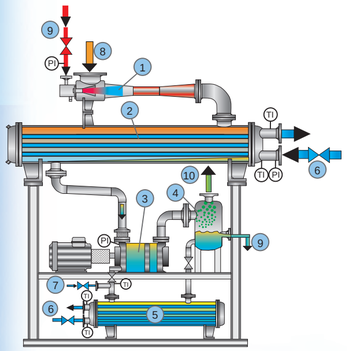
The advantages of the vacuum system operating with mixing (direct contact) condensers are:

- very efficient due to direct contact between the process medium and the cooling medium
- low investment costs compared to indirect cooling
- simple and easy operation
- proven technology

Hybrid vacuum systems as skid mounted unit

A vacuum system comprising a small booster, a surface condenser and a liquid ring vacuum pump as final stage installed as skid mounted unit is very popular for drying applications. The system is called hybrid system and is a customised solution. A non-barometric installation is also possible by means of this design. A horizontal installation of the surface condenser increases the risk of pollution.



Design parameter

- 100 kg/h water vapour + 5 kg/h air @ 50 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37 °C	Electrical energy (kW)
36	12	3.3

1 booster
2 surface condenser
3 liquid ring vacuum pump (lrvp)
4 separator (lrvp)
5 service water re-cooler (lrvp)
6 cooling water
7 fresh water (lrvp)
8 process flow
9 overflow (lrvp)
10 gas outlet separator (lrvp)

The advantages of the vacuum system operating with surface condensers – compared to the conventional ones using mixing (direct contact) condensers – are:

- strict separation of cooling water and process medium
- environment-friendly e.g. low air pollution and clean cooling tower
- easy cleaning during operation
- proven technology supported by positive customer feedback

Körting vacuum systems

for drying, neutralisation and bleaching of edible oil

Körting HANNOVER AG
THE EJECTOR COMPANY

Körting Hannover AG
Badenstedter Strasse 56
30453 Hannover
Germany

Tel.: +49 511 2129-253
Fax: +49 511 2129-223

st@koerting.de

www.koerting.de

Mixing (direct contact) condenser

Direct contact between the process steam and the cooling medium is the most efficient way of steam condensation.

That is why conventional vacuum systems operating with mixing condensation are still very popular for this application.

Low operation costs and trouble-free and proven operation are the main advantages of this kind of vacuum systems.

Depending on the available cooling water temperature an upstream booster can be used.

Surface condenser

The initial idea for developing a vacuum system with indirect condensation was the requirement of environment-friendly systems in barometric and non-barometric design.

Compared to conventional systems - with mixing (direct contact) condensers - the somewhat higher investment costs for such systems are quickly paid back due to increased environmental protection.

Positive feedback from customers and an increased number of inquiries prove that the system operates successfully, reliably and trouble-free.

Vacuum systems consisting solely of ejectors

1 mixing condenser
2 interconnected steam jet ejector (stage 1)
3 interconnected mixing condenser
4 last ejector (stage 2)
5 seal tank
6 motive steam
7 cooling water
8 process flow
9 overflow (seal tank)
10 to cooling tower

Without booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 70 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37,5 °C	Electrical energy (kW)
78	14.5	—

With booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 40 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37,5 °C	Electrical energy (kW)
135	21.5	—

With booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 40 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

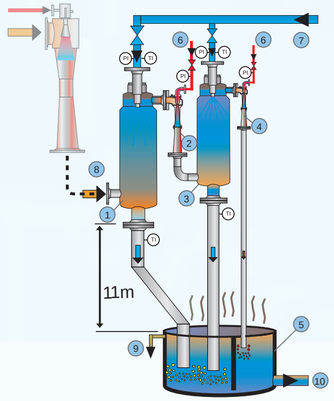
Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37 °C	Electrical energy (kW)
168	33.5	—

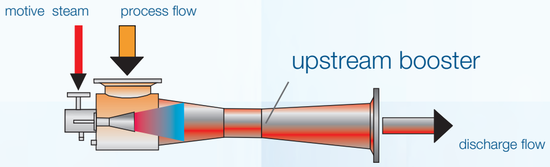
Without booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 90 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

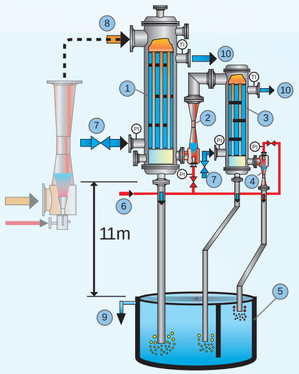
Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37 °C	Electrical energy (kW)
72	20	—

1 surface condenser
2 interconnected steam jet ejector (stage 1)
3 interconnected surface condenser
4 last steam jet ejector (stage 2)
5 seal tank
6 motive steam
7 cooling water
8 process flow
9 overflow (seal tank)
10 to cooling tower





All systems are designed to operate with pre-condensers, but an additional booster can be installed upstream



Hybrid vacuum systems (combined with liquid ring vacuum pump)

1 mixing condenser
2 interconnected steam jet ejector (stage 1)
3 interconnected mixing condenser
4 liquid ring vacuum pump (lrvp – stage 2)
5 seal tank
6 motive steam
7 cooling water
8 process flow
9 service water (lrvp)
10 overflow (lrvp)
11 gas outlet (lrvp)
12 overflow (seal tank)
13 to cooling tower

Without booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 70 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37,5 °C	Electrical energy (kW)
17	12.5	3.5

With booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 40 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

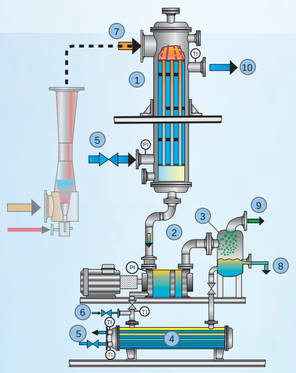
Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37,5 °C	Electrical energy (kW)
74	20.5	3.5

With booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 40 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37,5 °C	Electrical energy (kW)
98	28.5	7.7

of the condenser. By means of this installation a vacuum level below 40 mbar is easy to reach.



Without booster

- Design parameter: 100 kg/h water vapour + 10 kg/h air @ 90 mbar and 80 °C
- motive steam pressure 9 bar (abs)
- cooling water inlet temperature 32 °C

Motive steam (kg/h)	Cooling water (m^3/h) 32 °C => 37,5 °C	Electrical energy (kW)
—	13	7.7

1 surface condenser
2 liquid ring vacuum pump (lrvp)
3 separator (lrvp)
4 service water re-cooler (lrvp)
5 cooling water
6 fresh water (lrvp)
7 process flow
8 overflow (lrvp)
9 gas outlet separator (lrvp)
10 to cooling tower