

Plant Description
of GEA Filtration ceramic MF Plant
for bacteria and spore reduction

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DESIGN CRITERIA

The design and performance of the quoted plant is based on the following:

MF

Pre-treatment prior to CMF and HTS

Skim milk from normal fresh cow's skim milk, pH 6.6 – 6.8 and titrated acidity of 16 – 18.

- Avoid introduction of air
- The whole milk must not prior to this pre-treatment, have been exposed to any kind of heat treatment such as thermization or pasteurization, as well as homogenization.
- The milk must not contain unnatural substances such as defoaming agents etc.
- Fat separation at 52 – 54 °C.
- Cream separated to 40% fat (Reference Röse-Gottlieb).
- Less than 0.08 % fat in the skim milk.
- Free from air.

FILTRATION PROCESS

- Ceramic Micro Filtration, bacteria- and spore reduction, of the pre-treated skim milk
- Process temperature: 50 – 55 °C.
- Volumetric concentration factor, VCF20x
- Skim milk feed: approx. 11,273 l/h
- Permeate flow: approx. 10,709 l/h
- Retentate flow: approx. 564 l/h
- Time in production: up to 8 hours
- CIP time: approx 3 hours
- Bacteria reduction: Min. 99.8 % at min. 30,000 cell forming units in feed to CMF plant.

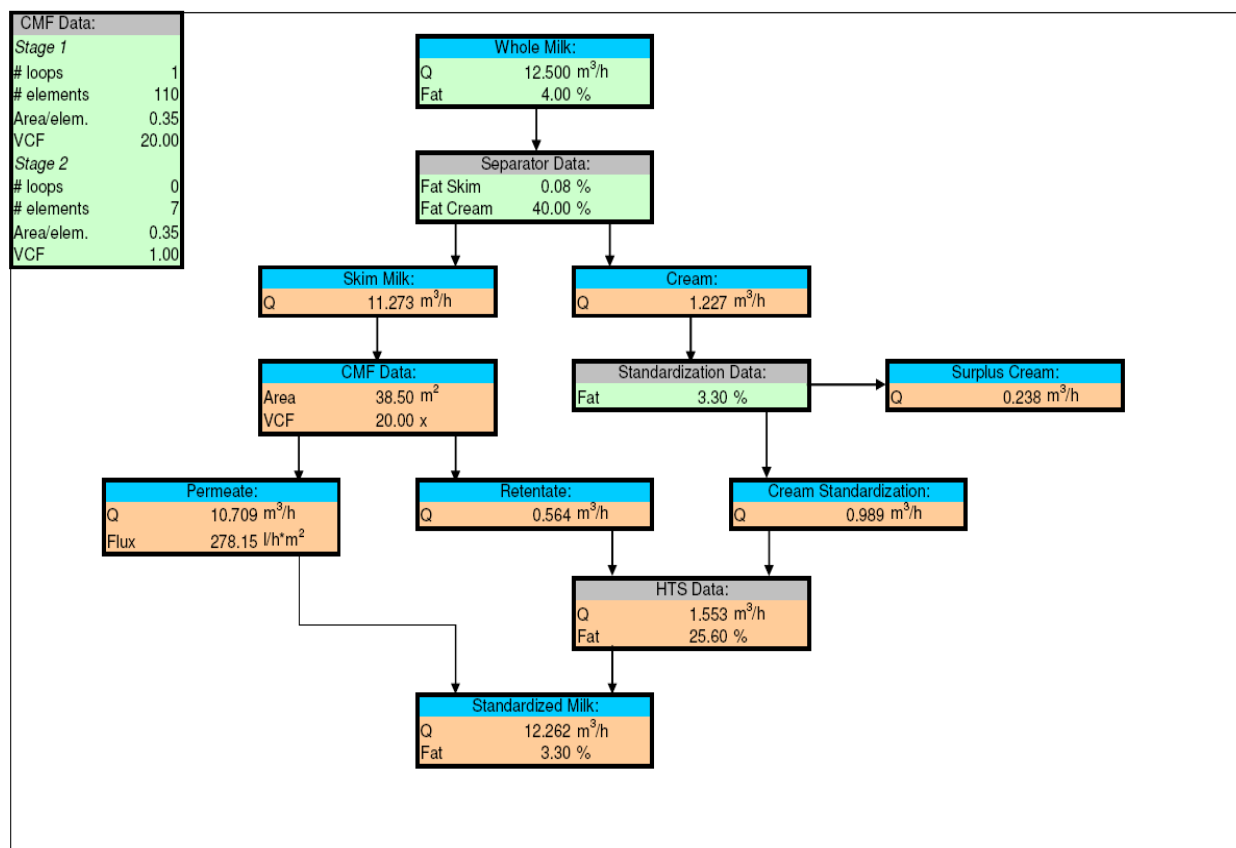
Bacteria reduction calculated as follows:

$((\text{cfu per ml in feed} - \text{cfu per ml in permeate}) / \text{cfu per ml in feed}) \times 100$

NOTE:

Analysis will be based on relevant and latest versions of FIL-IDF standards for analysis on milk chemistry and bacteriology. The above feed composition has been used in the design of the Plant. Any deviation from this may change the design and the performance of the Plant. Pls. note that the data stated in the above Estimated Mass Balance are to be understood as theoretical figures only and not as guaranteed figures.

FLOW DIAGRAM



MACHINERY SPECIFICATION

Machinery Specification of one (1) Ceramic Microfiltration Plant, 11.273 L/h according to Flow Sheet No. 100118-11002.

Feed / CIP Section

- Balance tank for feed and CIP
- Level transmitter
- Level switch
- Hygienic control valve for process water
- Centrifugal feed/CIP pump (frequency controlled)
- Plate heat exchanger for CIP and sanitizing (batch heating and –cooling)
- Safety pre-filter
- Pressure transmitter
- Temperature transmitter
- Control valves for steam and cooling water
- On/off valve for steam
- Sample point
- Water filter for process water incl. 2 pressure gauges
- Necessary pipes and valves.

Filtration Loops, Total Filter Area approx. 38.5 m²

1 Loop

Loop 1

- 2 membrane housings in hygienic execution, each for 55 ceramic membranes
- 110 ceramic membranes OD25x1178 23 chs 1,4 µm ISOFLUX[®], 0,35 m².
- Booster pump
- Pressure transmitters
- Permeate flow transmitter(s)
- Permeate flow control valve(s)
- Sample points
- Necessary pipes and valves

Retentate Section

- Electromagnetic flow transmitter
- Retentate control valve
- Sample point
- Necessary pipes and valves

Permeate Section

- Pressure indicator
- Sample point
- Necessary pipes and valves

CIP dosing system,

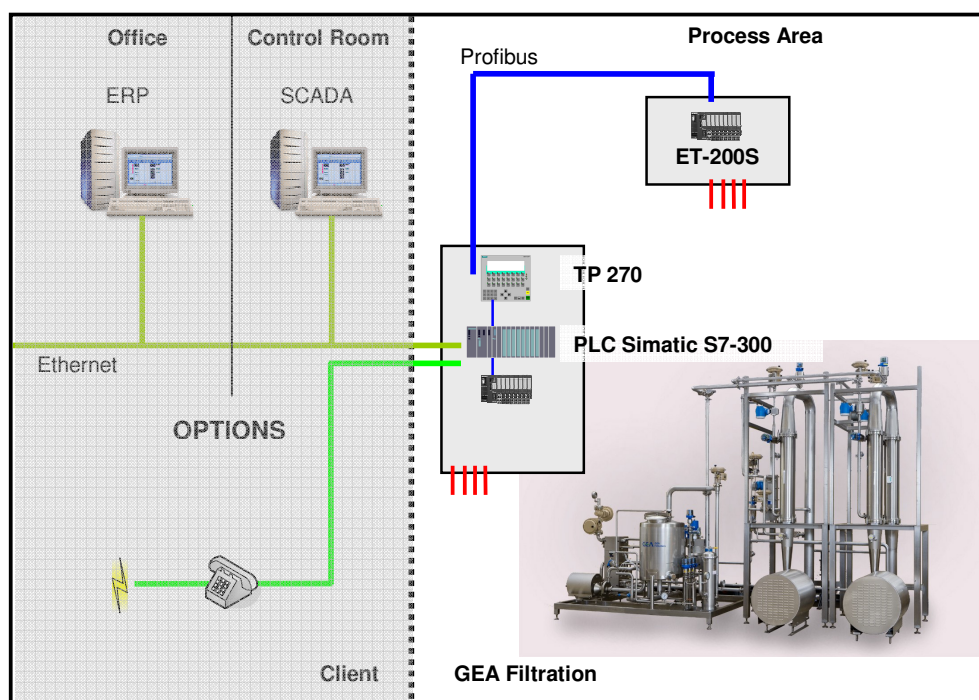
- Cip dosing system is not included

General

Item	Make
Pumps	Fristam FPE series, incl. stainless steel motor cover
Butterfly Valves	GEA Tuchenhagen incl. Control module ASI-Bus
Seat Valves	GEA Tuchenhagen incl. Control module ASI bus
Control Valves	Samson, incl. Samson I/P positioner
Control Valves	Samson incl Samson I/P positioner
Flow Transmitter	Endress + Hauser
Pressure Transmitter	Endress + Hauser
Level Transmitter	Endress + Hauser
Level Switch	Endress + Hauser
Temperature Transmitter	Endress + Hauser
Slot Safety Filter	Alfa Laval
Sample Valves	Alfa Laval type 32
Pipes $\leq$ OD101,6	DIN 11850, EN 2037, AISI 316L
Pipes $>$ OD101,6	ISO 1127, AISI 316
Connections, general	Clamp EN2852/EN2037
Gasket material	EPDM

Process Control, Motor Control and Cable Work

- 1 Panel, Stainless Steel, Main Panel, mounted at the feed section
Size: min. approx. 1,200 H x 800 W x 300 D mm
1 Siemens S7 PLC CPU Serie 300.
1 Siemens TP270 HMI with 10" Touch panel (Operator's interface).
Necessary applikationssoftware for PLC und HMI
1 Emergency stop and emergency stop reset
1 Main switch
Necessary power supplies and automatic fuses
Necessary Motor control incl. DOL, Y/Δ or Softstarters
Necessary terminals
- 2pcs Frequency converter 4 kW, Danfoss IP20
- 1 pc Frequecny converter 75kw, Danfoss IP54 (mounted on backside of control&MCC-panel)
- Necessary air regulator incl. oil- and water trap
- Open cable trays for cables and air tubes
- Cables and air tubes
- Pre-erection of cables and air tubes



Process Control – Option 1

- 1 Siemens Ethernet. card

COMMISSIONING, START-UP AND DOCUMENTATION

Technical Documentation

- 1 CD-ROMs containing the technical documentation for the delivered equipment.

Commissioning

- Commissioning is not included in the quotation

TECHNICAL DATA (APPROX. VALUES)

Necessary Utility Capacity		CMF	HTS
Process temperature	°C	52	
Installed electrical power	kW	83	8
Power (<i>shaft power</i>)			
Production	kW	76	1
Preparation and CIP	kW	75	1
Cooling water 2 °C			
Production	kW	68	26
Preparation and CIP	kW	216	13
Steam 4 bara			
Production	kg/h	--	54
Preparation and CIP	kg/h	755	122
Process/CIP water	m ³ /h	20	1
DIA Water	m ³ /h	0	0
Drain capacity	m ³ /h	20	1
Hold-up volume	Litres	716	
Consumption per cycle (based on the selected cleaning detergent)			
Production, up to	Hours	8	8
Preparation and CIP, approx	Hours	3.4	3.6
Power (<i>shaft power</i>)			
Production	kWh	608	4
Preparation and CIP	kWh	282	3
Cooling water (2 °C)			
Production	kWh	541	205
Preparation and CIP	kWh	141	2
Steam			
Production	kg	--	432
Preparation and CIP	kg	453	55
Process water	m ³	17	1
DIA Water	m ³	0	0
Drain	m ³	17	1
Cleaning detergents: Ecolab			
P3-Ultrasil25	Kg	21.5	
Nitric Acid		7.2	
NaOH 100%	Kg		4.1
HNO3 100%	kg		1
CIP Capacity	m ³ /h		1.1536
Maximum CIP temperature	°C		80
Alternative recommendable Cleaning Detergent: Diversey			
Other			
Power supply		3 x 400 V, 50 Hz	
Compressed air, 6 bar, oil- and water free			

WATER REQUIREMENTS

For the membrane warranty to be valid and in order to ensure an optimum cleaning result, all water in contact with the membranes, such as CIP and process water, but also water from adjoining equipment, must comply with the following specifications:

Substance	Unit	Polymeric RO/NF Membranes	Polymeric UF/MF Membranes	Ceramic UF/MF Membranes
Iron (Fe)	mg/l	< 0.05	< 0.05	< 0.10
Manganese (Mn)	mg/l	< 0.02	< 0.02	< 0.05
Soluble Silica (SiO ₂)	mg/l	< 15.0	< 15.0	< 25.0
Colloidal Silica	mg/l	Absent	Absent	Absent
Aluminium (Al)	mg/l	< 0.05	< 0.1	< 0.1
Chlorine – Cl ₂ /HOCl	mg/l	0.0	< 5.0	< 5.0
Organic N ₂ , Kjeldahl	mg/l	< 0.05	< 0.05	< 0.05
Turbidity	NTU	< 1.0	< 1.0	< 1.0
Silt Density Index	SDI	< 3.0	< 3.0	< 1.5
German degree of hardness*)	°dH	< 15.0	< 15.0	< 15.0
Total Plate Count	per 1 ml	< 1,000	< 1,000	< 1,000
Coliforms	per 100 ml	Absent	Absent	Absent

*) 1 German degree of hardness is equal to 10 mg/l CaO or 17.9 mg/l CaCO₃

The CIP water must be prefiltered using a 5–10 micron depth filter with stainless steel housing(s). The piping from the stainless steel filter housing to the filtration unit must be in stainless steel.

Water fulfilling the above specification is generally acceptable provided that formulated detergents are used. Softened water is also acceptable, it must, however, be pointed out that softened water may prolong the time needed for flush and consequently lead to a higher water consumption.

If stored and handled correctly, RO permeate and evaporator condensate may be used as CIP water except for the last flush.

CUSTOMER'S SUPPLY

Our supply comprises a Unit as described in SCOPE OF SUPPLY. However, certain supplies, services and connections as specified below must be arranged for and paid by the Customer.

Any non-compliance in terms of time, quantity, quality and/or place of delivery of the below stated supplies, services and connections may influence on both the time schedule and the price of the Order.

- Provision of any information needed for the design of the Unit (drawings and production parameters of existing equipment or equipment to be supplied by the Customer, building layout, raw material data, results of water analyses, climatic conditions, etc.)
- Any permission and/or approval required by the local authorities
- All taxes and duties to be paid in connection with the import of the goods to the site and the activities taking place on site
- Testing of the equipment as required by law or regulations if not specifically mentioned in SCOPE OF SUPPLY.
- Preparation of the site where the Unit is to be installed
- All kinds of civil work (buildings, supporting structures, floors, drains, ventilation, air-conditioning, access platforms, stairways, ladders, guard rails, cranes, monorails, foundations, holes for pipe penetration, staff and office facilities, laboratories, etc.)
- Overhead travelling crane for handling of filter modules, pump motors, etc. throughout the lifetime of the plant (for ceramic systems only).
- Any analysis expenses in connection with start up and taking over.
- All necessary utility supplies (electrical power, steam, compressed air, well water, cooling water, ice water, fuel, gas, etc.) in line with the utility requirements informed by GEA Filtration
- All necessary service plants (fire detection system, fire suppression system, gas detection system, lightning protection system, telephone communication system, sewer line, waste water treatment plant, etc.)
- Control system and electricity (control system, MCC panel, main power supply to the MCC panel, electric cables and cable trays from field instruments and motors to control panels and MCC, frequency converters, electrical installation, power supply incl. main supply to MCC, plant lighting, efficient earthing of all parts, etc.) unless specified in SCOPE of SUPPLY
- All process, CIP and utility piping outside the delivery limits of the Unit.
- Any insulation work not mentioned in SCOPE OF SUPPLY
- All spare parts needed for trouble-free operation of the Unit.
- All consumables, detergents, tools, welding equipment, lifting devices and trucks, scaffolding, adequate, lockable staff and storage facilities, etc. needed in the installation and commissioning period
- Qualified operators and other assistance needed during commissioning mastering the languages required by GEA Filtration
- Outside cleaning of the process equipment and piping prior to commissioning
- Any other item or service not specified or stated as "Customer's Supply" in this Quotation

WARRANTY

It is a prerequisite of the below warranties that the erection and commissioning are supervised by supervisors appointed by GEA Filtration.

Process Warranty

The warranty for the process capacity figures is based on the data given in Technical Data and the capacity given in the Estimated Mass Balance and it will only be applicable on condition that the pre-treatment conditions as well as the process data described in Pre-treatment and Process, the water quality as stated in Water Requirements and the CIP procedures agreed upon are complied with.

In case of shortfall in capacity, despite fulfilled conditions, GEA Filtration reserves the right to modify the Plant. Any changes in the operating costs resulting from such a modification will be of no concern to GEA Filtration.

Mechanical Warranty

GEA Filtration undertakes the warranty for any defect due to ascertainable faults in design, material or workmanship. The warranty does not cover wear parts, faulty installation or operation, nor corrosion or abrasion.

This warranty shall be valid for a period of 12 months from date of signed Taking-over Certificate however not later than two (2) calendar months from readiness for shipment if this is sooner

It is a prerequisite of the above guarantee that the installation and commissioning are supervised by supervisors appointed by GEA Filtration.

Membrane Warranty

The below membrane warranties depend upon correct pre-treatment of the product prior to the Membrane Filtration Plant.

Besides, the below membrane warranties are dependent on all instructions in the Operation Manual being followed. This includes but is not limited to pH limitations, temperature limitations, rates of temperature changes, and oxidizer limitations. Any exception to proper following of instructions will void any remaining warranty.

Hence, the below membrane warranties are valid on the following conditions:

- Operating and cleaning procedures recommended by GEA Filtration in writing have been followed
- The specified type and quantity of cleaning agents have been used
- The specifications of pH and temperature have been followed
- All water in contact with the membranes, such as CIP and process water, but also water from adjoining equipment, must comply with the water quality as stated in WATER REQUIREMENTS
- The "GEA Filtration Daily Record System" (supplied by GEA Filtration on delivery of the Plant) has been filled in and kept by the Customer
- No unapproved materials have been introduced into the system

- Membranes must be cleaned and sanitized and returned to GEA Filtration within a reasonable time if they are to be replaced in the framework of this guarantee
- The Customer shall be responsible for all freight expenses incurred in connection with returning or supply of membranes under guarantee.

Ceramic Membranes

The membrane elements installed in the Membrane Filtration Plant at the delivery will be replaced at no cost in the event of failure due to material or workmanship caused during the first thirty-six (36) calendar months counted from the start date.

The start date of the above warranty will be the date of the first membrane exposure to CIP, alternatively process water, however not later than two (2) calendar months from readiness for shipment if this is sooner.

LIMITATION OF LIABILITY

GEA Filtration shall in no event, before or after Taking Over, pay any compensation for consequential loss or consequential damage, including but not limited to loss of use of production facilities or equipment, loss of profits or production, loss of revenue or use of revenue, plant downtime, or other indirect loss.

The agreed milestone for shipping of the Unit shall be subject to liquidated damages, and not penalty, in case of late delivery. The liquidated damages shall be 0.5% of the portion of the price of the Order attributable to the delayed shipment per each full week up to a maximum of 5% of the total price of the Order.

GEA Filtration's overall aggregate liability to the Customer under the Order, or otherwise, shall in no case or respect exceed 10% of the price of the Order no matter what. This stipulation applies both before and after Taking-over.

GEA Filtration shall not be liable for injury caused by the use of the Unit on product(s) other than those specified in the order confirmation, nor shall GEA Filtration be liable for injury caused by any failure to comply with the Unit Operation and Maintenance Manual.

GEA Filtration shall not be liable for injury caused by any changes to the Unit or equipment or use of non-original spare parts.

CONFIDENTIALITY

All information and drawings contained in or belonging to this document, or given to the Customer in connection with the formation and the execution of an Order deriving from this quotation, shall be confidential and the property of GEA Filtration, and they may not be divulged to any parties other than the intended receiver.