E 4000 FF

DESCRIPTION OF THE PROCESS

The **E 4000 FF** is an evaporator/concentrator which exploits the combined effect of the vacuum technology and heating pump to obtain a distillation at low temperatures.
As can be seen on the flow sheet, the heating pump, by means of a refrigerating circuit, expands and compresses the "freon" gas which supplies both the calories necessary for the evaporation of the waste and the frigories for the condensation of its distillate. The heat transfer to the waste occurs in a tube heat exchanger *E01* outside the flash drum, whereas the steam condenses in the heat exchanger *E03*. The boiling temperature for aqueous solutions is 38-40°C at a residual pressure of about 6 - 7 kPa.
In the frigorific circuit an air cooling system *E02* dissipates the exceeding heat resulting from the compression work. The equipment can be provided with an auxiliary water heat exchanger *E05* operating in case of critical working conditions (i.e. room temperature over 30 °C).
The vacuum is generated by an ejector circuit: the distillate, collected from the tank and pumped through the ejector *S01* by the pump *G01*, generates a depression sufficient to extract both the incondensable gases and the distillate condensed in *E03*.
For a better efficiency of the ejector, the distillate stored in *D02* is cooled (ca. 20°C) by means of a cooling coil *E04*, a deviation on the main circuit of the heating pump provides the necessary frigories.
The waste feeding and drain discharge take place through pneumatic valves. A level control *LT* placed inside the flash drum regulates the feeding valve, whereas the drain valve is controlled by a timer which can be set on the desired concentration level.

EQUIPMENT'S COMPONENTS

The components of the equipment are:

Evaporating chamber D01: flash drum. This evaporation chamber is a vertical cylinder, with a 45° conical section bottom and a multicenter-form top supplied with demister for the drops separation. The construction materials are duplex steel UNS S32750 (DIN 1.4410) for the parts exposed to waste, austenitic steel AISI 316L (DIN 1.4435) for the parts in the condensing zone.
Approx. dimensions:
- diameter 900 mm, wall height 1100 mm, conical section 400 mm.

Heat exchangers E01: tube nest heat exchanger of duplex steel UNS S32750 (DIN 1.4410) for the parts in contact with waste.
Exchange capacity: 110 kW.
Approx. dimensions:
- diameter 220 mm, length 1800 mm.

Heat exchangers E03: condenser supplied with austenitic steel AISI 316 Ti (DIN 1.4571) U-tubes.
Exchange capacity: 110 kW.
Approx. dimensions:
- diameter 220 mm, length 1200 mm.

Distillate collecting tank D02: cylindric-vertical tank with cooling coil E04, both of austenitic steel AISI 316 (DIN 1.4436).
Exchange capacity: 1.5 kW.

Approx. dimensions:
- diameter 450 mm, height 800 mm, coil length 35m.

Circulation pump G02: centrifugal pump with open impeller, fluxed mechanical seal and motor power about 2 kW, delivery 12 m^3/h, head 12 mwc
Material of construction: austenitic steel UNS N08028 (DIN 1.4563).

Vacuum pump G01: centrifugal pump with closed impeller, mechanical seal. Motor power about 2.2 kW, delivery about 5,5 m^3/h, head 50 mwc.
Material of construction : austenitic steel AISI 316 (DIN 1.4436).

Ejector S01: Venturi type for vacuum generation.
Material of construction: polypropylene

Compressor K01: semihermetic compressor shelded by suitable safety pressure switches as max. and min. pressure switch for freon, differential switch for lubricating oil.

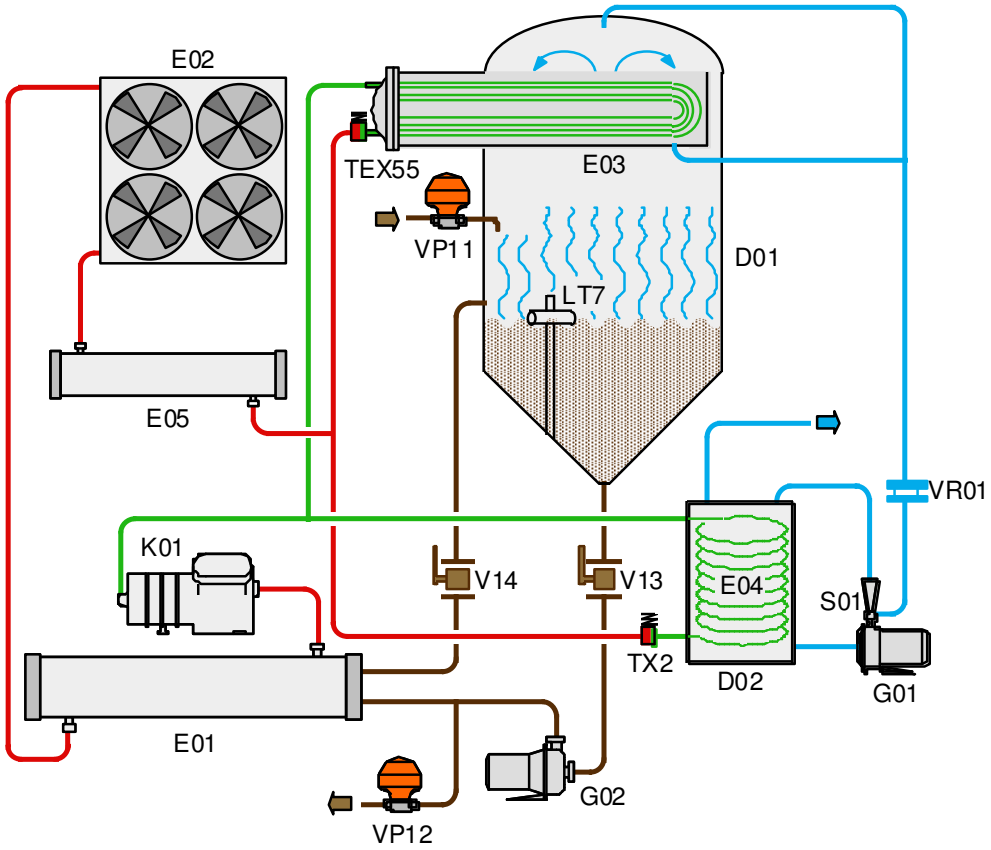
Heat exchangers E02: air cooling system for freon subcooling made of an exchanger with multipass finned pipes and one variable speed fan (0÷1400 rpm).
Exchange capacity: 30 kW.
- Max air flow: 15600 Nm^3/h.
Min air temperature 5°C, max 30°C.

Heat exchangers E05: auxiliary water tube heat exchangers.
Exchange capacity: 30 kW.
Diameter 170 mm, length 710 mm.

Frame and piping: the equipment is assembled on an AISI 304 frame (DIN 1.4301). Piping, hoses and accessories are of duplex steel UNS S32750 and of polypropylene.

NOTE: *Data are referred to a 50 Hz model.*

PROCESS FLOW-SHEET



INSTRUMENTATION*

- Evaporating chamber pressure control
- Feeding tank level control (prearrangement)
- Evaporating chamber level control
- Distillate tank level control (prearrangement)
- Concentrate tank level control (prearrangement)
- Drainage timing system
- Distillate conductivity control (prearrangement)
- Density control (prearrangement)
- Distillate pH control (prearrangement)
- Process fluid pH control at inlet (prearrangement)

* during the executive project the instrumentation may vary according to the process requirements

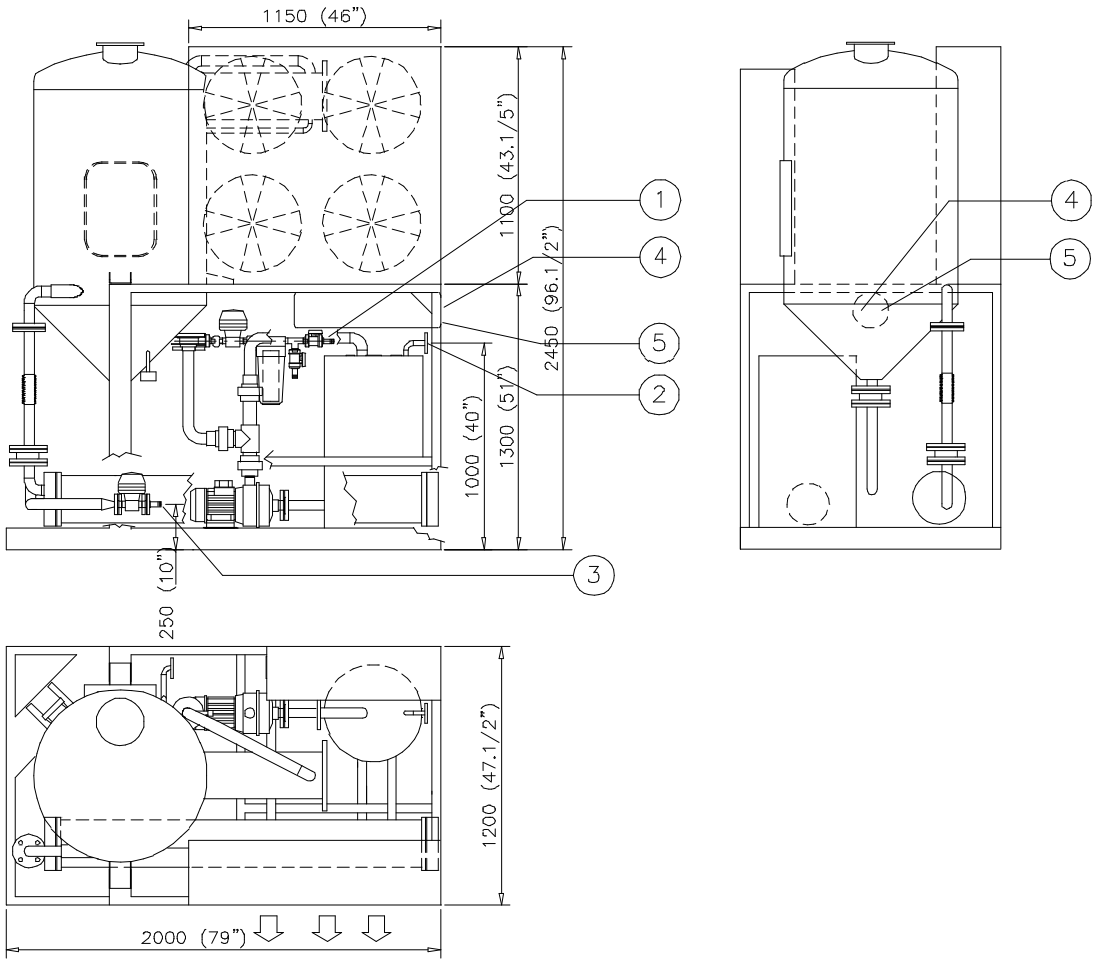
ELECTRICAL COMPONENTS

Centralized IP 54 eletrical board supplied with "Siemens" control PLC.
All automatic features of the equipment are connected to the main board.
"ESA" digital interface supplied with PLC to control alarms, working process and starting/stopping periods.

TECHNICAL CHARACTERISTICS

TECHNICAL CHARACTERISTICS		E 4000 FF 3	E 4000 FF 4
Frequency	Hz	50	60
Distillate product. max. with water	l/h *(gal/h)* 1/day *(gal/day)*	158 *(42)* 3792 *(1002)*	165 *(43.6)* 3960 *(1046)*
Absorbed power	kW	28	36
Voltage	V	400 3F+n	460 3F
Yield (specific consumption)	kWh/l *(kWh/gal)*	0,177 *(0.67)*	0.218 *(0.82)*
Produced heat	kcal/h *(Btu/h)*	17000 *(67460)*	20000 *(79365)*
Cooling air	m^3/h *(gpm)*	15600 *(68692)*	17900 *(78820)*
Empty weight	kg *(lb.)*	1150 *(2535)*	1150 *(2535)*
Width	mm *(in.)*	1200 *(47.3)*	1200 *(47.3)*
Length	mm *(in.)*	2000 *(78.3)*	2000 *(78.3)*
Height	mm *(in.)*	2450 *(96.5)*	2450 *(96.5)*
Noise	dBA	< 80	< 80

DRAWING



Ref.	Description	
1	Waste inlet	□ 20 mm
2	Distillate outlet	□ 20 mm
3	Concentrate discharge	□ 20 mm
4*(Option.)	Cooling water inlet	3/4"
5*(Option.)	Cooling water oulet	3/4"

NOTE:

All the above mentioned data have to be considered approximate. Water+LLP has reserved the right to change the values during the production without prior notice.