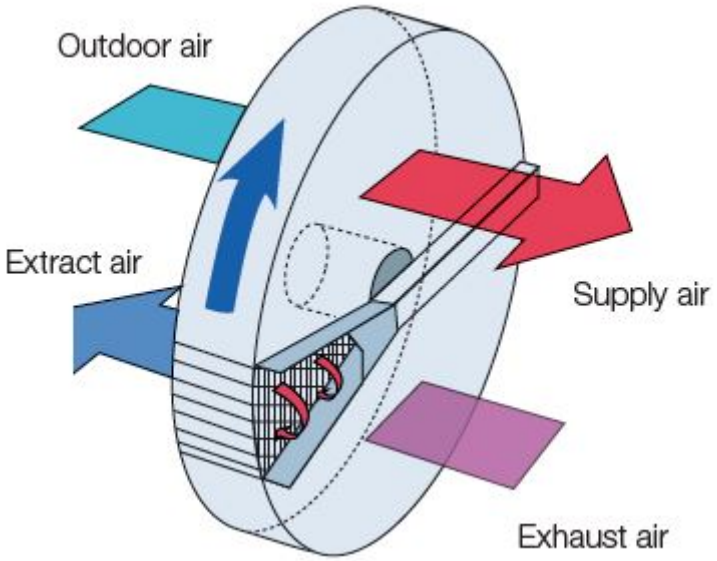
3.2 Horse Shoe Heat Pipe Type Heat Recovery

Horse shoe heat pipe type heat recovery exchangers are heat pipe types that are used for dehumidification operations in air conditioning systems. It performs pre-cooling of the air that shall be dehumidified and and reheating of this air with the energy taken. Thus, energy consumption is not required for both processes.



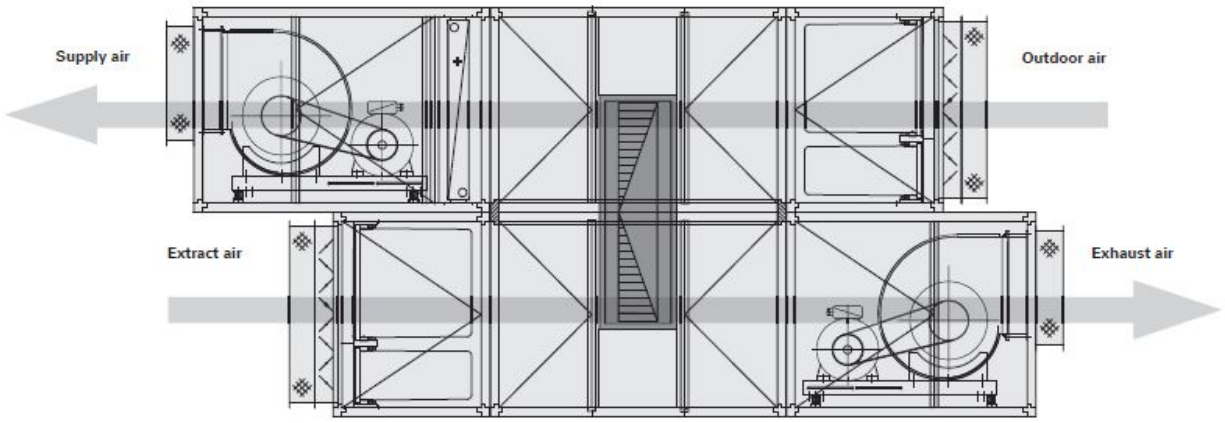


4. **Thermal Enthalpy Wheel**



In this arrangement, a rotating wheel is used to transfer heat from one air stream to the other. Energy recovery wheel can be incorporated into a ventilation system to transfer both the sensible and latent energy between outdoor and exhaust air streams. The core of an enthalpy wheel can be made from a variety of materials such as paper, metal or plastic, which is coated with a desiccant. This coating enables the wheel to transfer both sensible and latent energy between air streams. The enthalpy wheel provides first stage cooling or heating. For instance, in the summer the wheel removes moisture from incoming air and pre-cools it to lighten the load on the evaporator coil. Likewise, in colder temperatures (winter application) the wheel will inject moisture into supply air and pre-warm it to reduce the load on the reheat coil. In the summer and winter modes, the wheel saves energy. There are three general types of wheels being used today. They are sensible, enthalpy and regenerative.

a) Sensible wheel - This wheel is not coated with a desiccant and therefore transfers only sensible energy. The wheel can be constructed of almost any material (paper, metal or plastic) and transfers energy between two air streams as the mass of the material gains or loses heat to the opposite air stream. The wheel rotates at a speed of 25 to 50 revolutions per minute.
b) Enthalpy wheel - It is similar to the sensible wheel except that a desiccant media is added to the wheel's surface. As the wheel rotates, it now can transfer sensible energy and humidity. This wheel also rotates at 25 to 50 revolutions per minute.
c) Regeneration wheel- This wheel is used when low dewpoint conditions (<45°F) are required, such as industrial applications. It achieves low dewpoints by slowing the wheel to a speed of between 0.25 and 1 revolution per minute and by using an air stream heated to 250°F or more to drive off moisture and regenerate the wheel.
   This heated air stream is typically focused on only 1/4 of the wheel's area thereby allowing 3/4 of the area to be available for the process side.



5. Face and Bypass Damper

Face & Bypass Dampers for Re-Heating with Zero Energy Input

There are set of phase and bypass dampers are installed upstream of the cooling coil. Normal operation air passes through face dampers and enter the cooling coil, where bypass dampers are closed. When you need extra de-humidification for high latent lands, by pass dampers opens and some of the return air by passes the coil and enters supply air stream thus adding more heating to air.