

Edible oil refining

Comparison of operation costs

for different types of deodorising vacuum systems

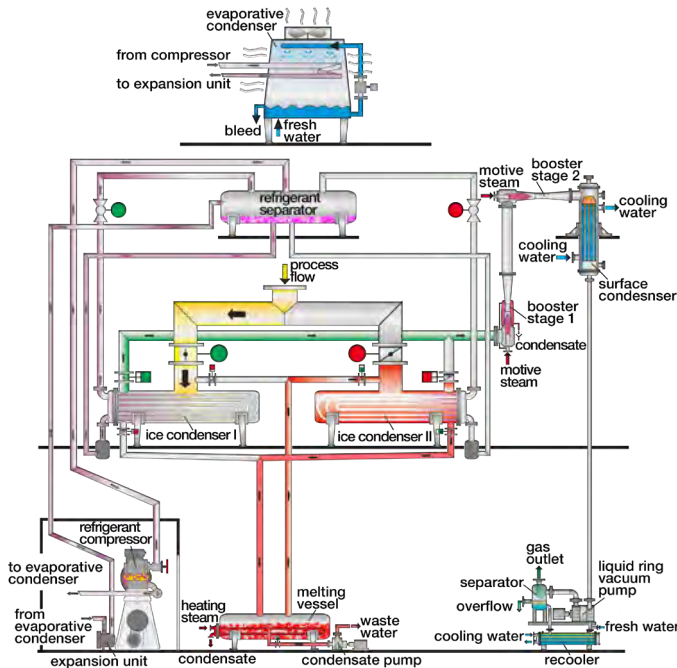


Körting
HANNOVER AG

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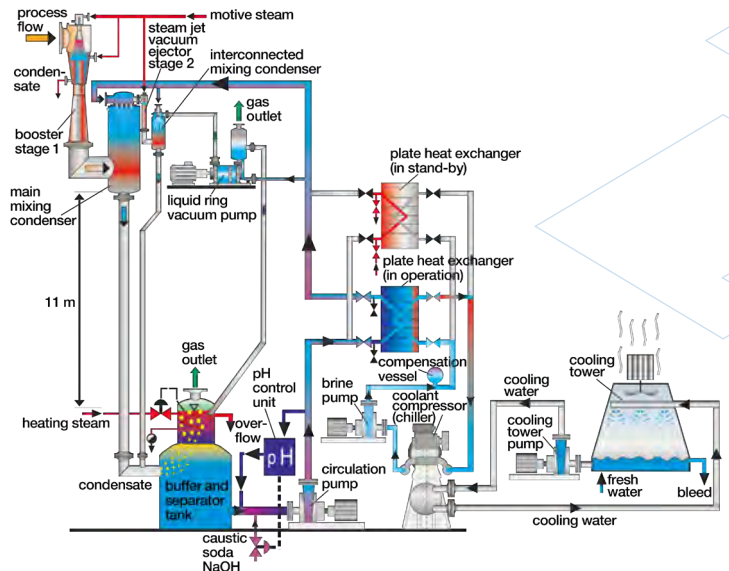
Four different vacuum systems compared

1 Körting ICE Condensation Vacuum System (ICE)



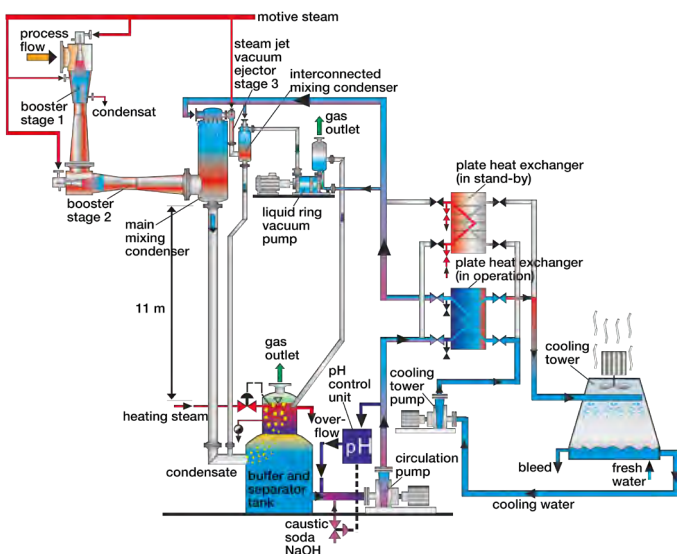
Total motive steam consumption	250 kg/h
Total cooling water consumption	35 m ³ /h
Total electrical power consumption	154 kW
Total waste water amount	0.504 m ³ /h

2 Alkaline Closed Loop vacuum system (chilled water operation) (ACL cold)



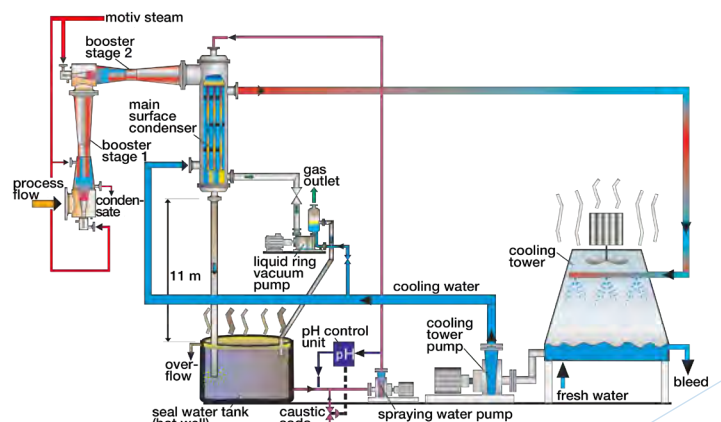
Total motive steam consumption	676 kg/h
Total cooling water consumption	212 m ³ /h
Total electrical power consumption	213 kW
Total waste water amount	0.933 m ³ /h

3 Alkaline Closed Loop vacuum system (cooling water operation) (ACL warm)



Total motive steam consumption	2 380 kg/h
Total cooling water consumption	395 m ³ /h
Total electrical power consumption	42 kW
Total waste water amount	2.637 m ³ /h

4 Vacuum system operating with surface condenser (OKO)



Total motive steam consumption	3 000 kg/h
Total cooling water consumption	459 m ³ /h
Total electrical power consumption	10 kW
Total waste water amount	3.257 m ³ /h

		1	2	3	4
		Körting ICE Condensation Vacuum System (ICE)	Alkaline Closed Loop vacuum system (chilled water operation) (ACL cold)	Alkaline Closed Loop vacuum system (cooling water operation) (ACL warm)	Vacuum system operating with surface con- denser (OKO)
DESIGN FIGURES					
suction flow: water vapour + 10 air + 4 FFA (kg/h)		250	250	250	250
suction pressure (mbar)		1.5	1.5	1.5	1.5
suction flow temperature (°C)		80	80	80	80
Cooling water inlet temperature: 30 °C • Motive steam pressure: 10 bar (abs) • Wet bulb temperature: 21 °C					
MOTIVE STEAM					
total motive steam consumption (kg/h)		250	676	2 380	3 000
COOLING WATER					
total cooling water consumption (m³/h)		35*	212	395	459
ELECTRICAL POWER (kW)					
chilling unit		146	175	0	0
liquid ring vacuum pump		8	7	4	8
centrifugal pumps		0	31	38	2
total electrical power consumption (kW)		154	213	42	10
caustic soda 25 % (kg/h)		0	3	3	3
WASTE WATER					
Total waste water amount (m³/h)		0.504	0.933	2.637	3.257
operation hours per year		8 250	8 250	8 250	8 250
steam costs per year	30 Euro/t	61 875	167 310	589 050	742 500
re-cooling costs for the cooling water per year	0.1 Euro/m³	28 875	174 900	325 875	378 675
electrical power costs per year	0.1 Euro/kWh	127 050	175 725	34 650	8 250
waste water costs per year**	0.0 Euro/m³	0	0	0	0
caustic soda costs 25 %	0.25 Euro/kg	0	6 188	6 188	6 188
OPERATION COSTS (Euro/year)					
savings compared to OKO system (Euro)		917 813	611 490	179 850	
equipment price (Euro)		1 100 000	430 000	380 000	340 000
additional costs compared to OKO system (Euro)		760 000	90 000	40 000	
savings after 1 year (Euro)		157 813	521 490	139 850	
savings after 2 years (Euro)		1 075 626	1 132 980	319 700	
savings after 3 years (Euro)		1 993 439	1 744 470	499 550	

* Fresh water for the evaporative condenser is included.

** Waste water costs excluded. Should be taken into account individually.



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