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WORLD-CLASS EXPERTS IN

MECHANICAL STEAM RECOMPRESSION BY HIBON

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In the current manufacturing climate, processes must be as cost effective as possible, consuming very little energy and resources plus generating minimal emissions. In addition, rising energy prices make it necessary to increase energy efficiency in order to maintain competitiveness. **Mechanical Steam Recompression** (MSC) is a solution that allows you to recover heat (in the form of steam) that is usually lost during the manufacturing process. The captured steam is then reused, resulting in easily calculable savings. The resulting reduced operating costs provide for a rapid and sustainable return on investment.

HIBON is well known for its expertise in MSC especially with their **rotary lobe steam blowers** that achieve increased thermodynamic potential of steam (increased degree of superheating) in a less expensive method than producing directly superheated steam.

OPERATING PRINCIPLE OF MSC

For a liquid to be concentrated it first must be heated in an evaporator, creating steam that is then sucked in by a booster to compress it, thereby also increasing its temperature. This superheated vapor is distributed to a heat exchanger to be condensed, using the extracted heat to increase the temperature of the liquid being concentrated and then reinjecting that into evaporator. This process loop allows the production of a new quantity of steam.

CLOSE TO **ZERO** DISCHARGE

Using MSC, a concentrate (to be landfilled or incinerated) and a distillate (or condensate) are recovered for reuse. This results in a **notable reduction in the volume of liquid effluents** and the consumption of cooling water to even zero discharge in some cases.

SIZING

To properly size a steam blower, it is necessary to know the following:

- Mass flow rate of the process
- Temperatures of the steam sucked in and discharged by the blower
- Chemical nature of the steam
- Suction pressure or vacuum
- Required discharge pressure

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ADVANTAGES OF HIBON STEAM BLOWERS

A steam blower has all the advantages inherent in blowers that use the « ROOTS » principle: operational safety, no lubrication problems, no steam leakage to the outside, no need for time-consuming and expensive pre-heating, start-up from room temperature, and very simple insulation.

As a **positive displacement machine**, the blower transfers a constant mass flow at the corresponding operating speed and adapts to slight variations in the customer's process. Its speed can be varied by using a customer frequency converter to drive the motor (linear flow variation in the range of 50-60 % to 100 %). The operating curve is a straight line, the flow rate is proportional to the speed, operating at constant torque.

MATERIALS AND SEALS DESIGNED FOR STEAM

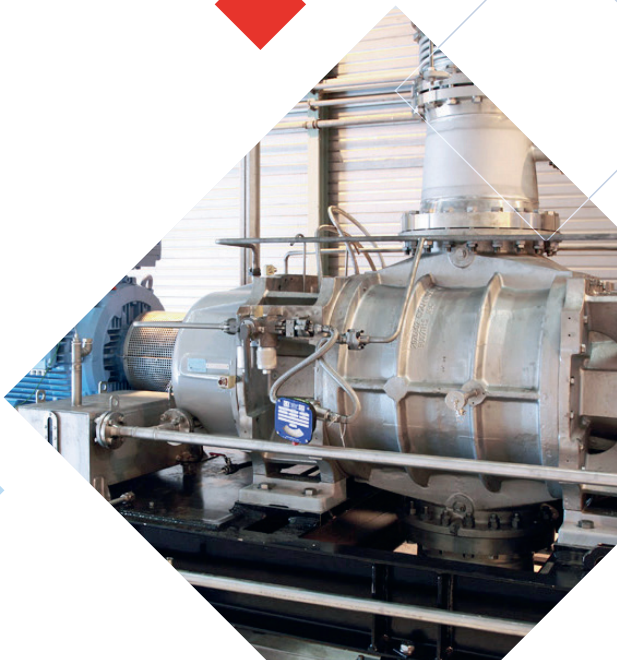
Water is injected as a spray through a desuperheating nozzle at the suction side of the blower, transforming the water into steam and resulting in a reduced temperature at the discharge. The discharged steam is cooled to the temperature that corresponds with the customer's required discharge pressure, provided that it is within the design limits of the booster in terms of pressure and temperature. This kg/h injected water flow rate is added to the kg/h steam flow rate sucked in, the total corresponding to the kg/h discharge flow rate.

HIBON STEAM BLOWER RANGE

In finding a solution for a customer process between **1 000 and 3 500 kg/h steam**, the desired flow rate range at the blower is determined by the size of the **rotary air blower** available. For pressure operations, with **discharge temperature up to 115 °C saturation** are available for **100 °C inlet steam**. For vacuum operations, an inlet saturation temperature **of 85 °C is available for a steam discharge of 100 °C**.

APPLICATIONS FOR HIBON STEAM BLOWERS

- **Chemical industries**: ethanol and methanol
- **Pharmaceutical industry**: distillation of pure water and essential oils
- **Environmental protection**: concentration of residues from polluted soils, heavy metals, cutting oil, printing ink, brine, treatment of rubber, paint and metal waste
- **Food industry**: concentration of juice, pond water, brine, desalination of sea water
- **Power plant**: Nuclear process (EPR)



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USEFUL VOCABULARY ON THE APPLICATION OF MECHANICAL VAPOR RECOMPRESSION

Saturated Vapor
Vapor whose temperature and pressure are balanced to remain constant without causing condensation into a liquid. For example, when water boils at atmospheric pressure, the temperature remains constant and equal to 100 °C. The vapor that is released above the liquid is called saturated vapor.

Although we continue to heat this boiling water, the temperature remains unchanged. The heat released is used to produce steam. The total heat of a steam consists of two variables:

- **Sensible Heat**: heat applied to the water to bring it to 100 °C,
- **Latent Heat of Vaporization**: heat needed to transform water at 100 °C into steam at 100 °C

Ratio of a Saturated Steam
If the saturated steam contains a certain percentage of water even at the same temperature as the steam, it is said to be wet saturated steam.

The ratio of a wet saturated steam is the ratio of the weight of the steam to the weight of the steam + water mixture. For example, a kilogram of steam containing 900 g of steam and 100 g of water has a ratio of 900/1000, or simply 0.9.

Dry Saturated Steam
Saturated steam with a ratio of 1.

Superheated Steam
If heat is added to dry saturated steam, it becomes superheated steam. Its characteristics can be read above the saturation curve on a Mollier diagram.

Degree of Superheat
This is the difference between the temperature of a superheated vapor and the temperature of a dry saturated vapor at the same pressure.

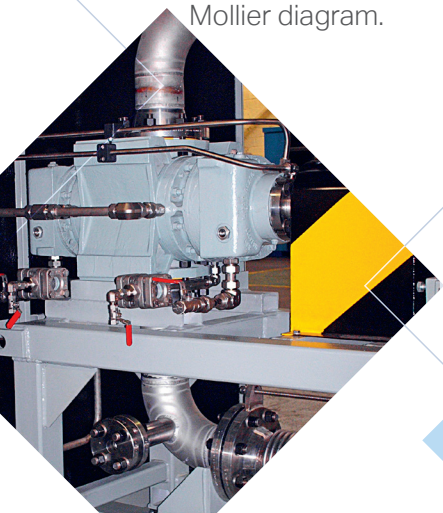
Specific Heat
The amount of heat needed to raise 1 kilogram of material by 1 °C. For liquid water, the specific heat is 1 kcal per 1 kg per degree Celsius. For steam, the specific heat is less at 0.5 kcal per 1 kg per 1 degree Celsius.

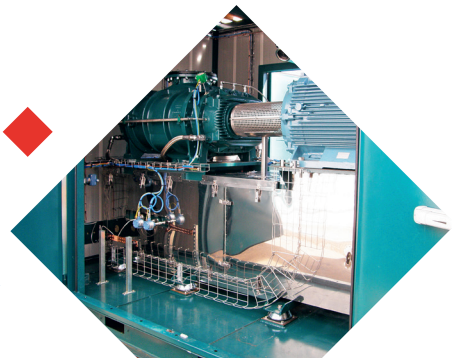
Mollier Diagram
This illustration explains the different characteristics of steam. Hibon's blower selection is based on saturation temperatures corresponding to pure steam on the Mollier diagram.

For further information, please contact HIBON France.

A CENTURY OF EXPERIENCE

For more than 100 years, Hibon has been supplying air blowers, process gas blowers, neutral gas blowers, vacuum pumps and blower units with operating pressures of up to 1 bar and vacuum levels of up to 92 %. Our products and services are based on our decades of experience, technological expertise and close contact with the customer. To meet and even exceed customer expectations, our engineering team continuously refines our blower and pump solutions, ensuring that they provide an ever higher efficiency and reliability.





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