

Drying with dehydrated air



Dehydrated air by absorption or special Hybrid dryers.

Description rotor

The centre of a dehumidifier is the rotor or absorption wheel. This part consists out of a chemical bound silica gel that can absorb moisture out of the air that passes through the rotor but can also release moisture during the regeneration process.

After the regeneration process the rotor is ready to absorb moisture again.

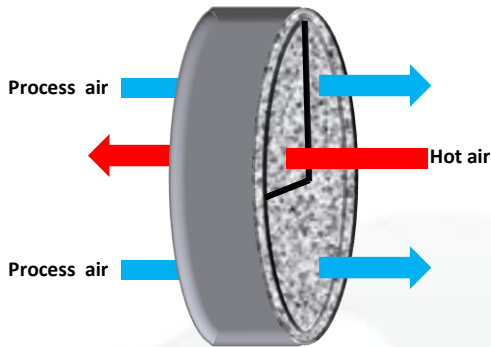


The structure of the rotor looks like honeycomb pattern with a lot of small air channels. All these air channels make a big absorption surface which takes care of the dehydration of the air that passages the rotor; the silica gel absorbs water from the air.

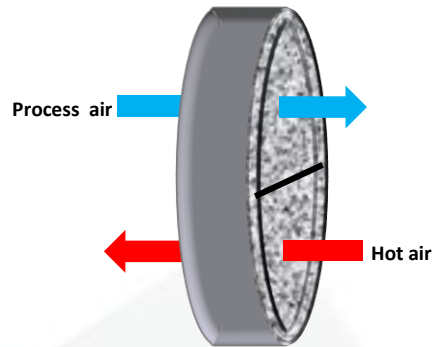
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Regeneration of the rotor

The silica gel in the rotor cannot absorb water unlimited. Nevertheless the absorption process is a continuing process. To make the absorption process a continuing process the construction of the rotor is designed to absorb water at 75 or 50% of the total surface of the wheel. 25 or 50% (depending the T° of the regeneration air) of the rotor is used for regeneration (drying the rotor).



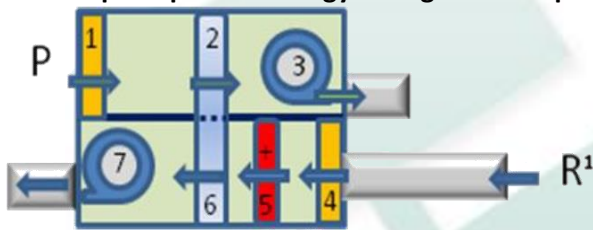
Rotor with 75-25 configuration; regeneration by hot air (150°C) from gasburner ad 25% of the rotor surface.



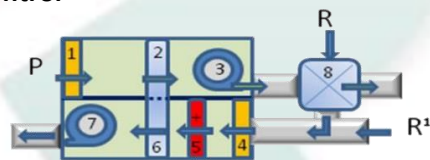
Rotor with 50-50 configuration; regeneration by warm air (60°C) from hot water battery or condensor.

By rotating, each part of the rotor will absorb water and will later be dried by regeneration. The regeneration section is isolated from the absorption section. By blowing hot air through the regeneration section, the absorbed water will be removed from the rotor. The moist regeneration air will be evacuated through air-channels to outdoors.

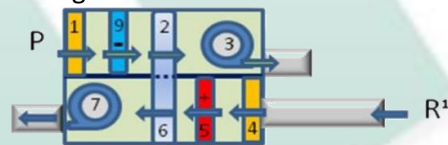
Several principles for energy savings and temperature control



- P:** Moist process air into the air dryer
- 1:** Process air will be filtered
- 2:** Process air will be dried by the rotor
- 3:** Dry and (warm) process comes out of the air dryer and can be used for drying products.
- R:** Regeneration airflow to dry the rotor
- 4:** Regeneration air will be filtered
- 5:** Regeneration air will be heated (60° or $120\text{-}150^\circ\text{C}$)
- 6:** Regeneration air will dry the rotor
- 7:** Moist regeneration air will be evacuated to outdoor.
- 8:** Heat exchange unit



Option I) 8: Heat exchange unit brings process air T° down to the ambient level + 3°C . Free coming energy will be used to warm up regeneration air; Energy saving.

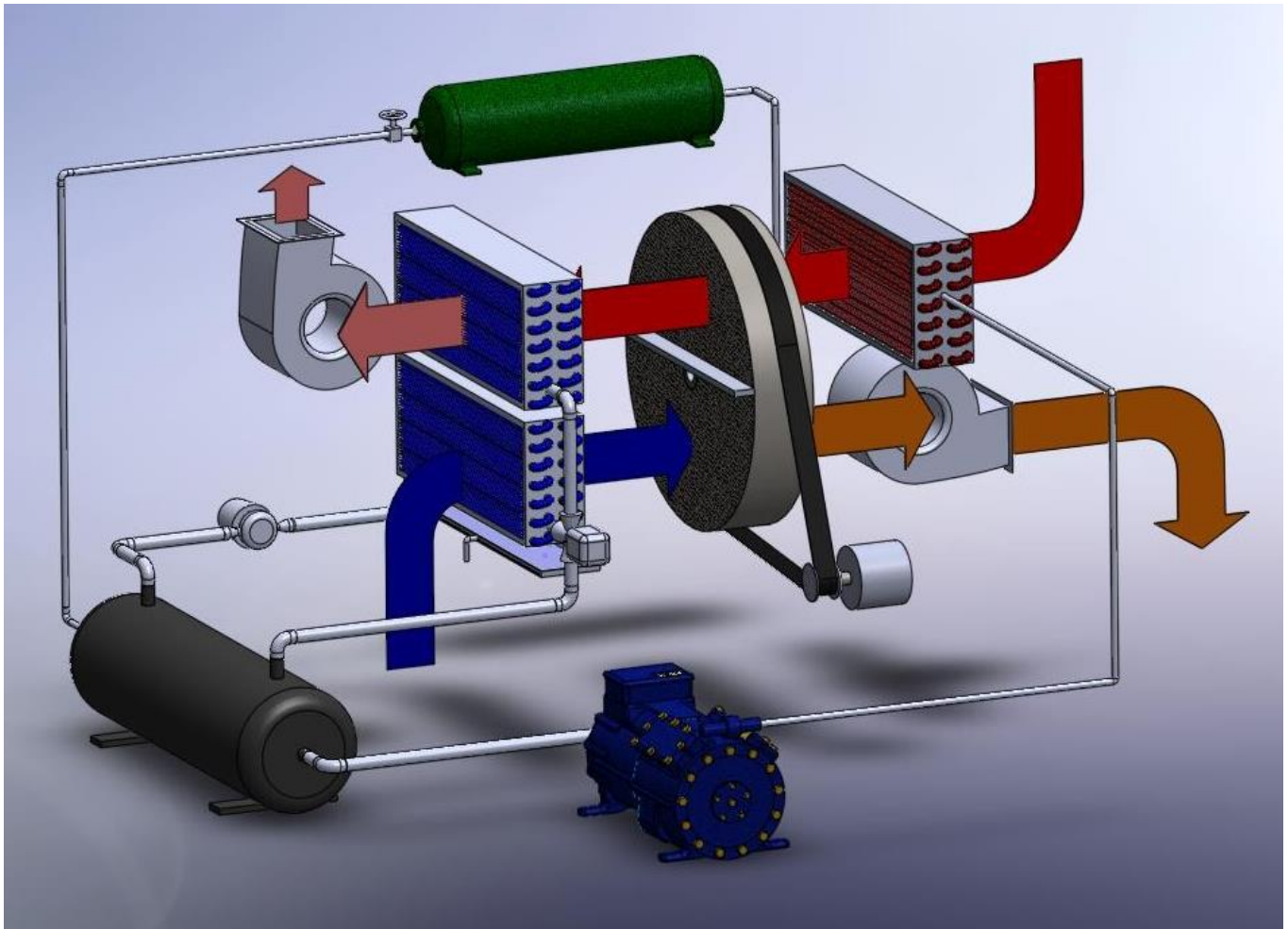


Option II) 9: Cold water battery (chiller) with modulated capacity can cool down the process air to any desired $T^\circ\text{C}$. Hybrid system



Option III) 8+9: Combination 8+9: Energy saving and reaching any desired $T^\circ\text{C}$ for outgoing process air. Hybrid system with heat-exchange.

Economically and modulating drying of air; The hybride principle

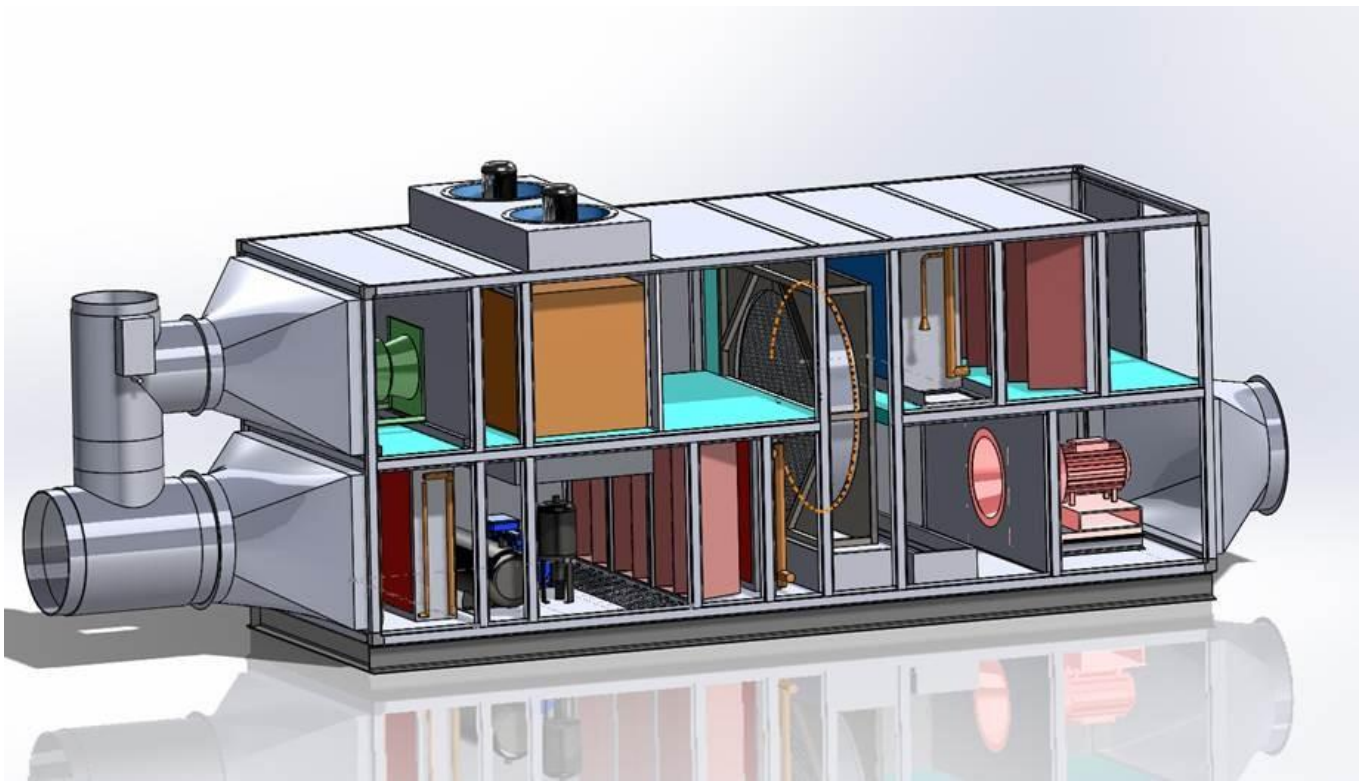


Hybrid heat pump with cold water

The hybride air dryer is specially developed to create very dry air with an constant (low) temperature of the process air. Process air is first being cooled, so water in the process air will Condensate on the evaporator. After this, the process air at 100% HR will be dried to a low level by the Absorption rotor. Because of high HR, the capacity of the adsorption rotor is at it's maximum. The capacity of the evaporator is modulating; The process air will be cooled to a level by which the out coming process air is at the desired T°.

Regeneration air will be heated by the condenser (heat-pump) and an additional radiator with hot water. Less external heating is needed and all energy will be used; energy saving!

The rotor will be dried by this hot air. A heat-exchange unit in the outlet of the regeneration air can pre-heat the extracted (cold) air for regeneration; extra energy saving!



Hybrid heat exchanger

Hybride installatie met warmtepomp en warmtewisselaars. Automatisch extractie proces-lucht direct van buiten of via warmtewisselaar voor maximaal energiebesparing. Modulerende warmtepomp voor 100% resultaat in zomer en winter.

Big advantage of absorption air dryers is that the maintenance costs and frequency for services is low.

Different air dryers can be used in several occasions where dry air is needed. We have mentioned some possibilities above. The final implementation and capacity depends which parameters are required. Regeneration process can be done by gas burner, hot water radiator or condenser (with extra radiator). Temperature can be controlled by installing a modulated air-air cross-exchanger, a cold water battery which must be connected to a cold water chiller or by a heat-pump installation. All controlled by the ABC processor.

Energy can be saved by installing a (modulating) air-air cross heat exchanger in the process air stream. The optimal and most economical air dryer is the ACR dryer from Agratechniek; When very dry process air (down to 1.5 gr/kg air) is needed at a low T° (down to 15-20°). Modulating capacity and energy saving!