Edible oil refining

Comparison of operation costs

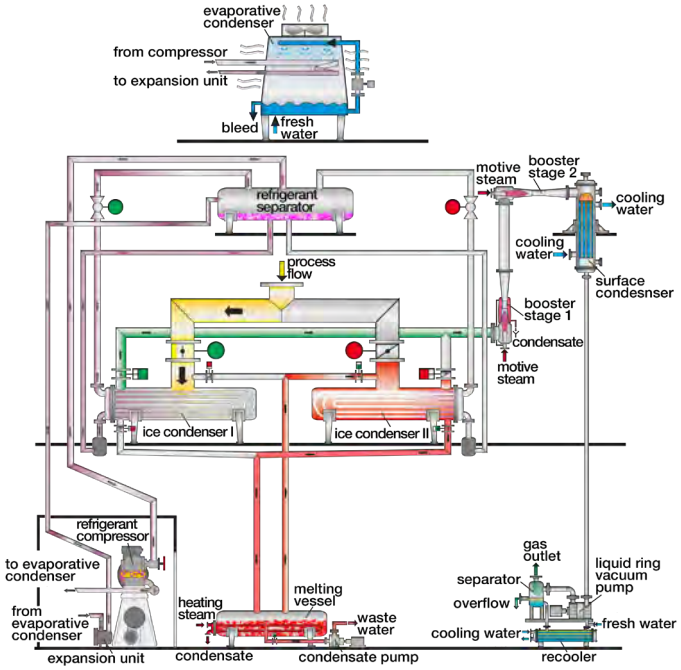
for different types of deodorising vacuum systems

Körting HANNOVER AG

THE EJECTOR COMPANY

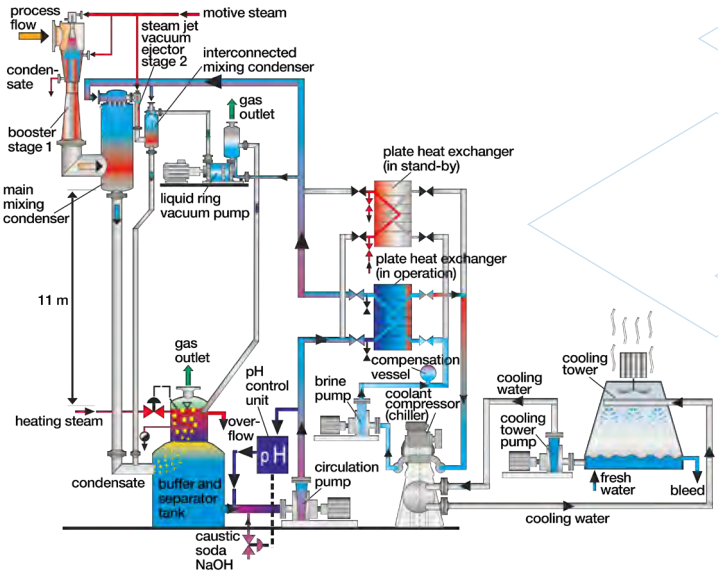
Four different vacuum systems compared

1 Körting ICE Condensation Vacuum System (ICE)



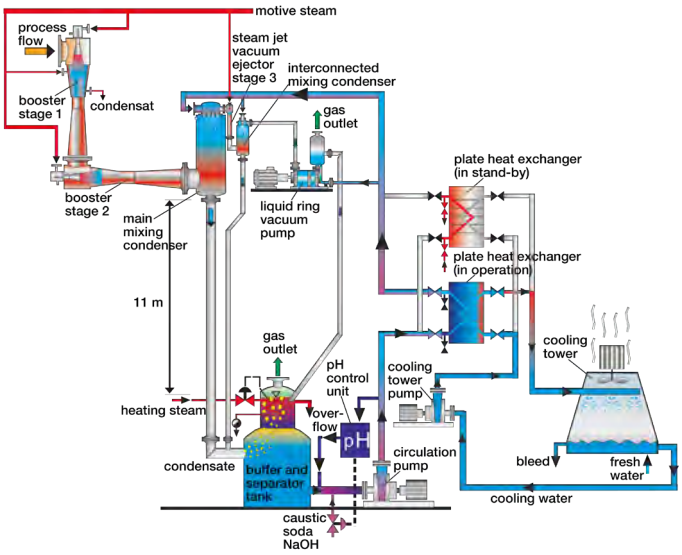
Total motive steam consumption	250	kg/h
Total cooling water consumption	35	m³/h
Total electrical power consumption	154	kW
Total waste water amount	0.504	m³/h

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



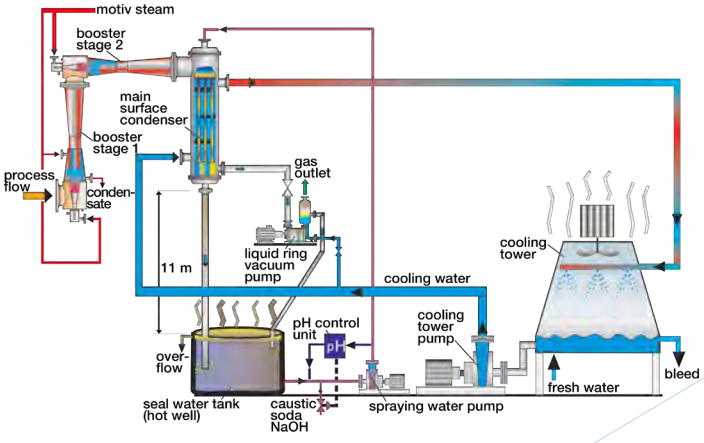
Total motive steam consumption	676	kg/h
Total cooling water consumption	212	m³/h
Total electrical power consumption	213	kW
Total waste water amount	0.933	m³/h

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



Total motive steam consumption	2 380	kg/h
Total cooling water consumption	395	m³/h
Total electrical power consumption	42	kW
Total waste water amount	2.637	m³/h

4 Vacuum system operating with surface condenser (OKO)



Total motive steam consumption	3 000	kg/h
Total cooling water consumption	459	m³/h
Total electrical power consumption	10	kW
Total waste water amount	3.257	m³/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 condenser (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)		217 800	524 123	955 763	1 135 613
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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