



Pall Corporation

Protecting What Matters, Every Day



## Next Generation Intelligent Beer Clarification

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10% of beer worldwide is not filtered

Pub/micro and craft breweries are the fastest growing segments

- 6.7% growth rate
- 90% not filtered

Haze Control with additives and centrifuge

- Isinglass, copper finings, pectine

Challenge

- Consistent product quality
- Limited shelf life
- Microbial stability
- Customer acceptance





# What About My Kieselguhr Filter ?

While health & safety and disposal issues are rising, kieselguhr use is still acceptable in many countries

- Solutions for operator protection are available
- Disposal is a niche issue

DE supply is not limited

- Beer industry consumes < 10% of kieselguhr mining

DE substitutes are available

- Polymer and cellulose based alternatives

Challenge

- Kieselguhr filtration is always a batch operation
- Powder handling is labor intensive
- Consistent quality (extractable Fe/Mn)
- High operating cost (media consumption, disposal, beer loss...)



**It works, but time is up**

# The new generation of beer clarification

## DE

- Batch
- Cost intensive (labour, DE, beer losses)
- Environmental Critical (disposal, water consumption)
- Well introduced but No more supplier
- Health, safety and disposal concern

## Cross flow Membrane Retentate Flow

- Batch with limited flexibility
- Lower in cost than DE
- High in water, cleaner consumption and beer residuals
- Well introduced, difficult to combine with stabilizing systems, good quality
- Green solution, environment friendly

## Cross flow Membrane Direct-Flow

- Batch and Conti processing
- Low in cost (Lower than DE and Retentate process)
- Low in Water, cleaner consumption, min beer losses
- Well introduced, easy to combine (stabilization/sterile filtration), perfect in quality
- Green solution, environment friendly



## Greater than 180 systems in operation worldwide

- Performance range 20 to 1,000 hl/h
- Greater 150 Mio hl filtered/year
- All types of beers are filtered with the PROFi System

## OPEX lower than kieselguhr filtration

- TCO comparison
- Continuous processing

## Studies confirm taste preference when compared to kieselguhr

- No Fe/Mn uptake
- Freshness





# How a intelligent beer clarification looks like ?

## Continuous filtration and stabilization

- Smaller design/increased flexibility/less beer losses/better quality

## Staggered flow rate design

- Adjustable to actual needs/easy expansion or down sizing

## Filtration integrated into packaging or fermentation

- Eliminate filter room
- „Just in time“ product based on packaging demand
- Replace BBT by buffer tanks positioned directly upstream of the filling line

## Membrane control test to confirm filtration performance

- Increase microbial safety
- Documentation and traceability

## Flexible to accomodate varying inlet solid loads

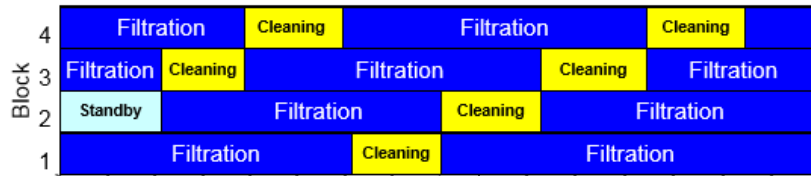
## Filtration serves Brewing

Selected filter technology must cope with varying conditions in the brewing process

- Incoming yeast counts
- Malt quality/seasonal crop impacts
- Brand changes and different beer types
- Brewhouse variations
- Stabilization technologies

### Impacts

- Customer satisfaction
- No change in operation plan
- Confidence in consistent quality
- Stay within OPEX warranty
- Operator safety



Intelligent technology provides beer in required quantity and quality „just in time“

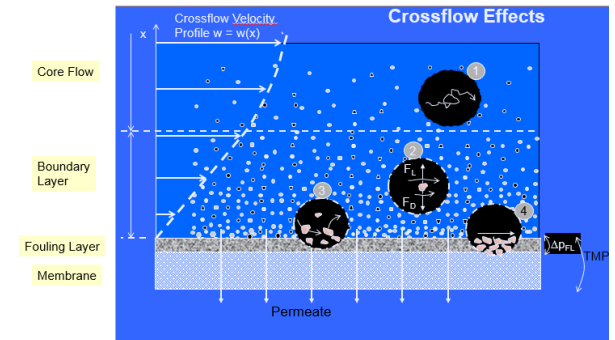
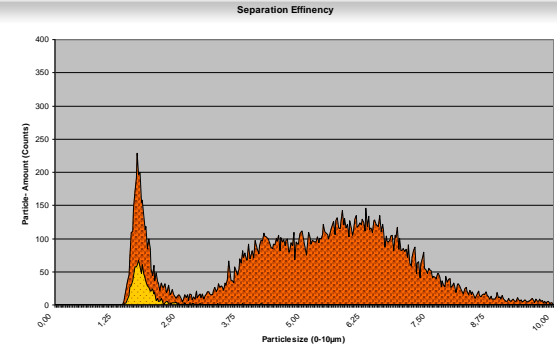
Filter line reliability is the #1 factor for control over commercial targets

## The Crossflow process impacts the fouling layer

- Less fouling results in
  - Less cleaning
  - Less energy input
  - Better performance
  - Minimized membrane exposure to operation and cleaning stress

## When does a centrifuge make sense

- Yeast with varying settling characteristics
- Multiple brands
- Horizontal tanks (always)
- Silica based stabilization
  - All stabilizers are allowed
  - Lower solid load on membranes
  - Less abrasion to membrane surface



Influence on Permeate Flux v:

$$v = \frac{\dot{V}}{A} = \frac{\Delta p}{\eta_P \cdot (R_M + R_{FL})}$$

with

- v = Permeate Flux (LMH)
- $\dot{V}$  = Permeate Volume Rate (l/hr)
- A = Membrane Area
- $\Delta p$  = Transmembrane Pressure Difference
- $\eta_P$  = Viscosity of Permeate
- $R_M$  = Membrane Resistance
- $R_{FL}$  = Fouling Layer Resistance



# Pall PROFi – the basic PRINCIPLE



Beer from Tank

>80 EBC

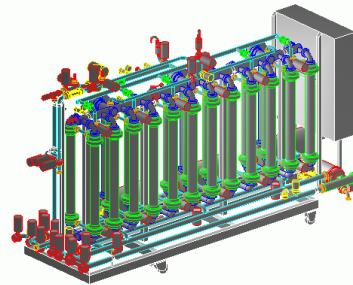


Yeast Concentrate  
>20 % Trs.



Centrifuged Beer

<15 EBC

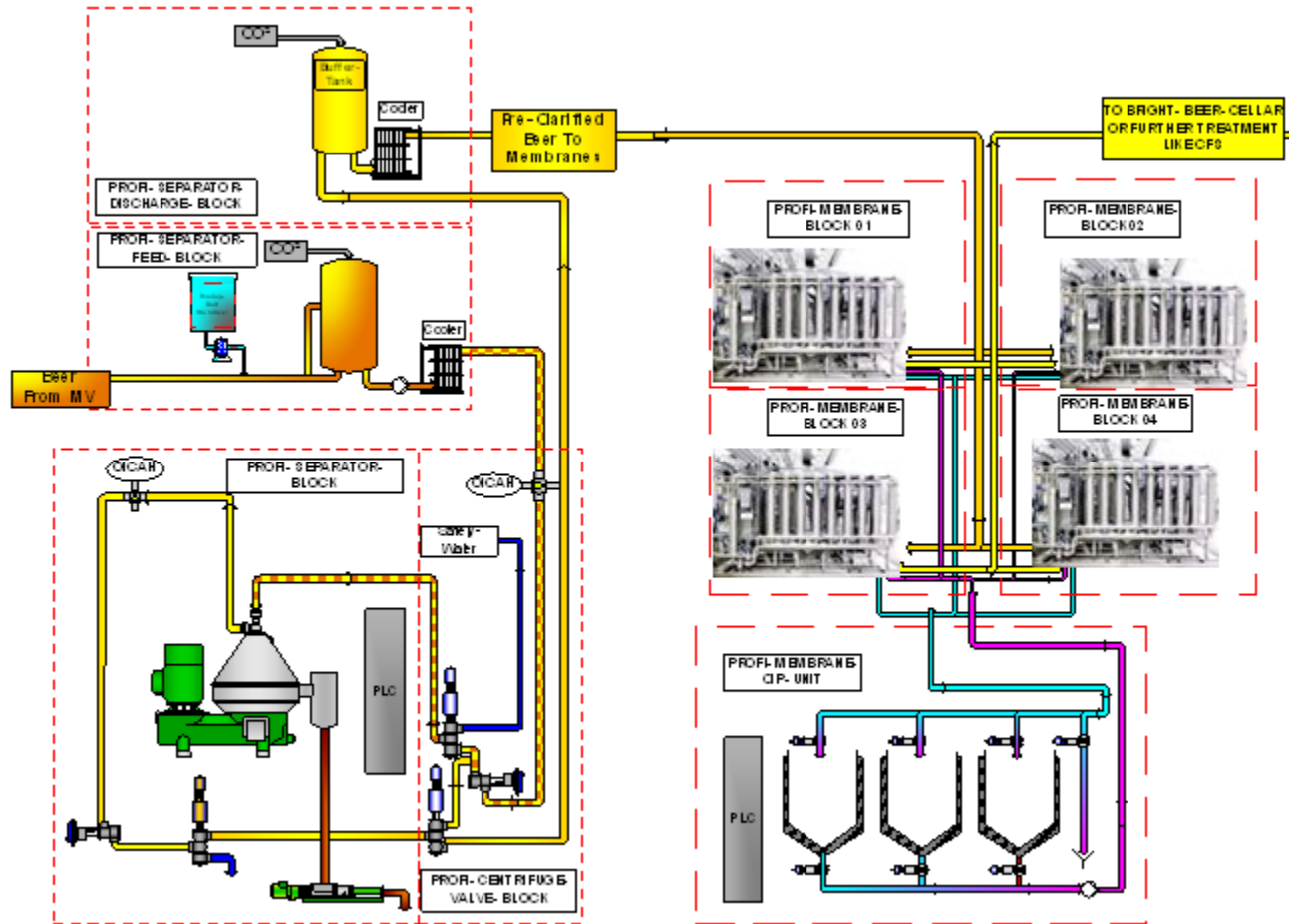


Filtered Beer

<0,5 EBC

- Always Forward Flow direction
- No Return of beer/yeast mix
- Perfect Quality
- No retentate handling
- Simple handling and operation

# Pall PROFi – the basic LAYOUT





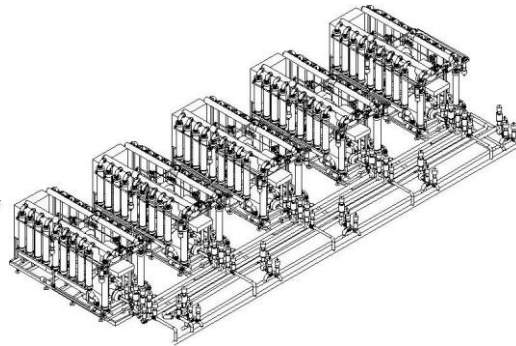
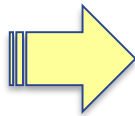
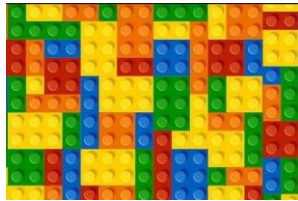
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# Intelligent Beer Clarification:

## Optimal Design

### Intelligent system build on modular blocks

- Modular design for all line items
- Flexible arrangement & positioning
- Integration of existing equipment



### Impacts

- Simplified process & Planning
- Transparency on capital cost
- Maximum utilization of available space (floor)
- Short delivery time
- Easy installation and flexible for capacity adjustments



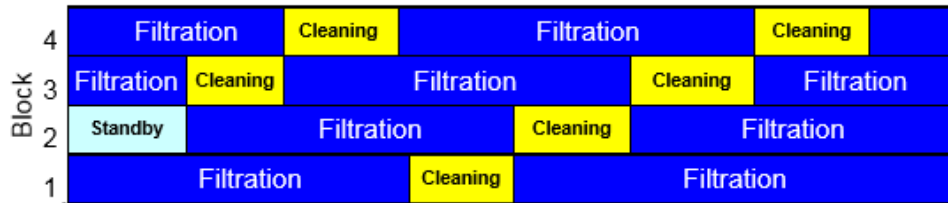
Easy block expansion/ down-sizing / transfer (inside-outside plant)

**Modular design enables flexibility operation**



### Intelligent systems for high process flexibility

- Switch on/switch off option for filter blocks
  - Adjust to brewery demand
  - Partial or full capacity
- Switch from batch to continuous operation
  - Low season
  - Peak season
  - Market demand



Intelligent technology provides beer in required quantity and quality „just in time“

### Impacts

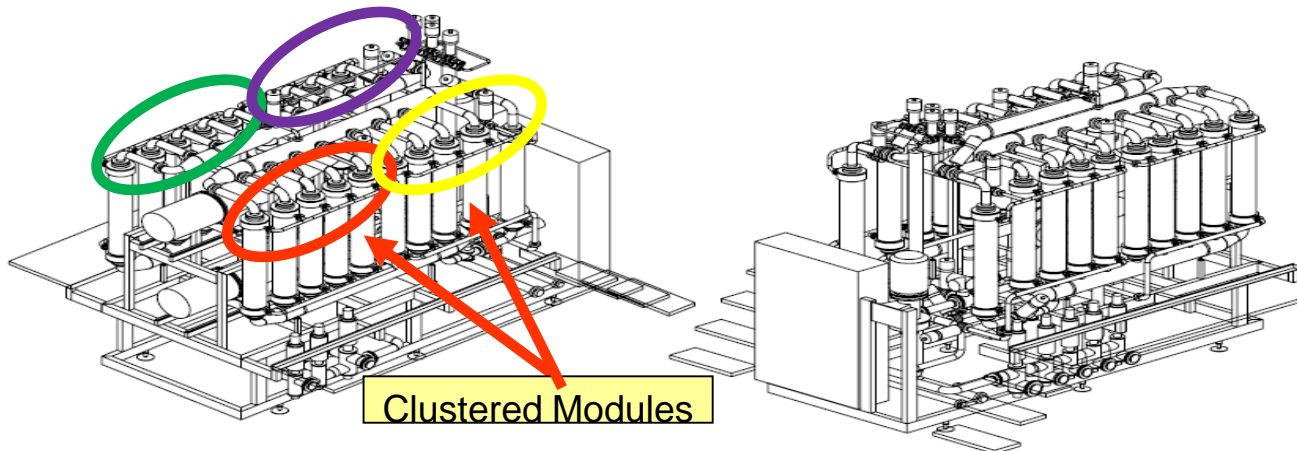
- Maximized productivity efficiency
- Longer membrane life
- Minimized media consumption
  - Water
  - Cleaner
- Reduced beer losses
- Maximise OEE (overall equipment efficiency)

### Automation controlling membrane for filtration quality

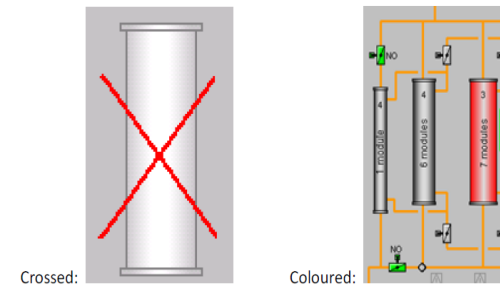
- Turbidity meter online monitoring
- Cluster Technology
- Modules Functioning Test (MFT) program:
  - MFT takes place after each cleaning before filtration
  - MBL can run even with two clusters off (within 4 clusters) per block

### Impacts

- Maximized process safety
- Maximized microbial safety
- No operator “headache” to find out leaked membrane
- Optimized production downtime with preventive action
- Optimized operation cost cause production failure

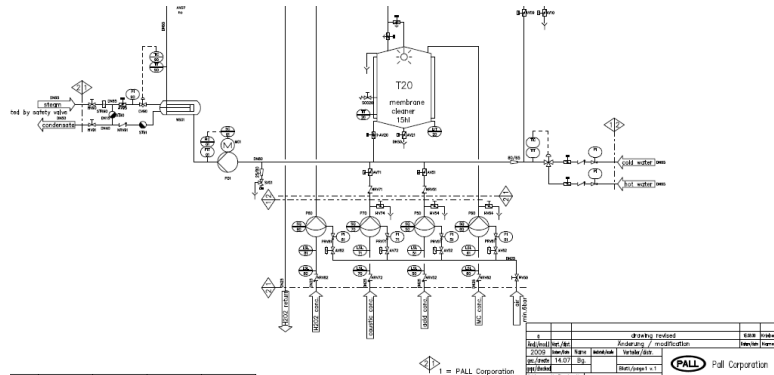


Example for visualization of blocked cluster:



## Intelligent Cleaning

- MCU compact integration in membrane system
- System knows when and how to clean
- Controls individual cleaner concentration
  - Cleaner specific dosing pumps
  - Conductivity & temperature controls
- Effective with standard caustic base cleaner
- Membranes need cleaning to maintain performance



## Impacts

- Reduced stress on membranes
- Long membrane service life
- Low cleaner cost
- Simple cleaner handling
  - Storage
  - Dosage
  - Disposal
- Documentation & traceability



## Intelligent integration design

- Process design to gain maximum efficiency into packaging or fermentation
- Pipe diameter, tank volumes, valve bloc design optimized to brewery specific situation
- Integration for turn key process of filtration line: Filtration / Colloidal Stabilization / Micro-organism Stabilization to brewing process



When everything fits  
everything works

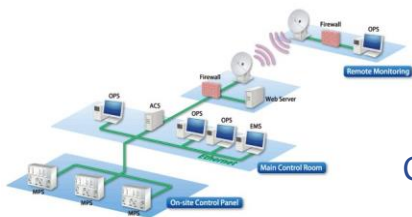
## Impacts

- Low water and cleaner consumption
- Optimized system down time for cleaning and maintenance
- Maximum beer yield
- Hygenic plan incl. microbial control protocol
- Bolt on service concept
- Training program which pulls operator

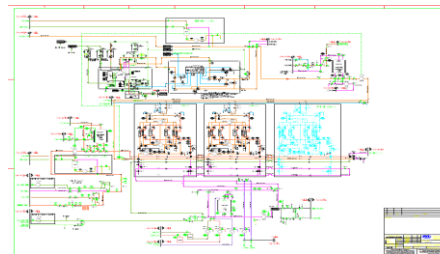


## Intelligent maintenance

- Machine monitoring
- Filter process data for tracking and analysis throughout entire line (data visibility and traceability)
- Service partnership program embracing brewery service technicians (on site trouble shooting by brewery including module repair)
- Remote monitoring to facilitate troubleshooting and service by vendor technician



Controls fit for function



## Impacts

- Usage of familiar control concepts
- Easy software maintenance
- Monitoring of line efficiency and media consumption
- Bolt on service concept
- Training program which pulls operator





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# Intelligent Filtration



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