

BIOENGINEERING

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Bioengineering –
Experience only
specialists can have

BioEquipment

Fermentation and Periphery

Airlift fermenters
Anaerobic fermenters
Autoclavable laboratory fermenters
Autoclavable fluidized bed reactors
Cell fermenters
Feed vessels
Fermenter configurations
Fermenters for plant cell cultivation
Fermenter downstream equipment
Fluidized bed reactors
Foam separators
HTE fermenters
High pressure fermenters
Illumination units
Laboratory fermenters L1523
Laboratory fermenters NLF22
Laboratory pilot fermenters LP351
Lamella clarifier units
Medium storage vessels 50–5000 l
Membrane reactors
NMR reactor
Pathogenous units
Photoreactors
Pilot plant fermenters
Rotaschon fermenters
Rotor filters
Small laboratory fermenters KLF
Solid state fermenters
Surface cultivation
Visual safety fermenters VSF

Probes/Measuring systems

Admittance level probes
Anti foam level probes
Circulation thermostats
Control valves
Dipsticks
Float switches
Dosage systems
Flow meters
Gas analyzers
IFM – Intelligent Front Modules
Load cells
Level indication 'Biowatch'
Level measurement probes
Media optimization
Pervaporation probes
pH/Redox probes
Plate spring pressure gauges
Platform scales
pO₂ probes
Pressure gauges
Pressure transmitters
Sterile pressure gauges
Pt100 temperature probes
Thermometers
Thermostats
Turbidimetry
Weighing probes
etc.

Accessories

Air filters
Autosterile filters
Rupture disks
Ceramic air filters
CIP spray balls
CIP valves
Condensate containers
Contained sampling systems
Dialysis probes
Dosing valves
Gas mixing stations
Glycerin containers
Harvesting valves
Incinerators
Injector valves
Lid opening devices
Mechanical seals
Media preparation filling methods
Pressure holding valves
Pressure overlay
Pressure reducing valves
Reflux coolers
Safety valves
Sampling valves
Sterile cases
Sterile traps, electric
Viewing ports
etc.

Components

Ball valves
Bottle cap screws GL45
Cold sterilization
Compressors
Coolers
Diaphragm valves
Dirt traps
Dispersing mixers
Electric steam generators
Enzyme membrane reactors EMR
Filters for liquids
Heat exchangers
Manual mini-Inversina tumbler mixer
Inversina tumbler mixer
Kobio pumps
Laboratory bottles
Magnetic circulation pumps
Non-return valves
Peristaltic pumps
Solenoid valves
Spiral filters
Steam traps
Sterile connections
Stirrer systems with direct drive
Stirrer systems with magnetic drive
Tri-Clamp connections
etc.

BioEngineering

Design and manufacture of plants for the production of:

Amino acids
Antibiotics
Biomass/yeast
Biopesticides

Biopolymers/lipids
Enzymes
Ethanol
Flavors

Fruit juices
Monoclonal antibodies
Organic acids
Peptides/proteins

Sugar derivatives
Vaccines
Vitamins
etc.

BioControl

Back up
Data processing
Process analysis
Process management
Process control system PCS

Process optimization
Process supervision
Logging
Process data recording

PCS installations using:
AEG Modicon A250
Analog Device Macsym
Eurotherm T3000

FERM Software
Mitsubishi
Mod 300

Paragon
Selectron
Simatic S5
etc.



Membrane Reactor MF

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The MF membrane-dialysis fermenter – a double fermenter that uses dialysis to achieve high cell densities and production rates

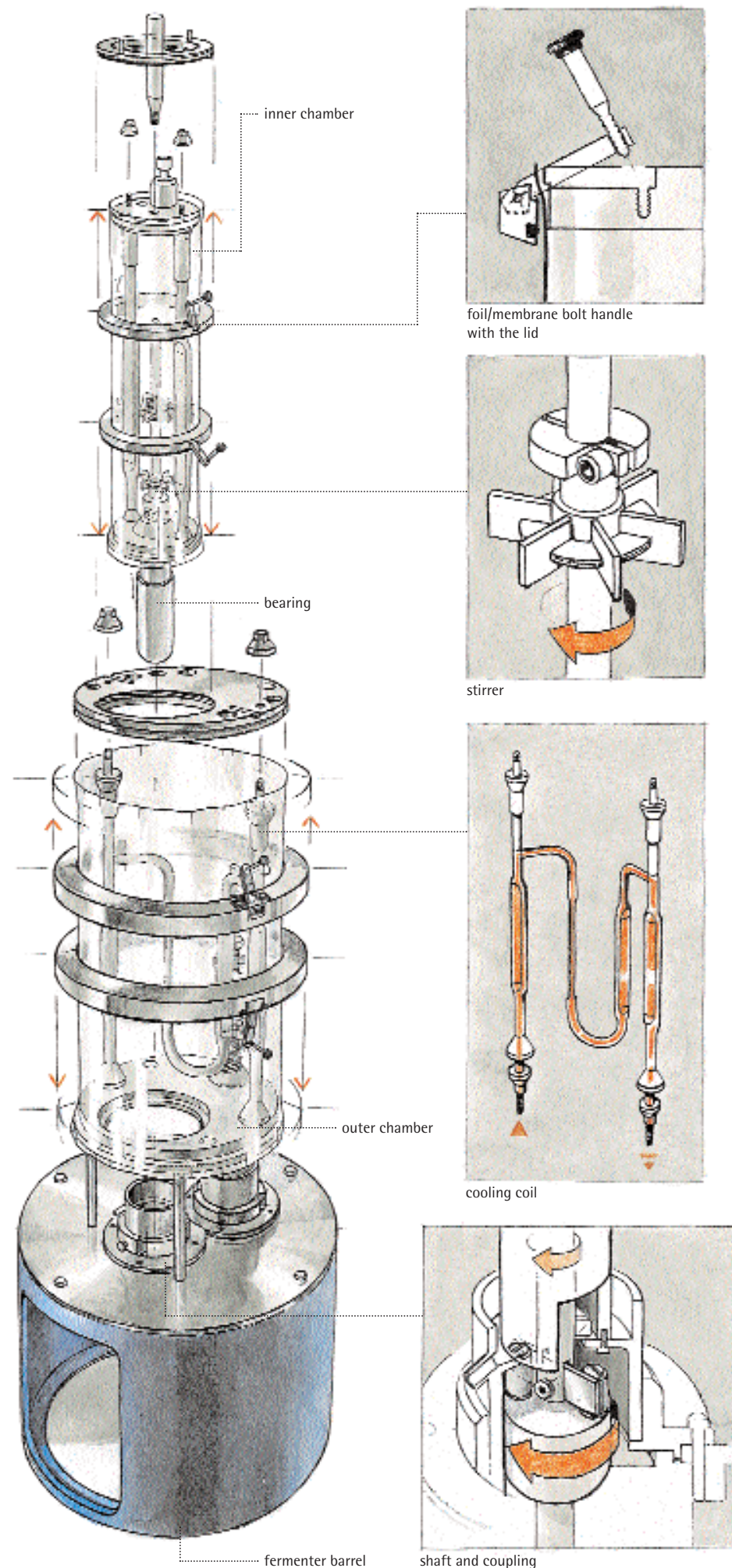
Eccentrically mounted in a cylindrical reactor is a smaller cylindrical membrane. The inner and outer chambers formed in this way can exchange low-molecular-weight substances through the membrane. A solution-diffusion membrane made of cellulose acetate with a molecular-weight cutoff of 10,000 Da is commonly used, but membranes with filtration properties (higher hydraulic permeability) can also be deployed in some applications. Cell yields in this equipment are a factor of 5–10 higher than in conventional stirred-tank fermenters.

Applications

The two fermenter chambers offer many connection options, making the system ideal for any conceivable instrumentation and control setup. Batch, fed-batch or continuous processes can be run in the inner and/or outer chamber.

The laboratory dialysis fermenter is an extraordinary tool for investigating microorganism growth and producing biomass or protein at high rates. Microorganisms whose growth is difficult to control, or for which media have not been optimized, quickly reach high cell densities when cultivated in this fermenter.

In industrial environments, the fermenter achieves high continuous production capacities in a small space. This fermenter has set a number of world records for cell density. *Escherichia coli*, for example, was fermented to a density of 174 g L⁻¹ (dry basis). Free-suspension and immobilized animal cell cultures, syntropic algal/bacterial cultures (with illumination unit), and fermentations of exotic microorganisms such as hyperthermophiles, acidophiles and halophiles have not only shown how versatile and powerful the fermenter is but have also demonstrated its robustness in extended service and under extreme conditions.



Sterilization and cleaning

The fermenter can be sterilized in situ. It offers the advantages of quick media heating, use of probes designed for in situ sterilization, and sterilization independent of other equipment. With glass reactors, in situ sterilization presents an explosion risk at 121° C and 1 bar gauge pressure. For this reason, glass has been replaced by a transparent, high-strength polyamide film in the laboratory dialysis fermenter. The thermally stable and elastic film sleeve (20 cm in diameter, 30 cm high) is supported by sturdy metal shells during in situ sterilization. The shells can be removed after sterilization.

The transparent film allows free sight into the reaction space and at the same time permits thorough sterilization of the fermenter.

For cleaning of the reaction compartments, the bottom and top cover can be taken off the fermenter pedestal without tools; the film or membrane can then be removed. Ease of access makes thorough cleaning much more convenient.

Stirrer and drive

The chambers can be independently stirred at speeds between 75 and 1500 rpm (infinitely variable control). Rushton turbines or marine impellers provide homogeneous mixing. The shaft seal in the reactor bottom features a simple mechanical seal. For special requirements, magnetic drives can also be mounted. The motor shaft torque is transmitted to the stirrer shaft through a coupling.

Temperature control

Temperature is measured with a Pt-100 probe. A PID controller holds the temperature at the setpoint by means of an electric rod heater and the controlled admission of cooling water into the cooling coil.

Configuration and connections

The inner and outer chambers are separately accessible. Each has 10 standard connections (diameters 12 and 19 mm), providing ample latitude for many connection options.

Sterile connections can thus be made even while cultivation is in progress. Probes are sterilized in situ along with the fermenter.

Controllers for additional control circuits are available in 19" modules for installation in standard 19" cabinets. The fermenter comes equipped with control, safety and throttle valves as well as a sterile pressure gauge.

Technical data	
Sterilisation temperature	121° C
Operating pressure with metaltube	1.5 bar gauge
Volume inner chamber	2.36 liters
Volume outer chamber	7.1 liters
Membrane area	942 cm ²

Material	
Stainless steel	316 L
Film	Polyamide
Dialysis membrane	Cuprophan or other

Drive	
2 AC motors	
Power	180 W each
Speed [rpm]	max. 1500

